Optimising Affordable House Design in the context of The Future Homes and Buildings Standard 2025

May 2022

Optimising Affordable House Design in The Context of The Future Homes and Buildings Standard 2025

Speakers

Steve Alcock – Director of Development & Sales, Torus Developments Ltd

Anthony Conroy – Director, Markhams

Paul Jeffrey – Director, Bowker Sadler Architecture

Steven Hunt – Managing Director, Steven A Hunt & Associates

William Baldwin– Director, Sutcliffe

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The Client's Perspective

Steve Alcock – Torus Developments Ltd

Developer Perspective – creating a brighter future

Looking ahead in 10 years time…..

- Creating a legacy for future generations
- All new build homes expected to be EPC A from 2025
- 25% of new development using MMC
- Zero carbon new build from 2030

torus

Developer Perspective – creating a brighter future

- Low energy, efficient, comfortable homes deliver health and wellbeing benefits for residents
- Greater impact on Torus residents given rising cost of living
- Proactively working with communities and stakeholders to ensure new development enhances the environment

torus

Developer Perspective – next steps

Turn the concept into a reality:

- Continue learning
- Site of 40-80 houses
- Ideally Liverpool, St Helens or Warrington heartland
- With or without planning
- SOS 2023
- Showcase technology

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Architectural Considerations & Design Options

Paul Jeffrey – Bowker Sadler Architecture

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CONSTRUCTING EXCELLENCE
Liverpool City Region

Steven A Hunt & Associates
the guinness partnership
torus
Sutcliffe
markhams BUILDING COST MANAGEMENT
casey
BOWKER SADLER **ARCHITECTURE**

The brief

1. 3 Bed 5 Person House – **terrace of four or semi detached.**
2. **Functional and practical**, high quality spaces to NDSS - 93m^2.
3. **Commercial viability and minimising longer term maintenance cost.**
4. **Fabric first approach** adopting robust materials with appropriate air tightness rating.
5. **Customer focused** and avoiding over complicated end user interfaces.
6. **Incorporate MMC.**
7. **Renewables** - including primary energy source and supportive technology.
8. Materials with **highest 'Green Guide'** rating achievable, assess embodied carbon/Whole Building Life-Cycle Assessment.
9. **Heat recovery** considered.
10. **Maximise natural light but address overheating risk.**
11. **Surface water drainage strategy** including attenuation, permeable hard surfaces and storage for garden usage.
12. **Improve biodiversity.**

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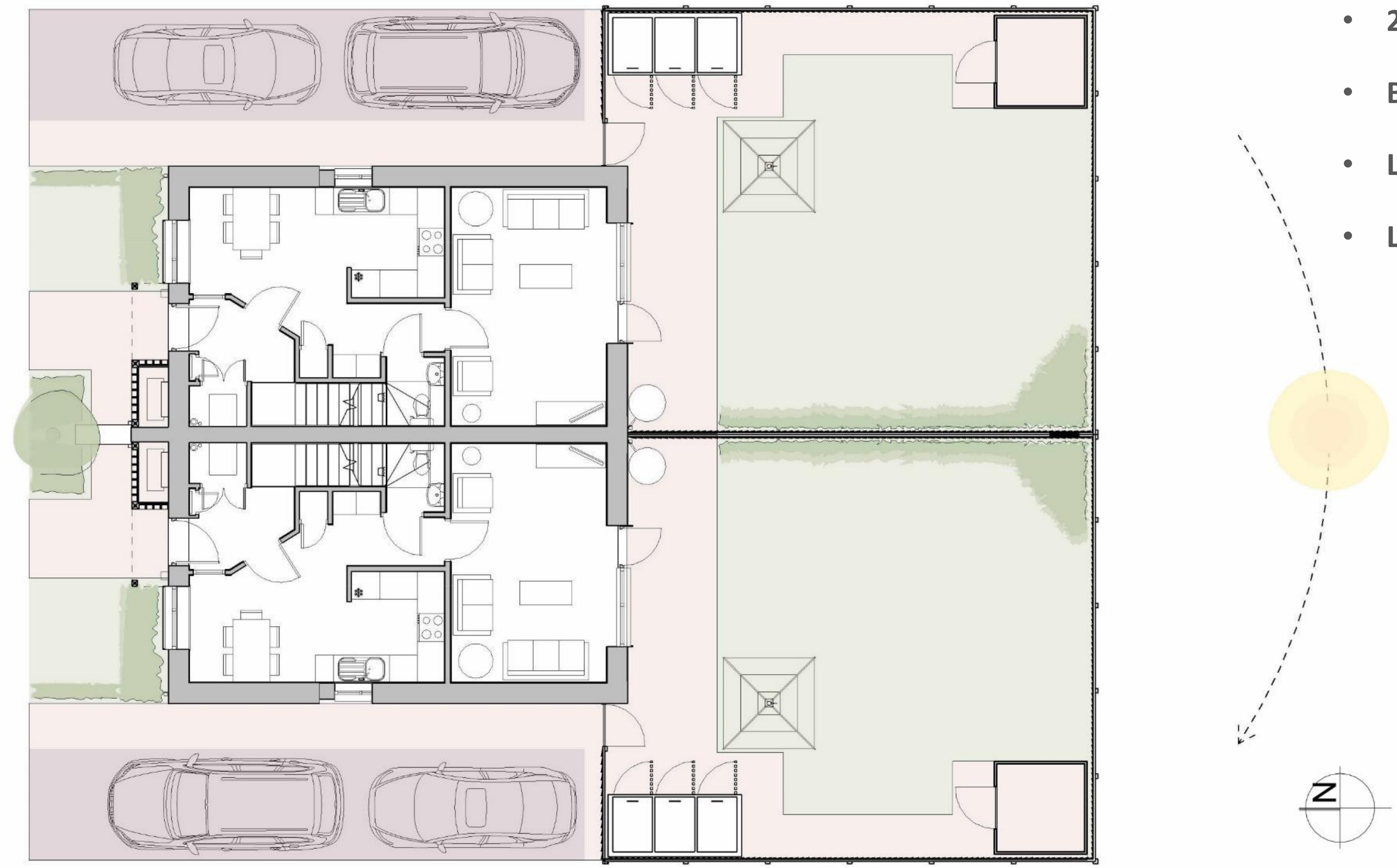
Semi-detached arrangement



- 200% car parking
- Bins at rear
- Larger rear gardens
- Landscaped front gardens

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Terraced arrangement

- Intrinsically **thermally efficient.**
- **0 U-value** through 3 no. party walls.
- **Services and capital cost efficiencies**.

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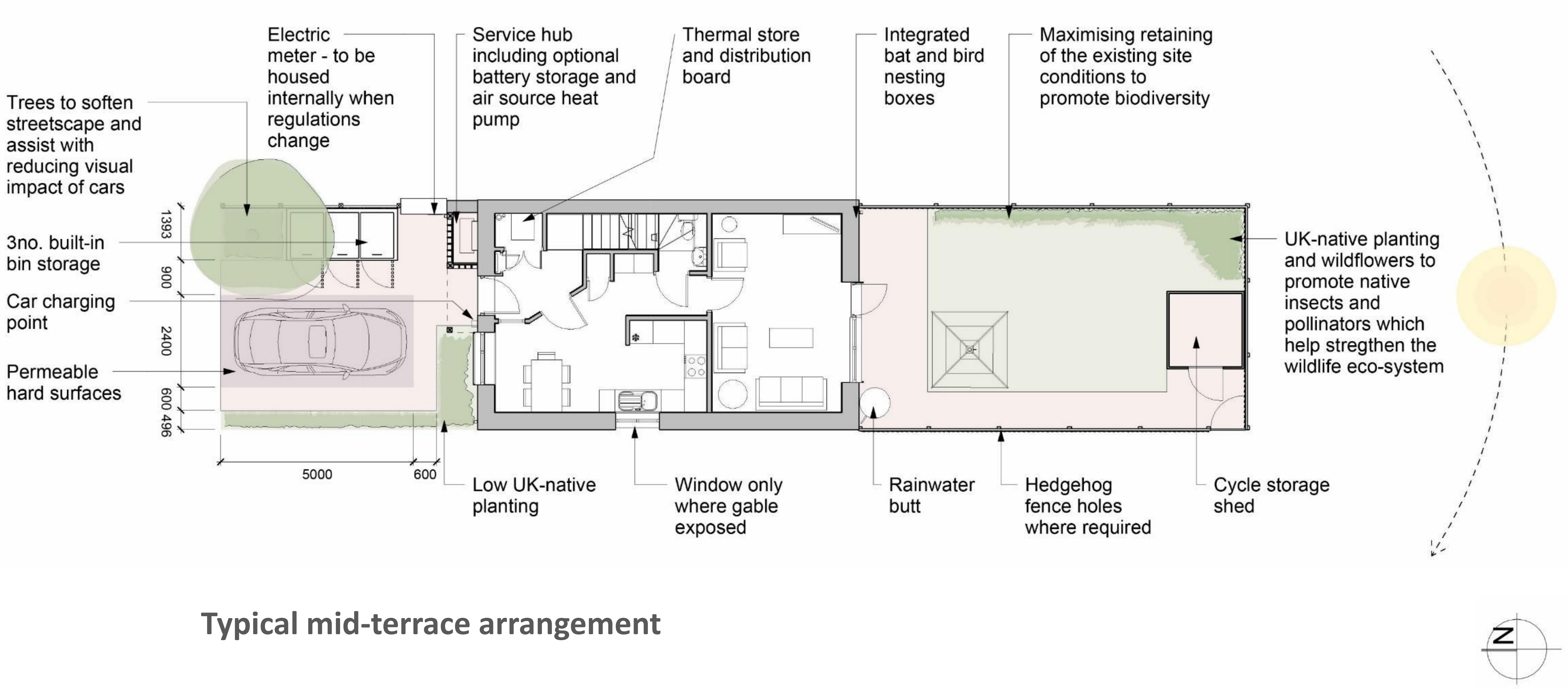

