

HAVELOCK FARM, WAKEHURST
STAGE 4 – STRUCTURAL ENGINEER’S REPORT

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HAVELOCK FARM, WAKEHURST

STAGE 4 – STRUCTURAL ENGINEER’S REPORT

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C O N T E N T S

	Page
1. INTRODUCTION	1
1.1 Brief Description of Structure	1
2. INFORMATION RECEIVED.....	2
2.1 Reports	2
2.2 Drawings.....	2
3. SURVEYS CARRIED OUT AND EXISTING BUILDING STRUCTURE	3
3.1 East Range and Bothy	3
3.2 South Range.....	8
3.3 Lateral Stability – Existing Building	11
4. RIBA STAGE 4 STRUCTURAL DESIGN	12
4.1 East Range and Bothy	13
4.2 South Range.....	14
4.3 Lateral Stability – Proposed	15
5. OUTLINE CONSTRUCTION SEQUENCE	17
5.1 East Range and Bothy	17
5.2 South Range.....	17
6. SFK STRUCTURAL DRAWINGS	18
APPENDIX A – LATERAL STABILITY SKETCHES	
APPENDIX B – SFK DOCUMENT REGISTER AND TRANSMITTAL SHEETS	

1. INTRODUCTION

SFK Consulting is appointed as Structural Engineer for the repair and restoration of Havelock Farm at Wakehurst Place.

This report is prepared as part of restoration of Havelock Farm. The report should also be read with SFK Consulting's Structural Specification 24079/R02. This report also describes relevant parts of the existing building and then for each area where structural works are to be undertaken.

All SFK drawings produced as part of the Stage 4 work and referenced in the report are listed in Section 6.

This report may be used to support the planning submission for Havelock Farm.

1.1 Brief Description of Structure

Havelock Farm comprises four buildings (Figure 1), which are the Barn, West Range, South Range, and the East Range and Bothy. The East Range and Bothy is the only two-storey building at Havelock Farm. All external walls are built with bricks, and all buildings have a pitched tiled roof supported by timber trusses and rafters. The East Range and Bothy and the South Range are included in the scope of works. Historical maps show a similar layout of buildings from 1912 but that have clearly undergone many alterations. The buildings are not listed.

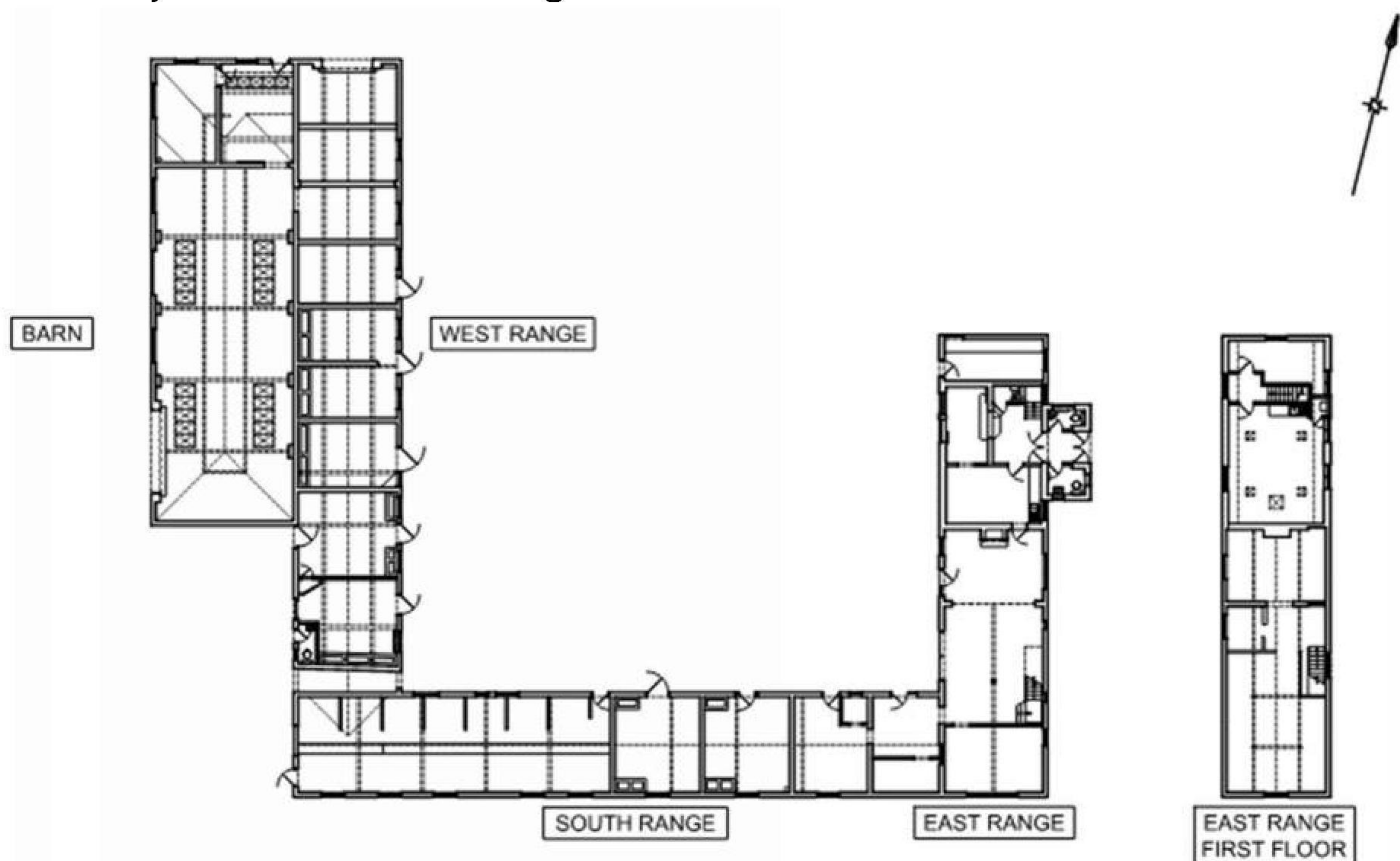


Figure 1 Key plan of Havelock Farm.

