

Gravesham Borough Council

Project Name: Bailiffs House Barn, Camer Park,
Camer Road, Meopham DA13 0XT

Structural Heritage Assessment Report

Date: April 2022

Project Number: A8542

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Document Status and Signatures

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Document Status and Signatures

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Signed on behalf of CTP	
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1.0 Brief

- 1.1 The brief was to undertake a structural inspection of the barn, sufficient to advise on protections and repairs and adaptations. The inspection was to be accompanied by a report with photographs, indicative sketches and discussions.
- 1.2 The brief was confirmed by email dated 9th February 2022 from Ian Rafter of CTP to the architect Frances Whittingham and the client.
- 1.3 The report was to be sufficient to help illustrate a listed building consent application for repairs along with the consideration for the proposed conversion of the barn to residential by the client.
- 1.4 We have not inspected woodwork or other parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect.
- 1.5 CTP has no responsibility to any other parties to whom this report may be circulated, in part or in full, and any such parties rely on the contents of this report solely at their own risk.
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2.0 Introduction

- 2.1 Bailiffs Barn falls within the curtilage of Bailiffs House, and is a Grade II listed timber-framed agricultural barn, currently used for storage and horse stables.
- 2.2 The barn comprises an original, symmetrical, five-bay mid to late 18th Century timber framed structure with four main internal frames and suspended first floor within the first two southern bays. The main barn doors are located on the east elevation, with small windows set between the timber structure located on the east and south. The building was later extended by one bay to the north and one bay to the west, creating catslide roofs on the west and northern elevations. (Photographs 1 and 2). Early photographs show the southern elevation was gable ended before being rebuilt with a dutch gable pitch following storm damage.
- 2.3 The barn frame is in oak, with oak posts, cross-beams, wall plates, sole plates and haunch bracing. The main elements of the wall framing to the north, east and south appear original with the exception of a small section of repaired/replaced studding to the south of the east window, although the half height west elevation has been significantly replaced with modern timber studding over the four most southern bays. Many of the rafters are missing, with perhaps up to half of the remaining being original.
- 2.4 The roof is clad with a modern profile sheeting. The external walls are covered with weatherboarding, to which the north, west and south elevations look quite recent replacements. The building sits on a brick plinth of varying height, with some lower sections being built of flint.
- 2.5 The barn has various defects and has been the subject of other recent reports. However, the client has asked for a structural engineering practice specialising in conservation, to assess the historic fabric and the impact of any proposed alteration works.
- 2.6 A sketch and a plan for general orientation appear in Appendix A. Photographs appear in Appendix B. Detailed sketches of the condition of frames and structure appear in Appendix C. Proposed alterations and impact on the existing fabric appear in Appendix D.

3.0 Observations

3.1 General

- 3.1.1 The initial inspection was undertaken by Ian Rafter of CTP on 22nd February 2022. The weather was cold and with occasional rain showers. A further more detailed site inspection was undertaken on 11th April 2022, following discovery that some of the electronic survey information was missing.
- 3.1.2 The building was in use by the client as store and stables. The inside perimeter of the barn contained various items in storage, restricting full inspection to low level areas of external walls. The northern end of the barn was being used as stables, and within this fifth bay of the main barn there were low level timber lining panels to protect the barn from livestock damage.
- 3.1.3 The central floor area was relatively clear. The floor was uneven earth, with a local area of timber floor boarding noted in the bay directly opposite the barn entrance doors, on the north side.
- 3.1.4 Lighting levels for inspection were quite poor in places due to the small windows, requiring the barn doors to be propped open to allow natural light in. There was no internal electrical light available. The first floor platform was particularly poorly lit, and limited visual access was provided by scaling a leaning section of substantial timber section fixed to the open end of the floor. There was no ladder access. A second visit
- 3.1.5 The main frame elements were all inspected where access was available, particularly for integrity in vertical loadbearing and lateral stability. Main frame joints were inspected. Secondary elements including roof rafters and purlins were also inspected, along with the condition of the raised first floor structure.
- 3.1.6 There was evidence of local attack by common furniture beetle and other wood-boring insects to structure still intact, but little evidence that this insect attack had weakened any of the structure to failing, requiring replacement. Evidence of removed horizontal brace beams in the west nave would suggest previous damage by degradation or storm damage.
- 3.1.7 Some local rot was evident, most of the remaining superstructure appeared in reasonable condition.
- 3.1.8 Load bearing plinths and dwarf walls were in varying conditions of disrepair. A considerable proportion of existing rafter members were missing.