Typical mid-terrace arrangement

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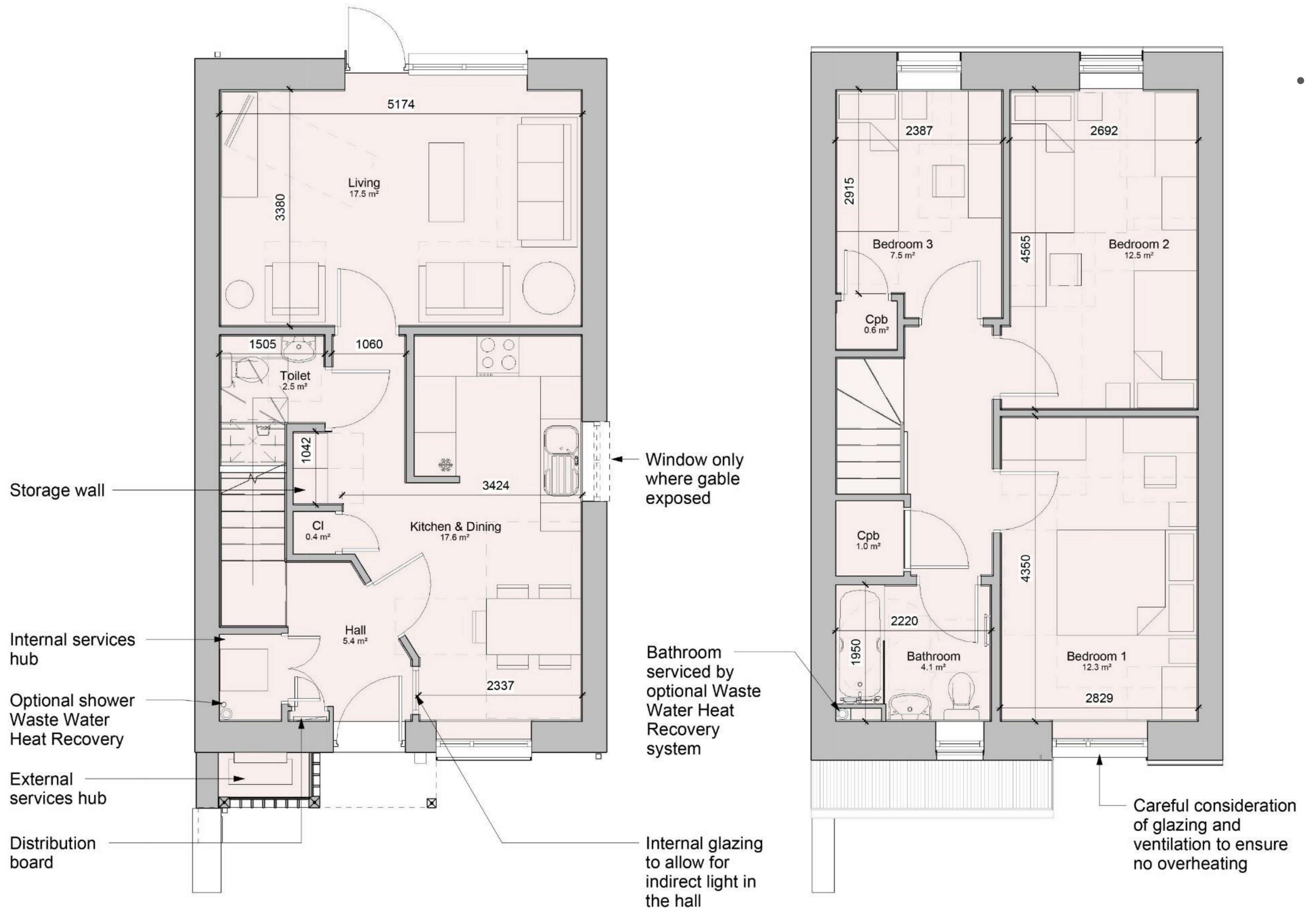

Ground Floor Plan

First Floor Plan

- **Floor area to NDSS 93m² .**

BOWKER SADLER **ARCHITECTURE**

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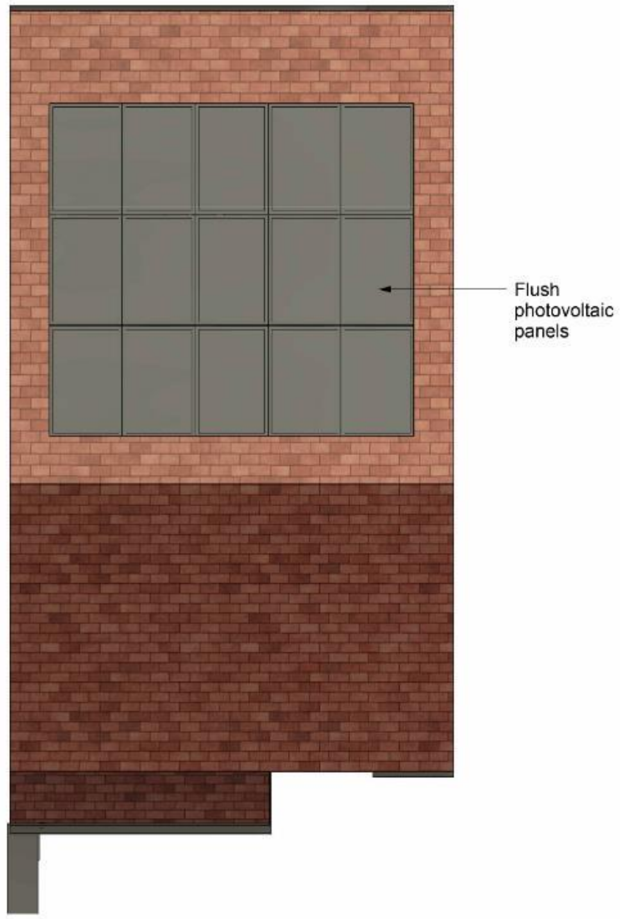
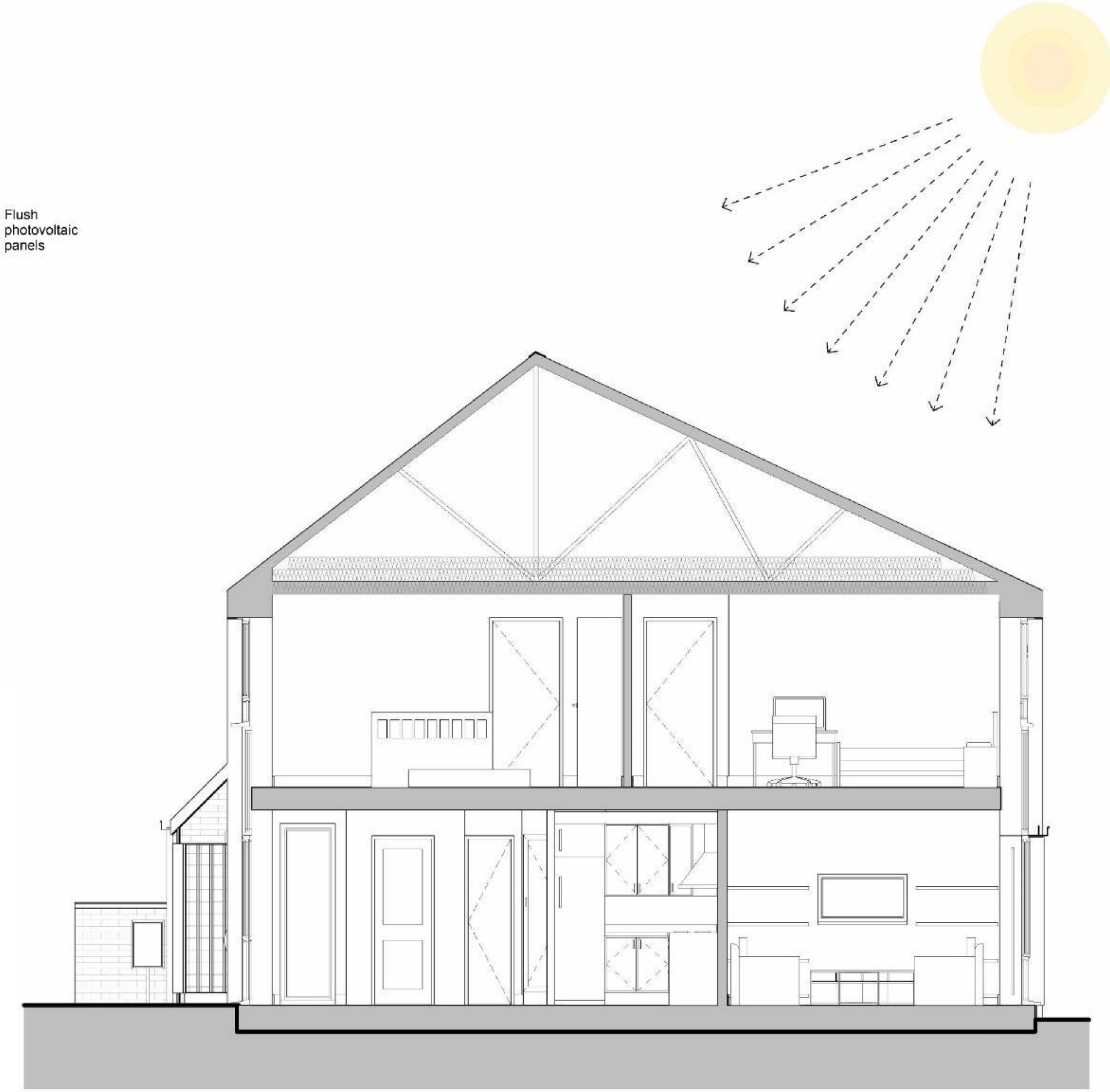


Roof plan



Typical section

Photovoltaics

- **Inset flush PV panels**
- Potential maximised/ **future proofed by roof orientation** and offset ridge increasing area of south facing roofscape
- 4kW PV min. array / 40% of ground floor area

Flush PV panels

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Front/North elevation

Rear/South elevation

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Terraced arrangement - Front/North elevation

Semi-detached arrangement - Front/North elevation

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Typical mid-terrace house exterior