2. INFORMATION RECEIVED

Information relevant to structural work is summarised below.

2.1 Reports

- Pick Everard Phase II Geo-Environmental Site Investigation Report (MC/EBE/210453/17-2 R002) dated May 2022.
 - o Although this was carried out for the demolition work of several other farm buildings, Havelock Farm is adjacent. The ground conditions are unlikely to vary significantly over this distance. It is therefore considered relevant to include details of this report.
-

2.2 Drawings

- Measured building survey with AutoCAD dwg files produced by Greenhatch Group dated July 2024.
- Topographical survey by MKSurveys dated September 2016.

3. SURVEYS CARRIED OUT AND EXISTING BUILDING STRUCTURE

A series of visual inspections were undertaken by Mr N Winterbottom and Mr M Lee of SFK Consulting in 2025 to investigate the condition of the East Range and Bothy and the South Range at Havelock Farm.

For drawings of the existing building, refer to the SFK drawings as in Section 6 of the report.

3.1 East Range and Bothy

The East Range and Bothy is a two-storey building. The East Range and Bothy is divided by a brick party wall incorporating a chimney (Figure 2). The East Range is attached to South Range East.

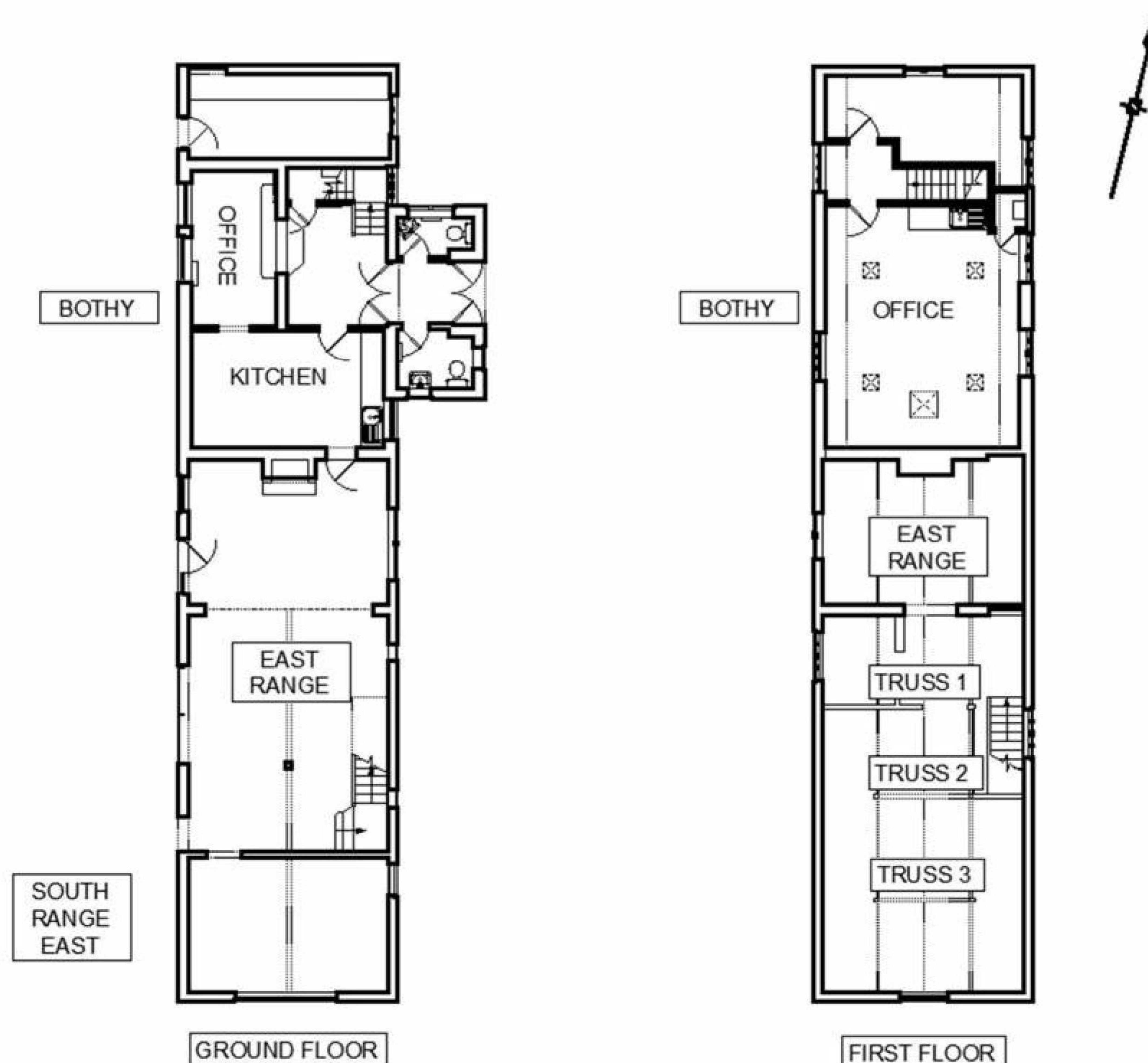


Figure 2 Key Plan of the East Range and Bothy.