3.2 *Primary frame timberwork*

3.2.1 Principal cross-frames and mezzanine floor frame.

The principal main frames were inspected individually for damage, decay and distress. The individual frames are shown schematically in Appendix C, along with the location of recommended repairs.

Defects to these frames include missing or damaged brace beams (photograph 1) and evidence of previous lateral displacements at eaves level. Previous beetle infestation was also noted in some areas, whilst some of the main posts contained noticeable splits. The missing brace beam adjacent the mezzanine post frames is not an immediate structural concern.

3.2.2 End walls

The end walls were inspected for damage and decay, as noted in Appendix C.

Defects to these frames include local rot to lower sections of post and plate on the south (photographs 2 and 3), and evidence of previous beetle infestation. Missing weather boarding was noted to the north.

3.2.3 Longitudinal arcade (West)

The longitudinal arcade comprising the timber eaves plate and diagonal haunch bracing over the most northern bays of the western side of the main barn were inspected for damage, decay and distress, as noted in Appendix C.

Eaves and wall plates suffer generally as main frame elements as they are in contact with the external finishes, and over the long life of the structure may be exposed to leaks for a prolonged period.

Defects to these include the loss of connection of the side jowl (photograph 4) and evidence of previous repairs to eaves plate

3.2.4 Side walls

The east and west elevations of the barn walls which support the high and low level eaves plates respectively, were inspected for damage, decay and distress, as noted in Appendix C.

Eaves and wall plates suffer generally as main frame elements as they are in contact with the external finishes, and over the long life of the structure may be exposed to leaks for a prolonged period.

There was evidence of considerable rot in an existing post on the west elevation, the rot extended into the low level eaves plate either side (photograph 5). The brace beam connecting to this post had also deteriorated and had been splinted for strength. Slight signs of wood softening to the post between the east window casements was evident (photograph 6).

3.2.5 Sole plates to walls and posts

The primary frame rests on oak sole plates under the main frame posts and around the perimeter walls.

Most lengths of sole plate were visible but a few areas were hidden behind items of storage to the perimeter. Approximately half of the western wall plate had been replaced with a modern timber plate, likely included in the barn repairs following the storm in 1987.

The plates below the posts are typically 150mm x 115mm deep (6" x 4.5") in section. They show local decay but are still functional, the decay generally being from worm attack and having eaten the sapwood and wicked down natural splits in the end grain (photograph 7).

The plates below the timber walls are in general more heavily decayed particularly beneath rotten posts described above and are typically 150mm square (6" x 6") in section. There is no obvious DPC between the plates and brick plinth below. They generally lie level but sometimes bridge over loosened wall construction (photographs 8 and 9). The southern wall plate is bowing outwards through the lean of the dwarf wall below.

Despite these defects, the sole plates are functioning adequately. In general, only when the decay is such that the plate twists on axis to split a tenon or the stud and post connection fail and flap is the functional performance lost. The decay is reasonable but not uncommon and is not a concern at present.

3.3 *Secondary frame timberwork*

The secondary frame timberwork is deemed to include the rafters, purlins, floor joists and high-level collars and lower level studs to the walls.

The original high-level framing of the roof appears largely missing in the southern section over the raised mezzanine. Additional modern rafters with collar ties have been constructed and form the majority of roof structure here, with no purlin support. The northern section has a single level of existing purlin dividing the main existing upper roof rafters into short spans. These purlins span between the main feature frames over the double height space and are irregularly shaped and taper.

Due to the size and sporadic arrangement of existing rafters, an additional outer timber structure has been constructed to support modern profiled cladding sheets across the whole roof area, independent of the existing rafters. This new secondary timber support extends down the western and northern pitches of the barn, and also the small hipped section above the southern eaves level. It is reasonable to state that the existing rafters serve little to no structural purpose, but have been retained for historic reference.

In common with early timber structures, there originally were no ridge-boards, the rafters being halved at the ridge. Previous historic damage has caused some existing rafters to skew or separate, and a ridge board can be seen in places to provide alignment for the modern secondary timber frame above (photograph 10).

Floor joists supporting the mezzanine boarding are typically 80mm (3.5") deep and will have limited design use (ie light storage only). They are supported on robustly sized timber oak cross beams spanning between the main frame posts and generally 225mm (9") deep and at least 125mm (5") wide (photograph 11).

3.4 *Brick and flint plinths to main frame*

The primary frame rests on earlier brick or flint plinths under the main frame posts and flint with upper brick cappings on the perimeter walls.

A plan showing the general state of internal plinths is shown in Appendix C.