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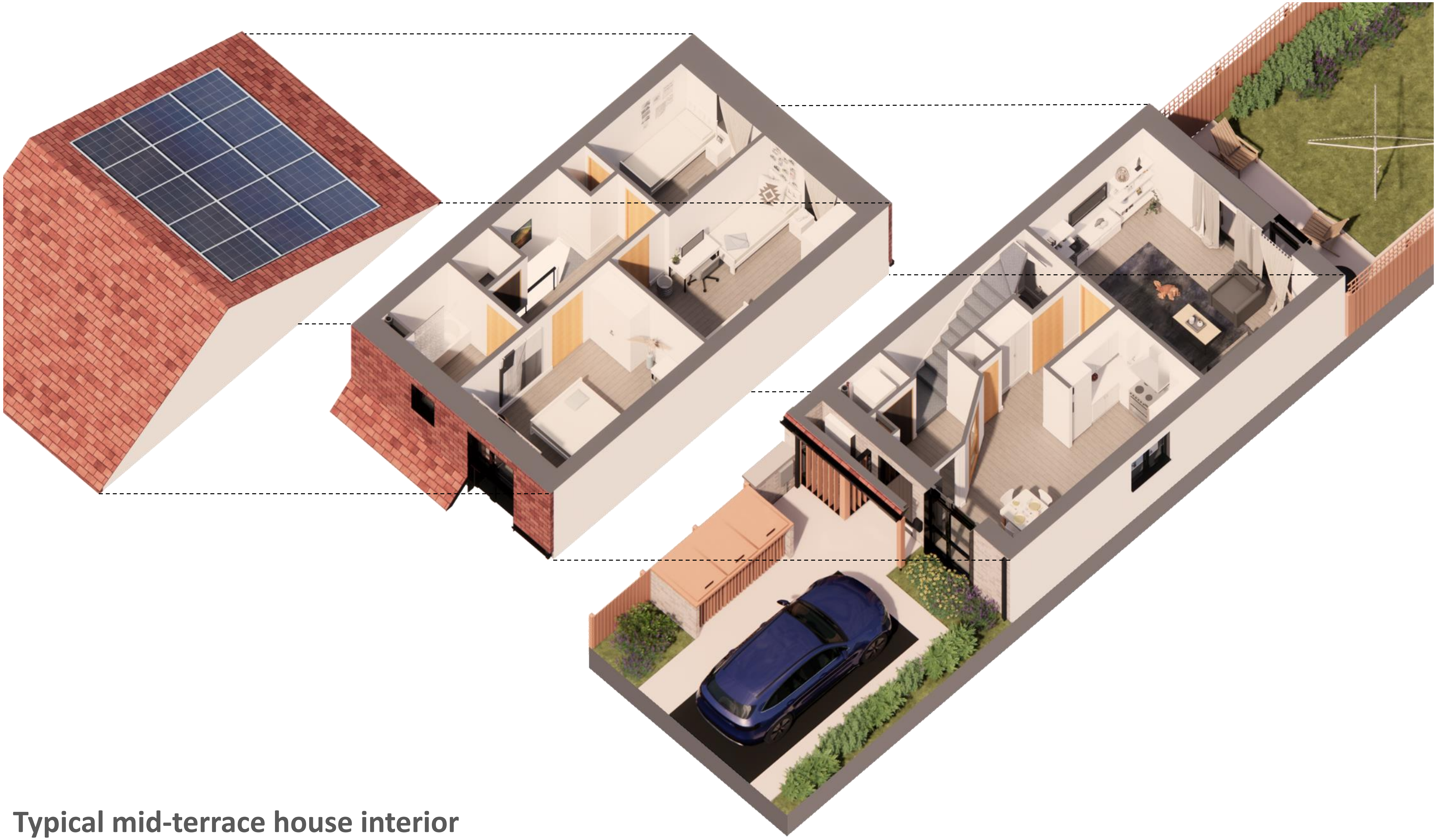

Typical mid-terrace house interior

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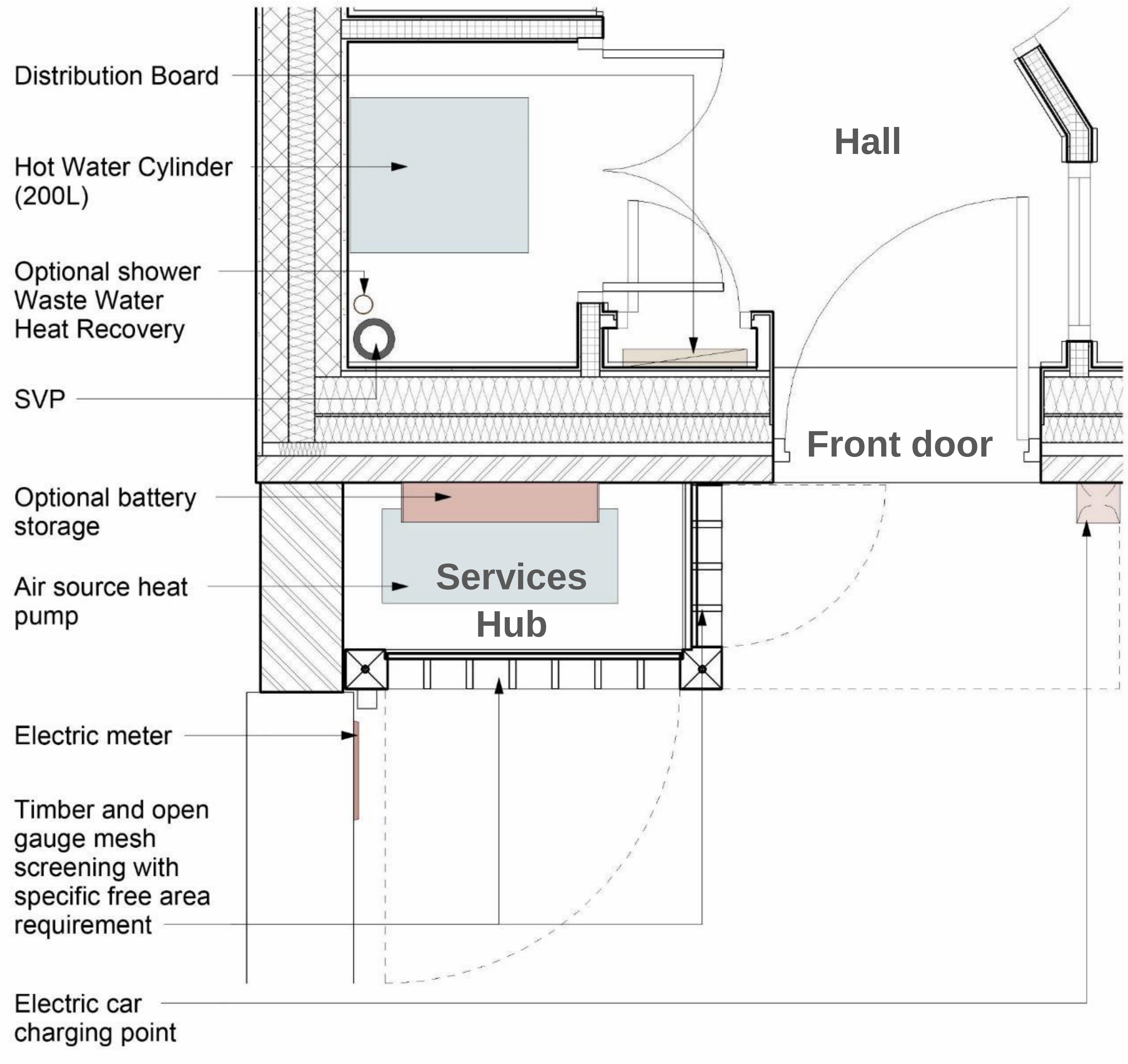
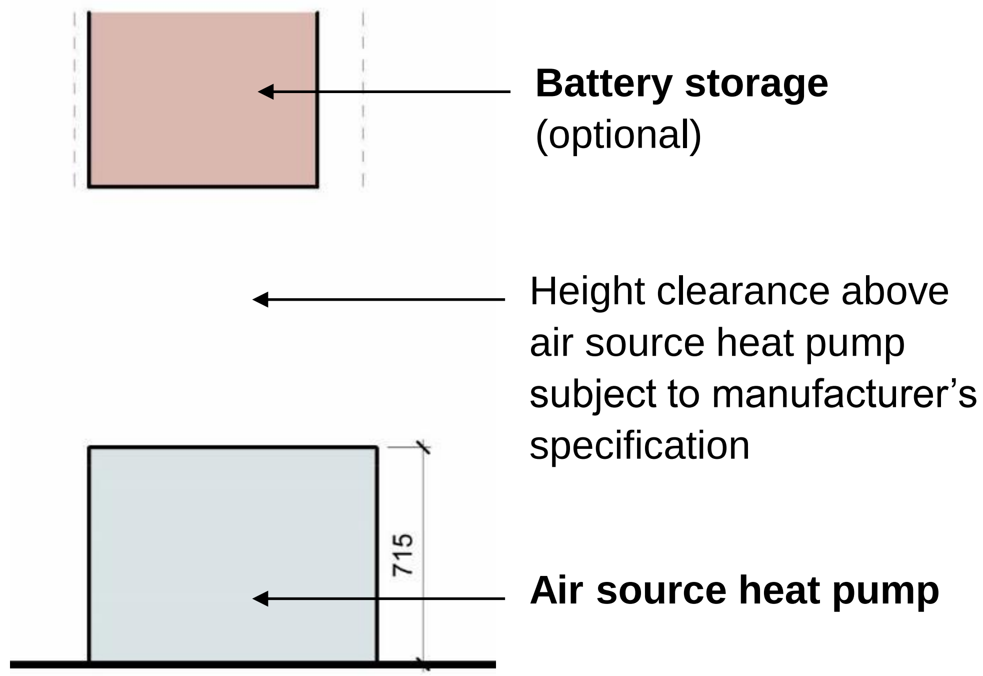


Services Hub

- **Integrated Twin** Compartment design
- **Air source heat pump** in mesh enclosure to ensure adequate air flow (Enclosure to be agreed with chosen manufacturer as required clearances around the unit may differ)
- **Battery storage** allied to PV panels (optional)
- **Car charging point**
- **Hot water storage tank adjacent to ASHP**
- **Electricity meter located externally** to suit current regulations.