The existing brickwork foundation depths of the East Range and Bothy vary. Trial Pits 1 and 3 indicate that the foundations to the east and south walls of the East Range are approximately 200 mm or less below ground level. Dampness was observed in the east-facing brick wall of the East Range.

The existing floor build-ups comprise a concrete slab finished with quarry tiles, laid over brick pavers, within the East Range and the Bothy.

The East Range has a pitched tiled roof with gable ends, supported by three timber trusses, rafters, and a brick cross-wall, which is supported on the existing steel beam (Figure 3). The Bothy roof is supported by rafters and two timber frames comprising collar tie beams and principal rafters. The rafters are in reasonable condition, as are the purlins. Collar ties are present between the chimney and the brick cross-wall. The existing steel beam is in reasonable condition.



Figure 3 Existing Steel Beam supporting brick wall above and timber beam, which is also supported off the timber column.

At first floor level, the joists within the East Range are generally in reasonable condition, although some have been notched on the underside. These joists are supported off a timber beam, which is supported by the south gable wall, a timber column, and the existing steel beam (Figure 3). The bricks in the east wall at joist bearing locations are in poor condition (Figure 4). Significant decay was noted to the bottom section of the timber column (Figure 5).



Figure 4 Bricks at joist bearing locations in poor condition.



Figure 5 Significant decay at bottom section of timber column.



Figure 6 Splice in timber lintel.

The timber wall plates, which act as lintels above some windows within the East Range, are generally in reasonable condition. One of the timber lintels is spliced (Figure 6). A concrete lintel to the south wall of the East Range, with a timber beam above, shows some deflection but no cracking and appears to be undersized (Figure 7).



Figure 7 Concrete lintel in the East Range.

The East Range roof trusses comprise structural members typically connected by pegged mortice and tenon joints. Truss 1 has been altered, with the bottom chord and a collar tie cut (Figure 8), and a strut removed to accommodate the staircase. The bottom section of the west timber post has been cut (Figure 9). Struts have also been removed from Trusses 2 and 3, leaving exposed half joints (Figure 10). Other than missing members, the timber condition in the trusses is reasonably good.



Figure 8 Collar tie removed on Truss 1.



Figure 9 Bottom section of the west timber post removed on Truss 1.



Figure 10 Exposed half joint on Truss 3.

The external walls are generally in reasonable condition. Brick arch lintels are mainly present at ground floor level within the Bothy, which are typically to remain. A soldier course of brickwork is present above a first-floor window on the north gable, but the form of lintel behind is not known. It is assumed this will be reused subject to opening up during the works.

3.2 South Range

The South Range has one storey and is divided into two halves (West and East) (Figure 11). South Range West is attached to the West Range and South Range East is attached to the East Range.

The existing brickwork foundation depths of the South Range vary, with trial pits indicating that some walls are founded 400 mm or more below ground level. The floor build-up in the South Range consists of concrete laid over granular material.