The earlier brick plinths below the internal posts are in relatively poor condition. The lime mortar has generally been eroded and some half-bricks lost. Most require repair and repointing (photograph 12).

The modern internal brick plinths below the internal posts to the mezzanine are in reasonable condition (photograph 13).

The brick plinth beneath the walls appears in generally poor condition, (with the exception of the east elevation), with most walls having their lime mortar eroded away, loosening the upper brick courses (photograph 14). The southern plinth has a noticeable outward lean, possibly through the failing of the central post along with shallow foundations. From trial pits excavated, nearly all plinths have very shallow footings, generally 400mm below ground level, with no founding width wider than the 225mm thickness of wall. Plinths to the northern walls (internal and external) are almost non-existent, with only small retained sections directly beneath primary posts.

The replacement of the external brick plinth in short sections, together with insertion of a DPC, would help ensure longevity of the structure.

3.5 *Cladding*

The barn currently has a modern profiled cladding sheet fixed to the roof, supported from a regular grid of modern timber rafters and cross purlins. The load from this sheeting is comparative to light tiling and currently does not cause a structural concern. (Photograph 15).

The timber weatherboard cladding to the building is in reasonable condition, with evidence of board replacement relatively recently to most elevations. The board sections have warped a little, pulling nails, and some re-fixing would be helpful. They would benefit from preservative treatment.

4.0 Discussion and Proposed Alterations

Many of the implications for repair of the structure are discussed in section 3 above, as defects are noted. This section discusses general principles of function and use.

4.1 *Vertical Loadbearing*

The structure appears to be carrying current loads adequately from the roof into the ground. There is no systemic excessive deformation of beam elements (rafters, plates and cross-beams) – there are no families of timbers that are undersized, with exception of the secondary structural elements. The posts are functioning reasonably, although the lack of plumb on grid 3 and 4 means that a good provision for stability becomes more important. Change of use for the mezzanine floor would require a design assessment for residential loading, and would likely require strengthening, however. An assessment on the existing foundations supporting this mezzanine floor area would also be required.

4.2 *Lateral Stability*

Lateral bracing is important in both longitudinal and cross directions.

The raking haunches that are found beneath the eaves beam of the longitudinal arcade and across the exposed main frames to the double height barn play a significant part in the cross-building stability system. These help to prevent rotation of the vertical posts. Despite this, there is evidence of lateral sway occurring on grid 4, and improvements to this should be considered in the barn's future use. Existing strapping should be reaffixed or improved at connections.

The mezzanine frame has no raking braces, reliant on the doveled tenon joints connecting the floor beams to the main posts for stiffness. There is evidence of slight lateral movement here and improvements to the mezzanine's robustness should be considered in the barn's future use.

Horizontal brace beams at low level eaves help to restrain the western wall and prevent the eaves from pushing out. The missing or damaged brace beams on the west should be repaired or reinstated where possible.

The minor defects noted should be repaired but in general there is good provision for stability in the longitudinal direction, along the arcade and within the side walls.

4.3 *Past repairs and interventions*

As with many historical barns, there is a clear patina of repairs, each honest to its date. Unlike some timber structures, Bailiffs Barn seems to have avoided the widespread use of reconstruction resins in the 1980s, which is helpful.

Whilst one or two repairs have not adequately addressed the problems and require re-working, as noted above, most others are not detrimental and add to the history of maintenance of the building.

Iron strapping would benefit from a light clean and application of a simple corrosion protection system.

4.4 *Proposed Repairs*

The defects observed to timberwork present a short, medium and long-term risk to the structure. The 'do nothing' option exists, but only in the very short term. Sympathetic repair is recommended.

New oak for small, minor repairs and let-in timbers up to about 150x75mm in section should be air-dried, to avoid the warping of small components in the body of a larger element.

New oak for larger components will need to be green oak, as air or kiln dried timber of large section is more difficult to obtain and the impact of movement in the structure is not so critical.

Pegged oak connections that have failed should be repaired by pegging where possible.

Metalwork fixings should be stainless steel, which is appropriate to the technology available in works of this generation and resistant to corrosion induced by tannins in oak.

New brickwork to plinths should be reclaimed red stock bricks or new handmade stocks, preferably of moderate or low porosity, not high. Brickwork should be reconstructed in 1:2 ½ lime:sharp sand mortar using NHL2 or NHL3.5. Flintwork should be reconstructed with a similar mortar mix.

It is possible during the on-site scheduling of repair that some other defects may be noted. These would be repaired using the same principles as noted above.