Services hub – diagrammatic elevation view

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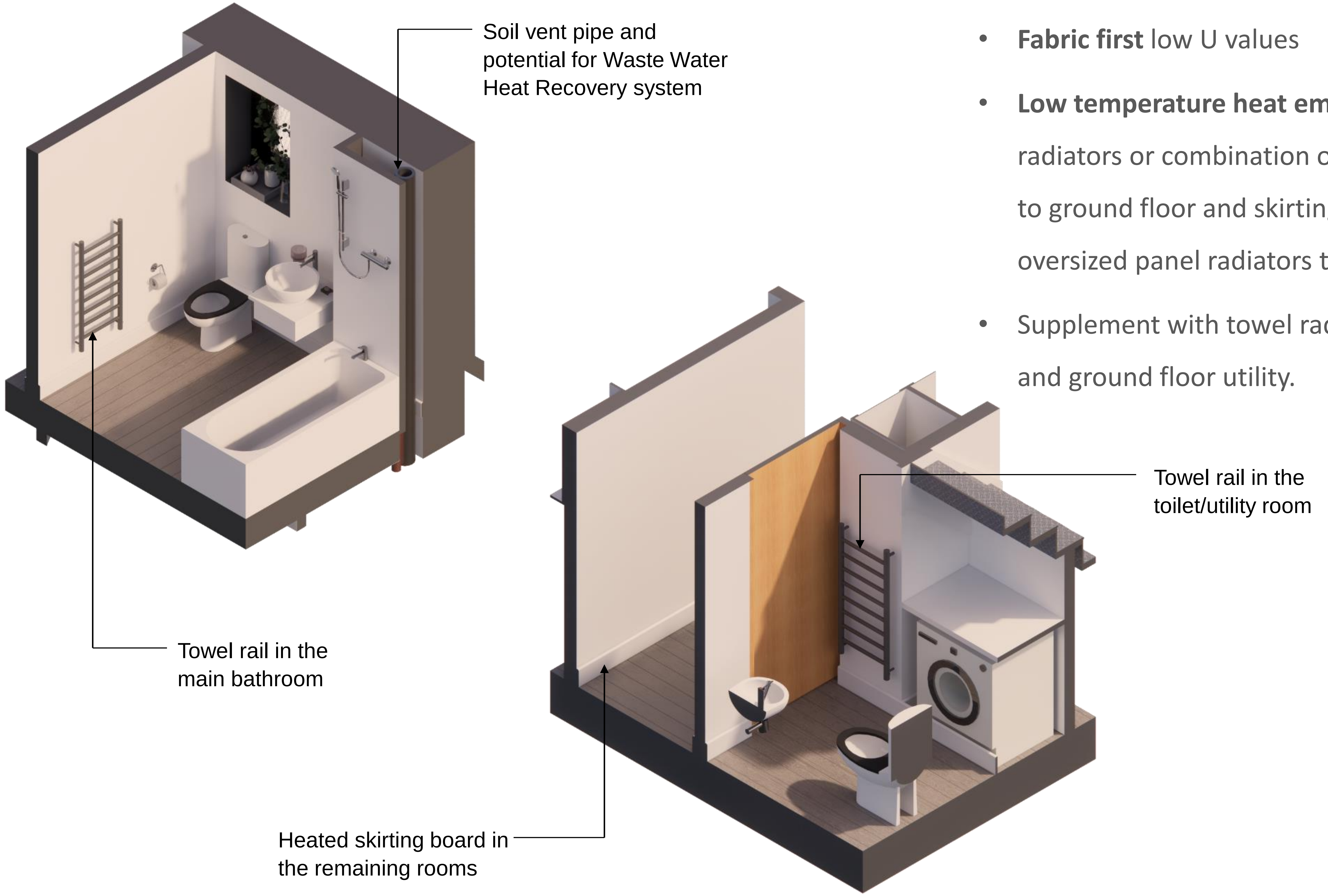

Heating Strategy

- **Fabric first** low U values
- **Low temperature heat emitters** via skirting radiators or combination of underfloor heating to ground floor and skirting radiators or oversized panel radiators to first floor.
- Supplement with towel radiator in bathroom and ground floor utility.

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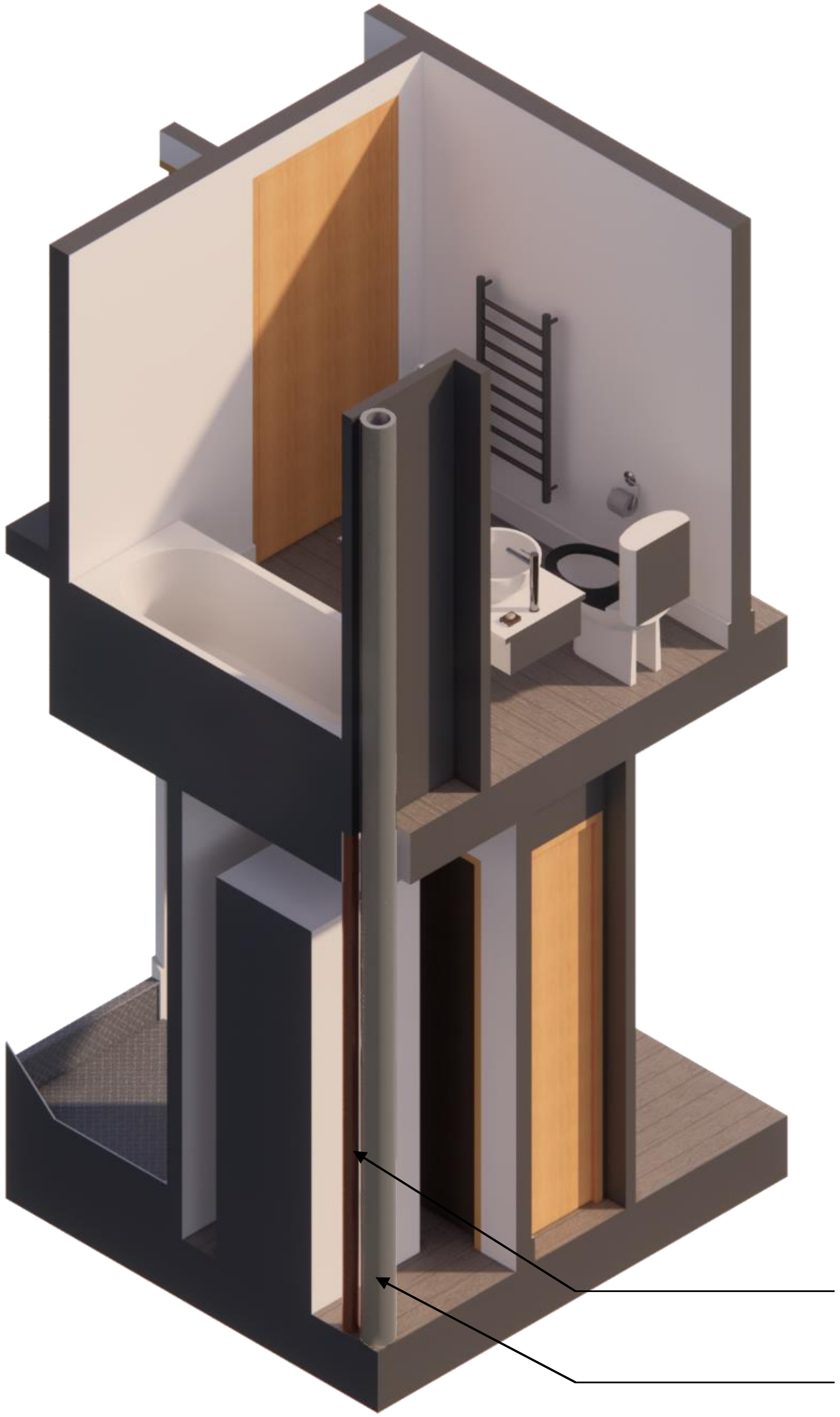

Potential for high efficiency WWHR unit allied to bath / shower

Soil vent pipe

Ventilation & Heat Recovery Consideration

- Adopt continuous mechanical extract system (allied to adopted air tightness rate < $5m^3/hm^2$ at 50 Pa)
- Use 'simplified' method relative to glazed areas and purge ventilation in order to address overheating risk
- Consider WWHR carefully, weighing up the holistic benefits

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Rear/South elevation

Overheating Risk

- **Controlled area of glazing** in line with 'simplified' method
- **Maximise natural light** to main daytime living spaces
- **Limit solar gain and remove excess heat**
- **Potentially avoids need for dynamic thermal analysis**