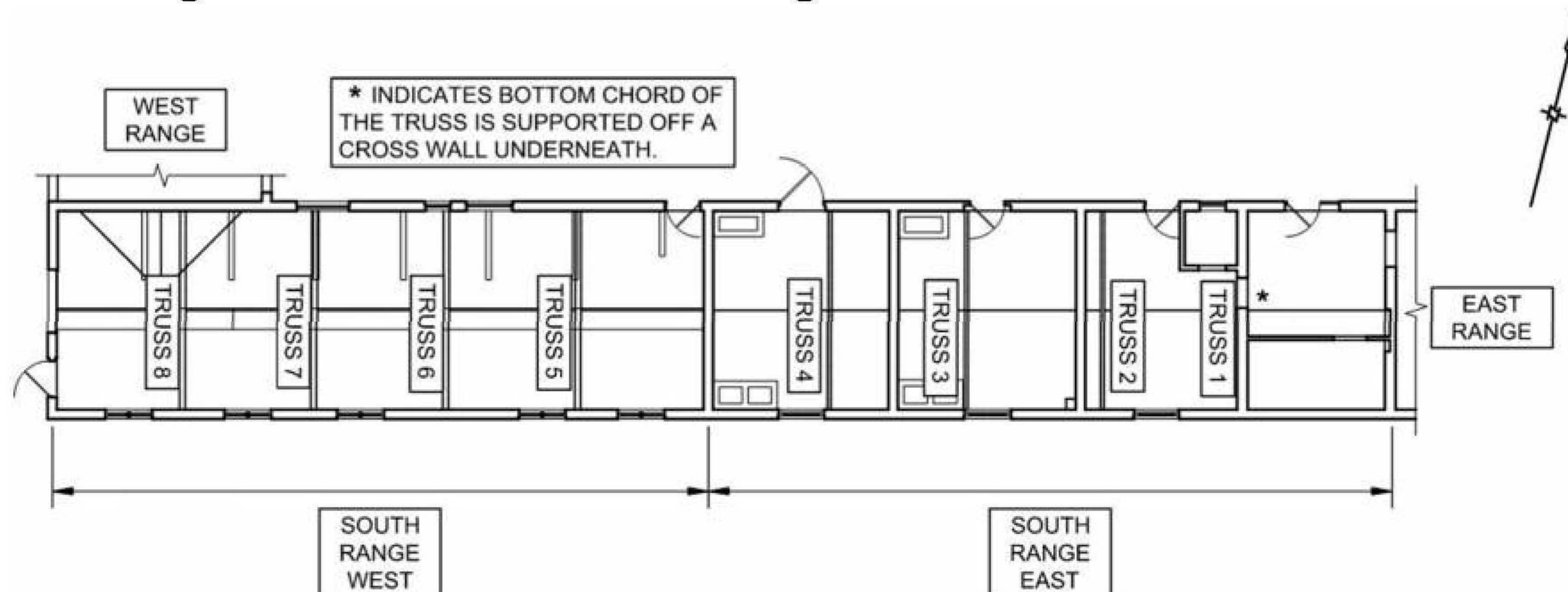


Figure 11 Key Plan of the South Range.

The South Range has a pitched tiled roof with gable ends, supported by eight timber trusses, rafters, and brick cross-walls. All the common rafters are generally in reasonable condition, although some are water stained. The purlins are generally in reasonable condition, but some show some deflection indicating they may be underdesigned. The purlin on the south side between the East Range and Truss 1 is broken and appears to have been strengthened, as there is another purlin installed alongside it (Figure 12). The wall plates in the South Range are generally in reasonable condition. The wall plates also act as a lintel for the windows.



Figure 12 Broken purlin with additional purlin alongside in South Range East.

Each truss has a single raked queen strut on either side, supporting the purlins from the bottom chords. Trusses 1 to 4 are in South Range East. The timber is of regular size and geometry with no decay observed (Figure 13). The raked struts are in reasonable condition, and the timber is softwood. Trusses 5 to 8 are in South Range West. The timber has irregular geometry, suggesting possible reuse, with bends and curvature in both vertical and horizontal planes. The softwood is generally of poor quality. The raked struts are in reasonable condition, but minor splits and surface decay were observed on the bottom chords (Figure 14). South Range West has existing sarking boards nailed to the underside of the rafters (Figure 14). Many of the boards were missing but the presence of nails suggests the South Range was fully boarded.



Figure 13 Truss 4 in South Range East.



Figure 14 Top surface decay on the north side of the bottom chord of Truss 7 (as denoted by red arrow, Truss 5 is located furthest away in this photo). Some sarking boards are present on the roof.

3.3 Lateral Stability – Existing Building

Refer to annotated plan on SKA1 in Appendix A.

Single Storey South Range

Some timber boards to the underside of the rafters are present but most are missing. It is assumed these would have acted to brace the roof, acting as a diaphragm to transfer loads to the brick walls.

North-South wind:

The west gable, cross walls and east range walls would act as shear walls. The cattle dividing walls to the south end are only partial height but may provide some local lateral stability to the north external wall. The tie beams are notched over the wall plates, providing restraint but it is not clear if the wall plates have positive fixings to the walls.

East-West wind:

The external walls would act as long shear walls.

Two Storey East Range - North Bothy area

The ceiling and ceiling joists to the 1st floor may act as a diaphragm as there is no bracing to the roof or soffit boards.

East-West wind:

North gable and brick cross walls would act as shear walls. 1st timber floor would act as horizontal diaphragm with joists built into walls.

North-South wind:

The external walls would act as long shear walls.

Two Storey East Range – area south of Bothy

Some timber boards to the underside of the rafters are present but most are missing. It is assumed these would have acted to brace the roof, acting as a diaphragm to transfer loads to the brick walls.

East-West wind:

Brick cross wall (at chimney) and south gable would act as shear walls. Roof trusses provide some lateral restraint, but original tie beams have been cut and brace framed. Some members are missing.

1st timber floor would act as horizontal diaphragm with joists built into walls.

North-South wind:

The external walls would act as long shear walls.

4. RIBA STAGE 4 STRUCTURAL DESIGN

For Stage 4 design, all analyses and design works is carried out in accordance with the relevant British Standards and UK national annexes, where any other suitable design code has been used, it has been clearly stated and referenced in the structural calculations. British Standards are considered more suitable than Eurocodes due to the age of the buildings.

For the historic buildings and other retained structures, calculations have been provided for all elements that would require them under the change of use, as defined in The Institution of Structural Engineers publication Appraisal of Existing Structures (referenced as part of 1.12 of Approved Document Part A).

The below is a table that outlines each area, its previous use and its proposed use with a comment on the loading.

Floor	Building	Previous Use	Proposed Use	Loading comments
Ground	Bothy	Offices	Offices	No change of use with change of structural loading.
	East Range	Agricultural		Change of use with change of structural loading.
	South Range			
First	Bothy	Offices		No change of use with change of structural loading.
	East Range	Unknown		Assumed change of use with change of structural loading.

The new imposed loads (from BS 6399-1) used for the Stage 4 structural design are listed below:

B Offices for general use	2.50 kN/m ²
C3 Stairs and landings (foot traffic only)	3.00 kN/m ²

As offices, the buildings will be Class 2A to Part A of the Building Regulations (Table 11 of Part A3 of Approved Document A). For masonry buildings in consequence class 2A, effective horizontal ties or effective anchorage of suspended floors to walls should be provided, as per part 5.2 of Approved Document Part A for buildings of loadbearing wall construction.