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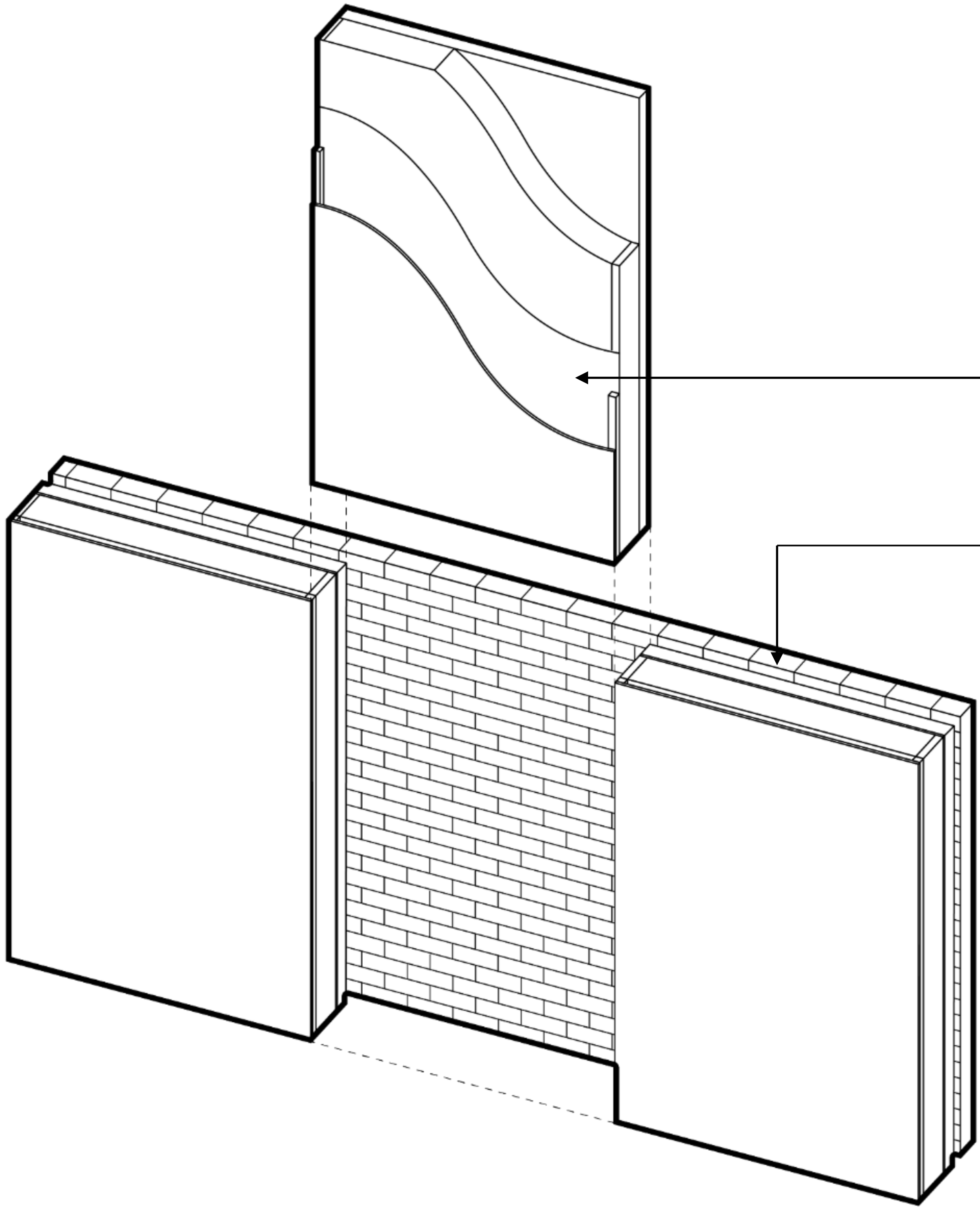

MMC

- **Open panel timber frame preferred** – for capital cost and flexibility, however Markham's (QS) have priced an alternative Modular approach to satisfy the min. 55% PMV for The Affordable Homes MMC Programme
- **SIP panels** use PIR or polyurethane or polystyrene – **perception over fire risk and capital cost.**
- **Full modular offsite** – greater capital cost, less flexible, site specific restrictions however it satisfies the min. 55% PMV for The Affordable Homes MMC Programme.

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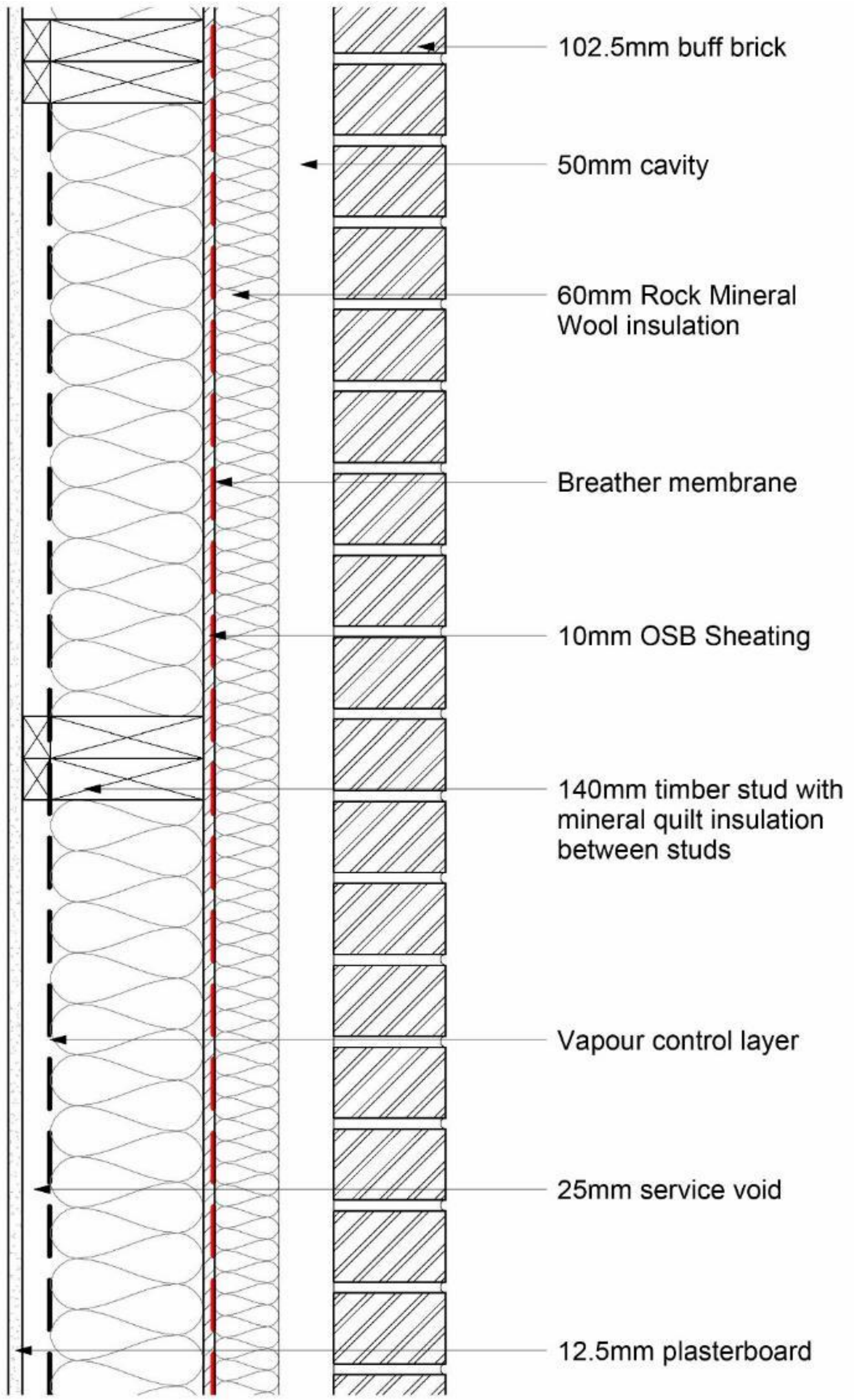

Typical external wall build up

Target U-values

- Roof 0.09
- Walls 0.18
- Floors 0.11
- Windows 1.2 (G Value – 0.72)
- Doors 1.0
- Party wall 0
- Air permeability 4

Note

All above require confirming via SAP Assessment

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Environmental Sustainability

- **BRE Green Guide** to Specification
- Use of **FSC timber** products
- **Reduce use of cement** through alternative specifications, including slab and foundation solutions.
- **Lighter weight construction**/ reduced mass and materials used.
- **Reduce waste** – off site manufacture/ coordinating sizes/ waste management strategy.
- **Reduce use of high G.W.P. materials**, e.g. glass/ aluminium.
- **Lifecycle assessment**… informing design and assessing carbon footprint.
- **Address embodied carbon & energy, GWP, fossil fuel depletion, climate change impacts.**
- **Balance choices** with maintenance, weathering, longevity, cost, fire and overheating risk.

Green Guide Materials – Brief Specification And Ratings.

Category	Rating	Green Guide Specification
External Wall	A+	Brickwork with cement mortar/concrete tiles with battens and breather membrane, OSB/3 sheathing, timber frame with mineral wool insulation, vapour control layer, plasterboard on battens, paint
Internal Wall	A+	Timber stud, plasterboard, paint
Separating Wall	A+	Robust Details E-WT-1, Twin timber frames without sheathing board, 240mm min. between wall linings, wall ties where necessary to each side – 60mm min. mineral wool between studs, 2 or more layers of gypsum based board (22kg/m2) and paint
Ground Floor	B	Screed on insulation laid on grouted beam and dense solid block flooring
Upper Floor	A+	Chipboard decking on timber I joists
Roof	A+	Timber trussed rafters and joists with insulation, roofing underlay, counter battens, battens and concrete interlocking tiles
Windows	A	PVC-U window with steel reinforcement, double glazed
Insulation	A+	Mineral wool insulation