The following sections summarise the proposed structural works coordinated with the architect's and service engineer's requirements.

4.1 East Range and Bothy

The proposed ground floor works are intended to meet the project requirements while avoiding unnecessary intervention to the existing structure. A new concrete slab will be constructed over the existing floor, removing the need to underpin the shallow existing wall foundations. New foundations will be provided beneath steel posts. The existing steel beam has been assessed and will be retained to support the first floor. New lintels will be installed beneath the chimney where the lower portion is to be removed, together with new lintels to raised door and window openings.

The first floor will be adapted to suit the proposed use by installing a new floor structure with new joists designed to accommodate the proposed office loads. Courses of existing brickwork within the current joist bearing depth are in poor condition and will be locally rebuilt in sections. The existing timber wall plate will be removed due to risk of decay, and new floor joists will be supported on joist hangers built into the rebuilt masonry. Horizontal restraint straps will be provided at 2.0 m centres to act as horizontal ties; these will comprise 1200 mm long galvanised mild steel straps fixed tightly against the masonry. A new stud wall will be constructed on top of the existing steel beam, replacing the previous brick wall which provided lateral stability. A new steel spine beam will replace the existing timber beam, which is in poor condition, and existing timber posts will be replaced with new steel posts. Additional new steel beams will be installed within the Bothy to accommodate the proposed office loading and staircase, along with a new steel frame within the party wall opening.

The proposed roof works will ensure the roof structure is suitable for the proposed loads and long-term use of the building. Existing rafters will be retained, with defective rafters replaced as necessary. New purlins will be added alongside the existing purlins to carry the proposed loads, and new collar ties will be installed at every other rafter above the purlins. Existing trusses will be reinstated and repaired, and sarking boards will be provided to improve overall lateral stability. At the Bothy roof, steel beams will be added to the principal rafters, with new timber beams added to the collar ties.

4.2 South Range

The proposed ground floor works to the South Range are intended to meet the project requirements while addressing level changes and improving overall stability. A new concrete slab will be constructed, with new concrete thickenings formed to existing walls to accommodate changes in level where these walls will act as retaining walls. Local underpinning will be provided beneath the north wall and the wall dividing South Range East and South Range West. Existing crosswalls will be removed; however, their ends will be retained as masonry nibs to provide lateral stability to South Range East. Existing masonry dividing walls on the north side of South Range West will be removed, with new steel windposts introduced on both sides to provide lateral stability. A new brick wall will be constructed between the West End Gable and Truss 8 to support the roof structure and provide additional lateral stability. New steel lintels will be installed over existing openings.

The proposed roof works are designed to ensure the roof structure is suitable for the proposed loads and use of the building. Existing rafters will be retained. All existing timber trusses are underdesigned for design code requirements. New timber trusses with new timber struts will be installed to South Range East. New steel trusses with new timber struts will be installed to South Range West but retaining the adjacent timber trusses for their historic value and appearance. New purlins will be added alongside the existing purlins to support the proposed loads, and sarking boards will be provided to improve lateral stability.

4.3 Lateral Stability – Proposed

Refer to annotated plan on SKA2 in Appendix A.

Single Storey South Range

Timber boards to the underside of the rafters to be replaced throughout to act as diaphragm. Max span:depth 1:2.6. Max span 13m. These are considered acceptable by inspection.

North-South wind:

In west end where cattle walls are removed steel posts provided tied into walls to provide local stability and help global transfer via roof diaphragm back to shear walls. New masonry shear wall provided near west end.

East end where two cross walls removed nibs to remain to provide local stability and help global transfer via roof diaphragm back to shear walls. Existing shear walls to be tied into new ground floor slab to provide additional bearing area for lateral loads. Existing wall plates to be strapped down to walls.

East-West wind:

The external walls would act as long shear walls as existing.

Two Storey East Range - North Bothy area

Ceiling and joists to be removed. Timber boards to the underside of the rafters to be replaced throughout to act as diaphragm. Max span:depth 1:2. Max span 10m. These are considered acceptable by inspection.

East-West wind:

North gable and brick cross walls would act as shear walls. Collar ties above purlins to be provided every other common rafter pair. Principal frames strengthened. New 1st timber floor will act as horizontal diaphragm with joists tied into walls.

North-South wind:

The external walls would act as long shear walls.

Two Storey East Range – area south of Bothy

Timber boards to the underside of the rafters to be replaced throughout to act as diaphragm. Max span:depth 1:2.6. Max span 13m. These are considered acceptable by inspection.

East-West wind:

Brick cross wall (at chimney) and south gable would act as shear walls. Roof trusses provide some lateral restraint. All truss members to be repaired/reinstated and connections strengthened.

New 1st timber floor will act as horizontal diaphragm with joists tied into walls.

North-South wind:

The external walls would act as long shear walls.

5. OUTLINE CONSTRUCTION SEQUENCE

The Contractor will be responsible for the construction sequence and the production of method statements for carrying out items of work within the overall sequence. SFK can only provide an indicative, outline construction sequence that may be varied by the contractor. SFK will highlight any abnormal health and safety risks that may affect the sequence – also refer to SFK Design Risk Assessment.

5.1 East Range and Bothy

- Erect scaffold around building and internally for safe working on roof. For temporary stability of the building with the removal of the first floor, one approach is for the scaffold to be designed to resist wind loads and tied into the building.
- Remove roof finishes.
- Temporary prop to roof as required.
- Construct new post foundations.
- Remove existing timber first floor to south and north and construct new timber/steel floors including new timber stair.
- Repair and strengthen timber roof including trusses as appropriate and including boarding to underside of rafters.
- Reinstate roof finishes.
- Remove existing ground floor concrete/screed (retain existing pavers), lay insulation and cast new concrete ground slab over.

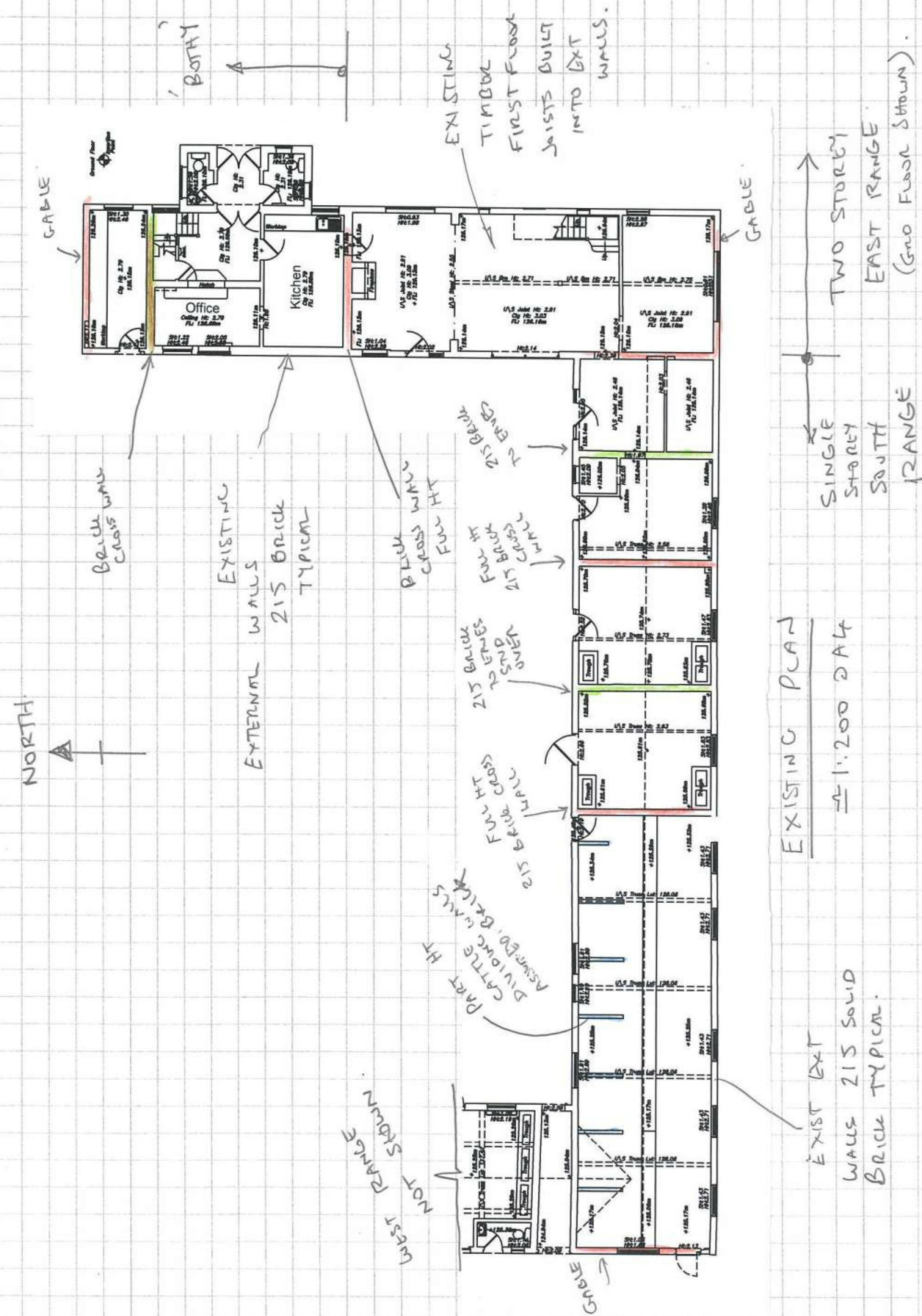
5.2 South Range

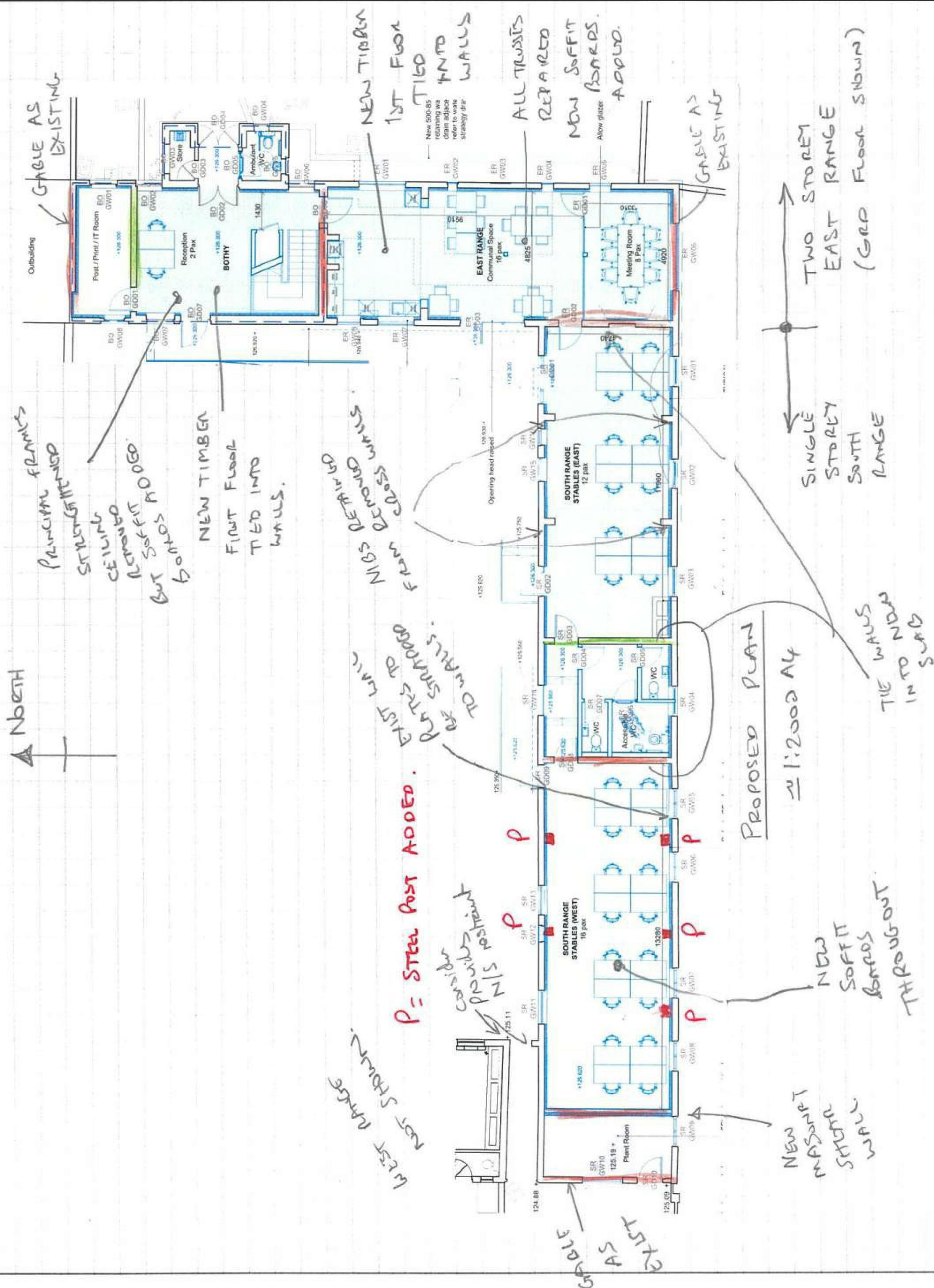
- Erect scaffold around building and internally for safe working on roof.
- Remove roof finishes.
- Temporary prop to roof as required.
- Construct new masonry shear wall near west end.
- East end – remove internal cross walls leaving nibs for stability.
- West end – remove internal cattle dividing walls.
- Central area – carry out underpinning work, construct new strip foundations and new internal retaining walls.
- East end – install new timber trusses, purlins and boarding to underside of rafters
- West end – install new steel beams, timber struts, purlins and boarding to rafters
- Reinstate roof finishes.
- At east end remove existing ground floor concrete/screed (retain existing pavers), lay insulation and cast new concrete ground slab over.
- In central area add concrete widening where walls are to become retaining.
- At west end overlay existing pavers with compacted fill, lay insulation and cast new concrete ground slab over. Slab to have edge thickenings as shown on drawings.
- West end - add steel posts tied into external walls.

6. SFK STRUCTURAL DRAWINGS

SFK RIBA Stage 4 structural drawings detailing the repairs and alterations required are listed on the issue sheet in Appendix B.