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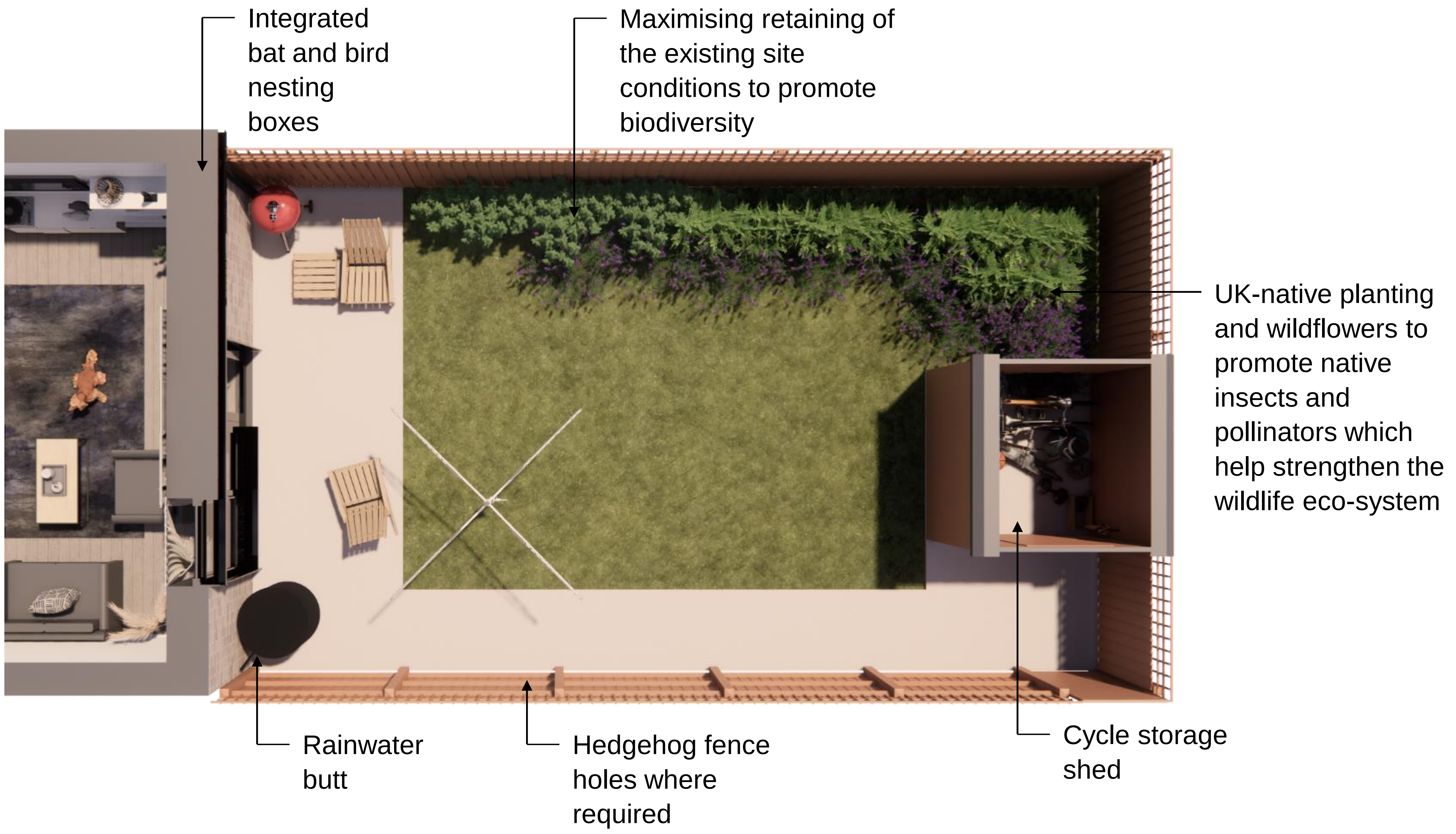

Typical rear garden

Externals/ Biodiversity

- **Rain water butt**
- **Permeable surfaces**
- **Bat/ bird boxes**
- Low/ zero maintenance **wildlife friendly native planting**

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Responding to Context

The overall approach to the **architectural language and material choice** has been based on **simple robust detailing and good quality materials, locally sourced where possible.**

Placement of the **'service hub'** to the front of the home requires integration at the building's threshold but **offers the opportunity to create a welcoming entrance feature** which gives character and identity to the house.

The previous option of tile hanging 'wrapping' down the elevation and forming an entrance porch is one approach, but we think it is important for the architecture to be able to respond to different contexts in terms of:

- **Orientation**
- **Topography**
- **Local architectural character and materials**

The following slides show a further elevational option and illustrates the inherent flexibility of the house type.

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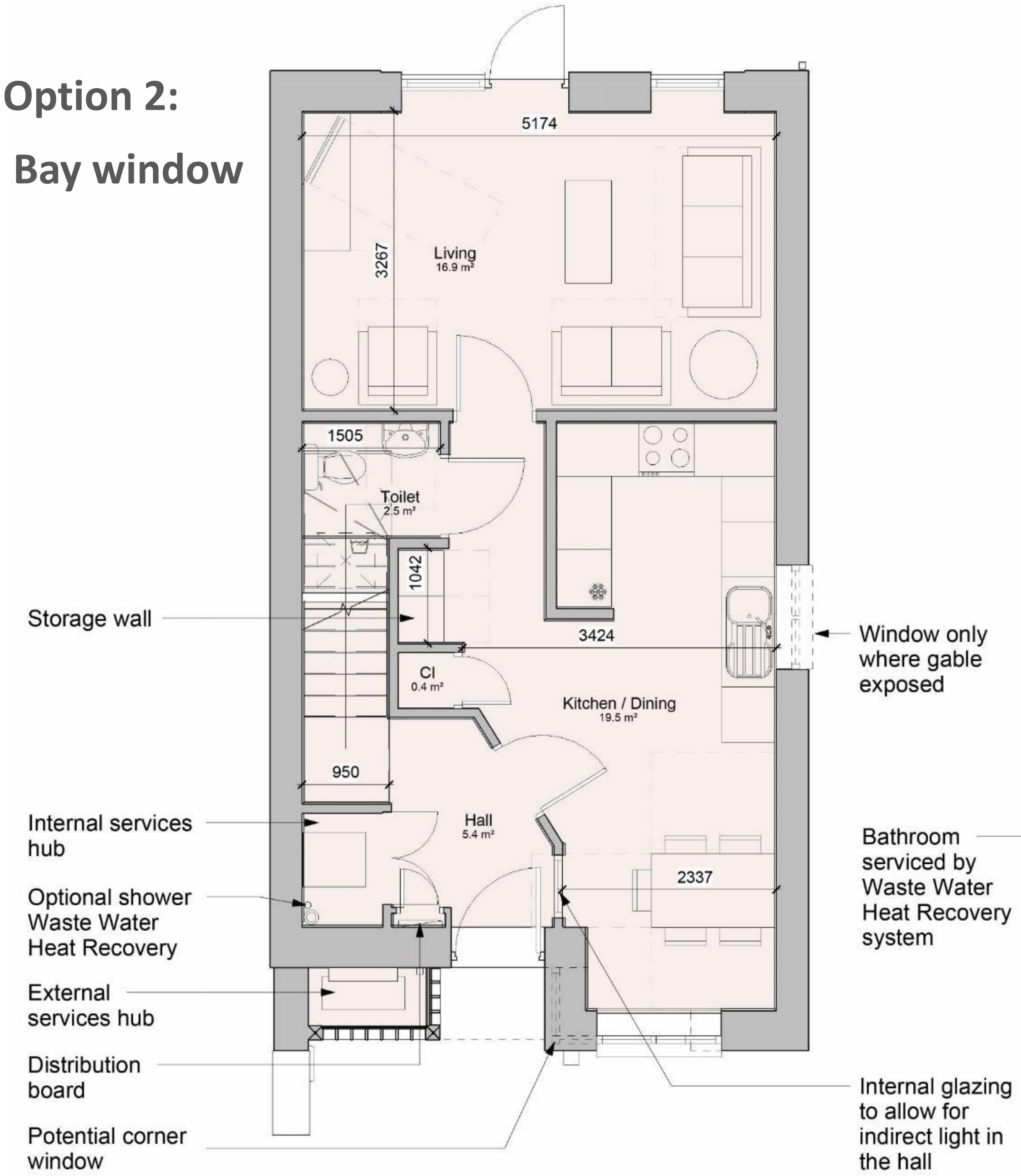
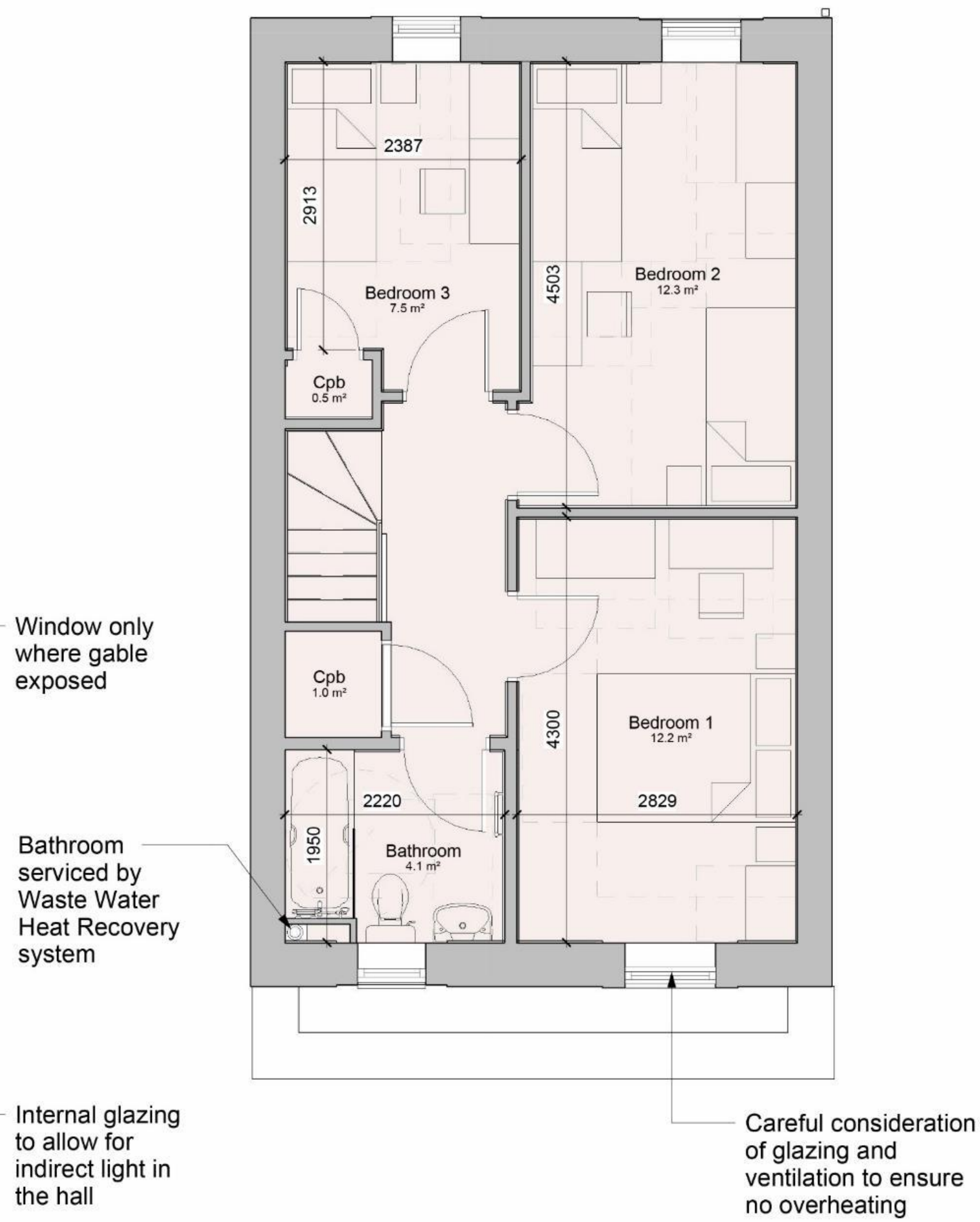
Option 2:

Bay window



Ground Floor Plan



First Floor Plan

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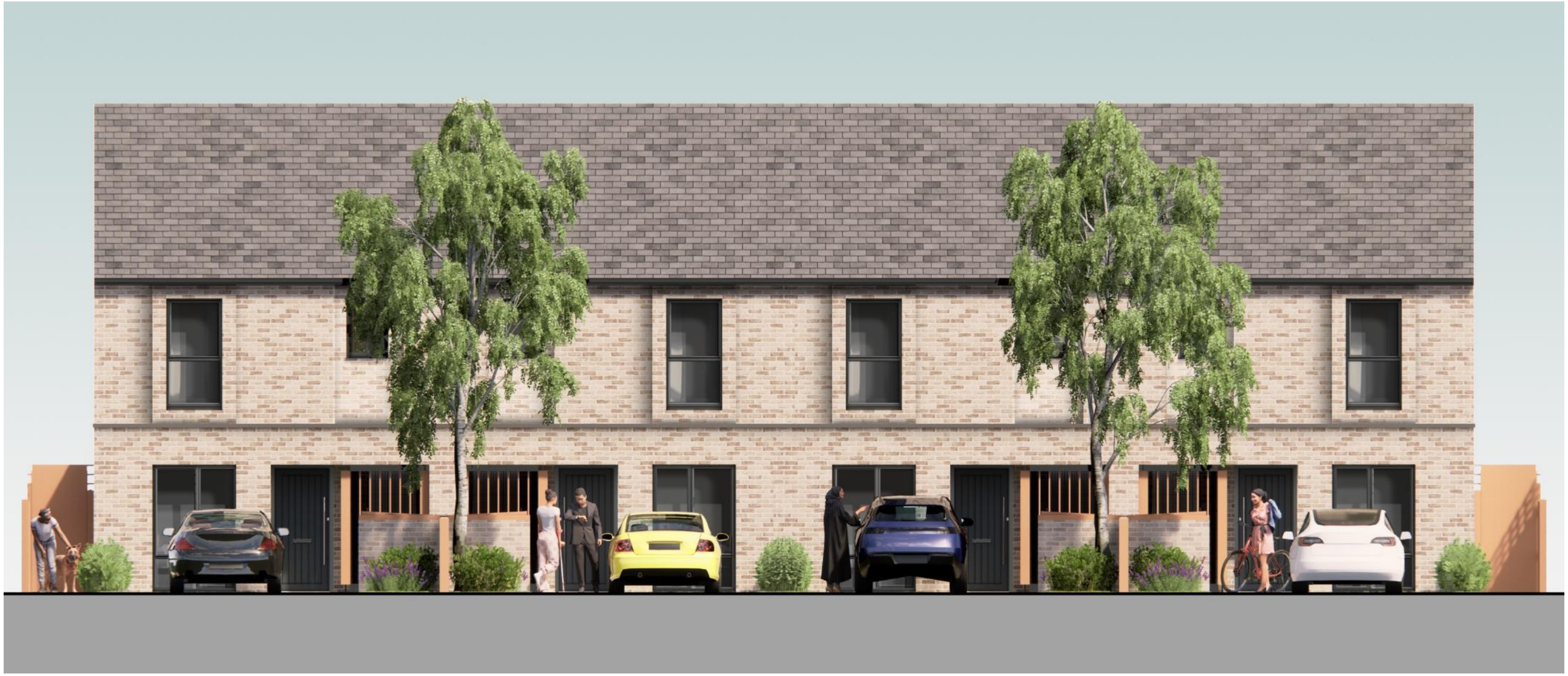
Option 2: Front/North elevation

Rear/South elevation

Option 2: Semi-detached arrangement - Front/North elevation



Option 2: Terraced arrangement - Front/North elevation

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Option 2: Typical mid-terrace house exterior

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Energy & Net Zero Carbon

Steven Hunt

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2025

Net zero carbon – Construction: *"When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy."*

Net zero carbon – Operational Energy: *"When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset."*

UK Green Building Council Definition – Net Zero Carbon

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UK Green Building Council Definition – Net Zero Carbon

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Regulated Energy
Energy consumption from controlled fixed building service.

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Regulated Energy
Energy consumption from controlled fixed building service.

- Heating
- Hot water
- Mechanical ventilation
- Lighting

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Regulated Energy
Energy consumption from controlled fixed building service.

- Heating
- Hot water
- Mechanical ventilation
- Lighting

Unregulated Energy
Energy consumption from a system or process that is not controlled.

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Regulated Energy
Energy consumption from controlled fixed building service.

- Heating
- Hot water
- Mechanical ventilation
- Lighting

Unregulated Energy
Energy consumption from a system or process that is not controlled.

- TV
- Washing machine
- Playstation
- Kettle

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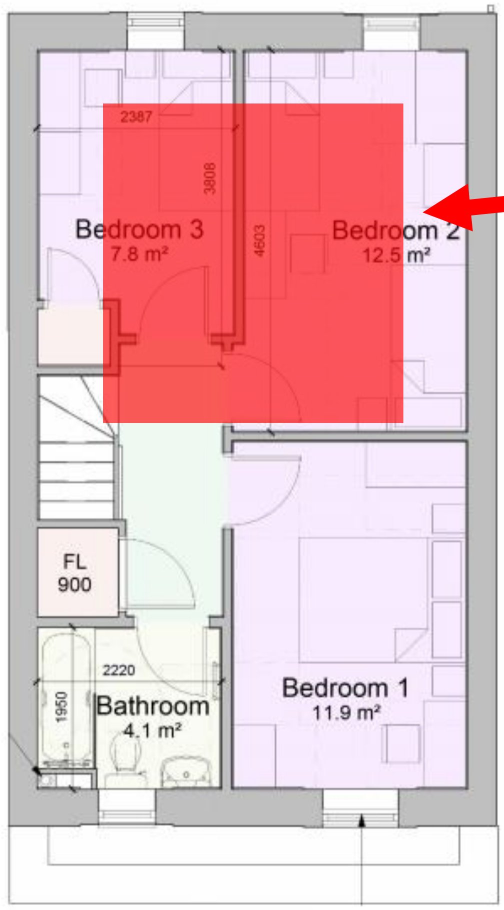
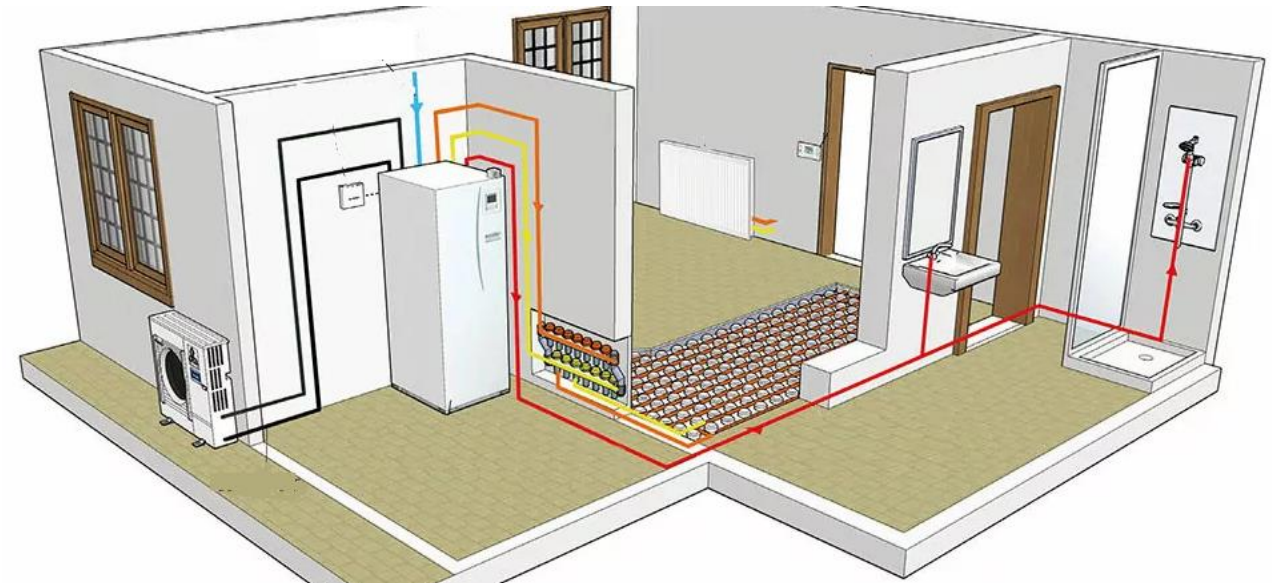


Baseline Requirements



ASHP with 4kW PV

SAP10 (Future Regs)										
SAP/EPC rating	**DER**	**TER**	**% Improvement**	**DFEE**	**TFEE**	**% Improvement**	**CO2 Emissions (t/yr)**	**DPER**	**TPER**	**% Improvement**
92 (A)	1.14	10.74	89.39	35.5	35.59	0.27	0.07	21.25	55.49	61.71

OPERATIONAL ENERGY CONSUMPTION

SAP calcs by:

COMPLETE SUSTAINABILITY SOLUTIONS ™

Regulated	**kwh**
Heating	1398
Hot water	438
Vent	52
Lighting	205
	2093
Unregulated	**kwh**
Published data	**1270**
TOTAL	**3363**

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Structural Solutions

William Baldwin

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Picture showing Future Found before pouring concrete. NHBC and BBA approved.