APPENDIX A – LATERAL STABILITY SKETCHES





APPENDIX B – SFK DOCUMENT REGISTER AND TRANSMITTAL SHEETS

DOCUMENT REGISTER AND TRANSMITTAL

SFK CONSULTING

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SFK CONSULTING Trinity House, 123 Winchester Road, Chandler's Ford, SO53 2DR Tel: 023 8251 6969		Project Title: Havelock Farm, Wakehurst																Job No: 24079			Sheet No: 01							
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Client Project Manager	Kew		pdf	pdf	pdf	pdf			pdf	pdf	pdf	pdf																
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Trial Pit Investigation	24079.0001		P1	P2	P3	P4			P6	T1	T1													A1				
Proposed Underpinning	24079.0002				P1	P2																		A1				
Coring Investigation	24079.0003								P1	T1	T1													A3				
Proposed Floor Buildups	24079.0004								P1	T1		T1												A1				
West Range Ground Floor Plan as Existing	24079.0100	P1						W	I	T	H	D	R	A	W	N								A1				
West Range Roof Plan as Existing	24079.0101	P1						W	I	T	H	D	R	A	W	N								A1				
Barn Ground Floor Plan as Existing	24079.0102	P1						W	I	T	H	D	R	A	W	N								A1				
Barn Roof Plan as Existing	24079.0103	P1						W	I	T	H	D	R	A	W	N								A1				
Barn Ground and First Floor Plans Proposed	24079.0104	P1						W	I	T	H	D	R	A	W	N								A1				
South Range Ground Floor Plan as Existing	24079.0105	P1							P2	T1	T1													A1				
South Range Roof Plan as Existing	24079.0106	P1							P2	T1	T1													A1				
East Range and Bothy Ground and First Floor Plans as Existing	24079.0107	P1							P2	T1	T1													A1				
East Range and Bothy Roof Plan and Trusses as Existing	24079.0108	P1							P2	T1	T1													A1				
Options for Trusses - West and South Ranges	24079.0109		P1																					A1				
South Range East Truss 1 As Existing	24079.0111							P1	P1	T1	T1													A3				
South Range East Truss 2 As Existing	24079.0112							P1	P1	T1	T1													A3				
South Range East Truss 3 As Existing	24079.0113							P1	P1	T1	T1													A3				
South Range East Truss 4 As Existing	24079.0114							P1	P1	T1	T1													A3				
South Range West Truss 5 As Existing	24079.0115							P1	P1	T1	T1													A3				
South Range West Truss 6 As Existing	24079.0116							P1	P1	T1	T1													A3				
South Range West Truss 7 As Existing	24079.0117							P1	P1	T1	T1													A3				
South Range West Truss 8 As Existing	24079.0118							P1	P1	T1	T1													A3				
South Range Trusses Structural Appraisal	24079/R01							-																A4				
East Range Truss 1 As Existing	24079.0121								P1	T1	T1													A3				
East Range Truss 2 As Existing	24079.0122								P1	T1	T1													A3				
East Range Truss 3 As Existing	24079.0123								P1	T1	T1													A3				

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M&E Engineer - MTA			MTA				pdf	pdf	pdf	pdf		pdf		pdf																	
Quantity Surveyor - Huntley Cartwright			HC	1	1	1	pdf	pdf	pdf	pdf		pdf		pdf																	
Record Copy				1	1	1	pdf	pdf	pdf	pdf	pdf	pdf	pdf	pdf	pdf																
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Trial Pit Investigation			24079.0001	P4	P5		P6	T1					T1												A1						
Proposed Underpinning			24079.0002	P2	P3																				A1						
West Range Ground Floor Plan as Proposed			24079.1100	P1			W	I	T	H	D	R	A	W	N										A1						
West Range Roof Plan as Proposed			24079.1101	P1			W	I	T	H	D	R	A	W	N										A1						
South Range Ground Floor Plan as Proposed			24079.1102	P1			P2	T1	T2		T3	T3													A1						
South Range Roof Plan as Proposed			24079.1103	P1			P2	T1	T2		T3	T3													A1						
East Range Foundation Plan as Proposed			24079.1104	P1			W	I	T	H	D	R	A	W	N										A1						
East Range Ground Floor Plan as Proposed			24079.1105	P1		P2	P3	T1	T2			T3													A1						
East Range First Floor Plan as Proposed			24079.1106	P1			P2	T1	T2		T3	T3													A1						
East Range Roof Plan as Proposed			24079.1107	P1		P2	P3	T1	T2		T3	T3		T4											A1						
East Range Elevations and Sections			24079.1108				P1	T1	T2		T3	T3													A1						
South Range Trusses as Proposed			24079.1111				P1	T1	T2		T3	T3													A1						
South Range East Trusses Details as Proposed			24079.1112					T1	T2			T3													A1						
South Range West Trusses Details as Proposed			24079.1113					T1	T2		T3	T3													A1						
East Range Truss 1 as Proposed			24079.1121				P1	T1	T2																A3						
East Range Truss 2 as Proposed			24079.1122				P1	T1	T2																A3						
East Range Truss 3 as Proposed			24079.1123				P1	T1	T2																A3						
South Range Foundation Details			24079.1151					T1	T2			T3													A1						
South Range New Lintel Details			24079.1152					T1	T2		T3	T3													A3						
East Range Details			24079.1155					T1	T2		T3	T3													A1						
East Range Wall Openings Adjacent to Chimney Details			24079.1156					T1	T2		T3	T3													A1						
South Range Ground Floor Plan as Proposed Alternative Option for WC Area Floor Levels			24079.1161						T1			T2													A1						
Structural Specification			24079/R02						-																A4						
Stage 4 - Structural Engineer's Report			24079/R04											-											A4						
MSB Project - Structural support to stud wall and light fittings			24079.2100							T1															A1						
East Range and Bothy - Structural Calculations													pdf																		
South Range - Structural Calculations													pdf																		
PURPOSE OF ISSUE P - Preliminary/Draft I - For Information CH - For Check A - For Approval T - Tender M - Measurement C - For Use/Construction O - Other as Noted BR - Building Regulations MEDIA P - Print O - Original N - Copy Neg. D - Disk E - Email Iss - Issue sheet only			Purpose of Issue	I	I	I	St 3	St 4	St 4	St 4	St 4 (P)	St 4	St 4	St 4	St 4	St 4									Size						
			Media	E	E	E	E	E	E	E	E	E	E	E	E	E	E														
			Issued By	ML	ML	ML	ML	ML	ML	NW	ML	ML	ML	ML	ML	ML															