Foundations

- The majority of new developments are on **brownfield sites**, that have **inherent foundation issues**.
- There is a need to **reduce carbon** and adopting alternative foundations from traditional mass fill foundations that include many vehicle movements and a high level of cement, can only provide benefits.
- On recent projects Sutcliffe have recommended **Future Found** this is a trenchless foundation system, manufactured in the UK, that uses **High-Density Expanded Polystyrene formwork (EPS),** designed & cut to suit the individual project design.
- The product arrives on site as a **fully engineered ready-made formwork** that fits together to create a **fully insulated concrete structural foundation**.
- This outline then remains in the ground and concrete poured in one operation to create an **eco-efficient slab**.
- Ground preparation treatments will be required, however **removing traditional trench foundation** saves on many fronts.
- If the existing ground is very poor piled or vibro foundations can be accommodated into the designs

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Picture showing a rain garden planter

SUDS

- All development sites will now have **SUDS** planning conditions applied to them.
- The proposal from Sutcliffe is to provide **permeable pavement** designs for the carparking at the front, with **rainwater butts** and **raingardens** (either depressions or raised planters) to the rear, to help retain the **first 5mm of rainfall**.
- These will capture rainfall in rear and front gardens and **reduce and slow the impact on existing drainage services.**

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Cost Considerations

Anthony Conroy – Markhams

Future Homes Comparison Exercise - 12 Unit Options

markhams BUILDING COST MANAGEMENT

1.00 ACCOMMODATION

1.01	Building Type	No.	Qty	Unit	Total	
	3B5P Terraced House	12	93	m^2	**1,116**	
	Total	**12**	**No.**		**1,116**	**m^2**
	Total Gross Internal Floor Area		**1116**	**m^2**		

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Future Homes Comparison Exercise - 12 Unit Options

markhams BUILDING COST MANAGEMENT

2.00 ESTIMATED COSTS BUILT TO CURRENT (2013) BUILDING REGULATIONS (PRE JUNE 2022 PARTS L/F/O/S UPLIFT)

2.01	Item	Qty	Unit	Rate	Total
	Facilitating Works				
	Site Strip and Clearance - minor breaking up and vegetation clearance	2,500	m²	5	12,500
	Substructure				
	Houses - Standard Strip Foundations	1,116	m²	120	133,920
	Superstructure				
	Houses - Traditional Masonry Construction	1,116	m²	750	837,000
	Plot Drainage/Attenuation	1,116	m²	85	94,860
	Road Connection	1	Item	15,000	15,000
	Attenuation Tank to 1 Garden or Driveway	1	Item	40,000	40,000
	Services (Gas, Electric & Water,BT)				
	Connections	12	No.	5,000	60,000
	External Works				
	External Works to Houses -	12	No.	11,500	138,000
	Dropped Kerbs/Crossovers	12	No.	3,500	42,000
	Street Lighting	2	No.	3,500	7,000
	Electric Vehicle Charging Point	12	No.	800	9,600
	Sub Total				1,389,880
	Preliminaries	46	Weeks	10,500	483,000
	Present Day Estimated Construction Cost				1,872,880
	Inflation to ....Q22 - Excluded				0
	Total Estimated Construction Cost				**1,872,880**
	Total Cost per Square Metre	=		1,872,880 / 1,116	**1,678**
	Total Cost per Unit	=		1,872,880 / 12	**156,073**

Assumed Affordable Rent Tenure
Assumed no new access road required - homes built onto existing street
Post Contract Design/Professional Fees Excluded
Substation Excluded as Gas Powered Heating System

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Future Homes Comparison Exercise - 12 Unit Options

markhams
BUILDING COST MANAGEMENT

3.00 ESTIMATED COSTS BUILT TO ANTICIPATED FUTURE HOMES REQUIREMENTS

3.01	Item	Qty	Unit	Rate	Total
	Facilitating Works				
	Site Strip and Clearance - minor breaking up and vegetation clearance	2,500	m²	5	12,500
	Substructure				
	Houses - Standard Strip Foundations	1,116	m²	120	133,920
	Superstructure				
	Houses - Panelised - Open Panel Timber Frame system	1,116	m²	750	837,000
	Air Source Heat Pump System (Vaillant Aro-Therm)	12	No.	8,500	102,000
	MVHR System - Envirovent or equal - Excluded	12	No.	0	0
	Flush/In Built Photovoltaic Panels	12	No.	5,500	66,000
	Plot Drainage/Attenuation	1,116	m²	85	94,860
	Road Connection	1	Item	15,000	15,000
	Attenuation Tank to 1 Garden or Driveway	1	Item	40,000	40,000
	Services (Electric & Water,BT)				
	Connections	12	No.	3,750	45,000
	External Works				
	External Works to Houses -	12	No.	13,000	156,000
	Dropped Kerbs/Crossovers	12	No.	3,500	42,000
	Street Lighting	2	No.	3,500	7,000
	External Bin Store	12	No.	1,500	18,000
	Electric Vehicle Charging Point	12	No.	800	9,600
	Timber hit and miss enclosure - services hub	12	No.	750	9,000
	Sub Total				1,587,880
	Preliminaries	46	Weeks	10,500	483,000
	Present Day Estimated Construction Cost				2,070,880
	Inflation to ....Q22 - Excluded				0
	Total Estimated Construction Cost				**2,070,880**
	Tesla Powerwall Battery Storage (Optional Item Not Included in Total Cost)	12	No.	11,000	132,000
	Updated Total Cost with Optional Item				**2,202,880**
	Total Cost per Square Metre	=		2,070,880 / 1,116	**1,856**

Total Cost per Unit	=	2,070,880 / 12	**172,573**
			172,573
			156,073
Cost per Unit Difference with Standard:-			**16,500**

Assumed Affordable Rent Tenure
Assumed no new access road required - homes built onto existing street
Post Contract Design/Professional Fees Excluded
External Works costs include permeable paving and other items on BS proposal
Substation Excluded as assumed Elec load in area adequated for 12 Homes

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Future Homes Comparison Exercise - 12 Unit Options

markhams BUILDING COST MANAGEMENT

4.00 ESTIMATED COSTS BUILT TO ANTICIPATED FUTURE HOMES REQUIREMENTS - MODULAR CONSTRUCTION

4.01	Item	Qty	Unit	Rate	Total
	Facilitating Works				
	Site Strip and Clearance - minor breaking up and vegetation clearance	2,500	m²	5	12,500
	Substructure				
	Houses - Standard Strip Foundations	1,116	m²	120	133,920
	Superstructure				
	Houses - Full Modular Construction	1,116	m²	1,300	1,450,800
	Air Source Heat Pump System (Vaillant Aro-Therm)	12	No.	8,500	102,000
	MVHR System - Envirovent or equal - Excluded	12	No.	0	0
	Flush/In Built Photovoltaic Panels	12	No.	5,500	66,000
	Plot Drainage/Attenuation	1,116	m²	85	94,860
	Road Connection	1	Item	15,000	15,000
	Attenuation Tank to 1 Garden or Driveway	1	Item	40,000	40,000
	Services (Electric & Water,BT)				
	Connections	12	No.	3,750	45,000
	External Works				
	External Works to Houses -	12	No.	13,000	156,000
	Dropped Kerbs/Crossovers	12	No.	3,500	42,000
	Street Lighting	2	No.	3,500	7,000
	External Bin Store	12	No.	1,500	18,000
	Electric Vehicle Charging Point	12	No.	800	9,600
	Timber hit and miss enclosure - services hub	12	No.	750	9,000
	Sub Total				2,201,680
	Preliminaries	40	Weeks	10,500	420,000
	Present Day Estimated Construction Cost				2,621,680
	Inflation to ....Q22 - Excluded				0
	Total Estimated Construction Cost				**2,621,680**
	Tesla Powerwall Battery Storage (Optional Item Not Included in Total Cost)	12	No.	11,000	132,000
	Updated Total Cost with Optional Item				**2,753,680**
	Total Cost per Square Metre	-		2,621,680 / 1,116	**2,349**
	Total Cost per Unit	-		2,621,680	**218,473**

	12
	218,473
	156,073
Cost per Unit Difference with Standard:-	**62,400**

Assumed Affordable Rent Tenure
Assumed no new access road required - homes built onto existing street
Post Contract Design/Professional Fees Excluded
Assumed 6 week saving on programme for Modular units
External Works costs include permeable paving and other items on BS proposal
Substation Excluded as assumed Elec load in area adequated for 12 Homes

Future Homes Comparison Exercise - 25 Unit Options

markhams BUILDING COST MANAGEMENT

1.00 ACCOMMODATION

1.01	Building Type	No.	Qty	Unit	Total	
	3B5P Terraced House	25	93	m²	2,325	
	Total	**25**	**No.**		**2,325**	**m²**
	Total Gross Internal Floor Area		**2325**	**m²**		

markhams BUILDING COST MANAGEMENT

CONSTRUCTING EXCELLENCE LIVERPOOL REGION - FUTURE HOMES STANDARD ASSESSMENT

COST ASSESSMENT EXERCISE BETWEEN DIFFERENT OPTIONS AND SCHEME SIZES

	CURRENT (2013) BUILDING REGS STANDARD - COST PER M²	CURRENT (2013) BUILDING REGS STANDARD - COST PER UNIT	FUTURE HOMES STANDARD MMC NON-MODULAR - COST PER M²	FUTURE HOMES STANDARD MMC NON-MODULAR - COST PER UNIT	FUTURE HOMES STANDARD MMC FULL MODULAR - COST PER M²	FUTURE HOMES STANDARD MMC FULL MODULAR - COST PER UNIT
12 UNIT (HOUSES ONLY) PROJECT	£1,678	£156,073	£1,856	£172,573	£2,349	£218,473
25 UNIT (HOUSES ONLY) PROJECT	£1,589	£147,735	£1,766	£164,235	£2,286	£212,625
50 UNIT (HOUSES ONLY) PROJECT	£1,482	£137,815	£1,677	£155,915	£2,207	£205,225
100 UNIT (HOUSES ONLY) PROJECT	£1,467	£136,390	£1,653	£153,690	£2,186	£203,340

Optimising Affordable House Design in The Context of The Future Homes and Buildings Standard 2025