4.5 *Proposed Changes*

The client wishes to convert the barn to a habitable single bedroom dwelling. This requires minor adaptations and interventions to include:

- New external door to east elevation
- New internal door through north wall
- New external window to north wall
- Two new windows to west wall
- Lower the floor to the north end to facilitate improved headroom within the kitchen space.

- Provide new ground floor slab
- New first floor window to south wall
- Two new roof lights built within the east pitch roof
- Conversion of the mezzanine floor for residential use.
- Reprofile the southern roof to accommodate a gable wall construction (reintroducing the original gable that existing pre 1980's)
- New external insulated cladding to roof and walls

Along with minor interventions to provide new openings, the most significant structural requirements will be related to the new ground floor construction, additional load to the mezzanine and the construction of the gable wall to the south. Shallow and narrow existing foundations will prove hard to justify for increased loadings from the new works, and with considerable strengthening and rebuilding required to the plinths below plate level, the provision of staged underpinning to all footings is expected. Appendix D illustrates the proposed strengthening and interventions required to the existing structure for the above.

5.0 Conclusions and Recommendations

- 5.1 Improvements to the roof support to suit the proposed roof cladding
- 5.2 Brace beams should be repaired or reinstated to restrain west wall and eaves
- 5.3 Other specific timber repairs are required, as noted within this report, to:
 - Principal external posts
 - Eaves plates
 - Brace beams
 - Sole plates
- 5.4 The internal brick plinths supporting the posts should be retained and repaired. This should be considered with any necessary underpinning.
- 5.5 Consideration should be given to the replacement of red stock brickwork and flintwork to the plinths around much of the perimeter of the building, including the insertion of a DPC. This should be considered with any necessary underpinning
- 5.6 The structure appears to be carrying loads adequately from the roof into the ground at present, but additional loading from the mezzanine, along with cladding loads, will likely require underpinning to increase the bearing capacity of the foundations.
- 5.7 The new cladding for the roof will require a support frame to suit the fixing requirements, fixed to the eaves and purlin line. New purlins will be required to the support the southern roof.
- 5.8 New openings need to avoid primary posts and bracing. Doorway thresholds will likely require the sole plate and plinth to be locally removed.
- 5.9 The lowering of the proposed kitchen floor area, will almost definitely require underpinning, with consideration for support for raised external ground to the north and west.

Appendix A – Location Plan

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LOCATION PLAN FOR BAILIFFS BARN, BAILIFFS HOUSE, CAMER PARK ROAD, CAMER PARK



Appendix B – Photographs

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Photograph 1 - Brace beams to West Elevation



Photograph 2 - Rotten central post to south below window



Photograph 3 - Rotten sole plate to south plinth and wall lean



Photograph 4 - Side jowl fixings prising out



Photograph 5 - Extensive rot to side post in west wall - Grid 5



Photograph 6 - External face of window post on east elevation



Photograph 7 - External sole plate with rot at ends



Photograph 8 - Loose and missing plinth to east wall



Photograph 9 - Loose and missing plinth to north sole plate



Photograph 10 - Ridgeboard insert to roof and new rafters



Photograph 11 - Shallow floor joists to mezzanine



Photograph 12 - Internal plinth support inner post



Photograph 13 - Internal brick plinths



Photograph 14 - External plinth to west wall



Photograph 15 - External roof cladding to barn



Photograph 16 - Weather boarding to east elevation



Photograph 17 - Proposed location for east door



Photograph 18 - Window and framing around south window



Photograph 19 - First floor joist bearing to south wall



Photograph 20 - Strapping around eaves frame - grid 4



Photograph 21 - Eaves detail to south above mezzanine

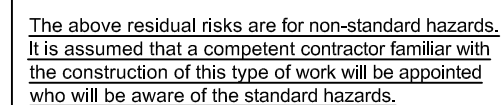


Photograph 22 - Concrete edging to sole plate in north stable



Photograph 23 - Sole plate deterioration in north west corner

Appendix C – Detail Sketches of Frame Condition



NOTES

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PRELIMINARY

P1	Report Issue	29-04-22
Revision	Amendments	Date Rev'd Chk'd
Created by:	Date created:	Discipline
-	-	STRUCT



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Project Title:

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Drawing Title:

EXISTING FIRST FLOOR
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STRUCTURAL
COMMENTS

Drawing Number:

A8542-SK02

Scale
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P1

CDM 2015 RESIDUAL RISKS

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Existing regularised modern rafters supporting cladding sheets

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P2	Report Issue	29-04-22		
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Project Title:
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Drawing Title:
EXISTING ROOF
SHOWING
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Drawing Number:
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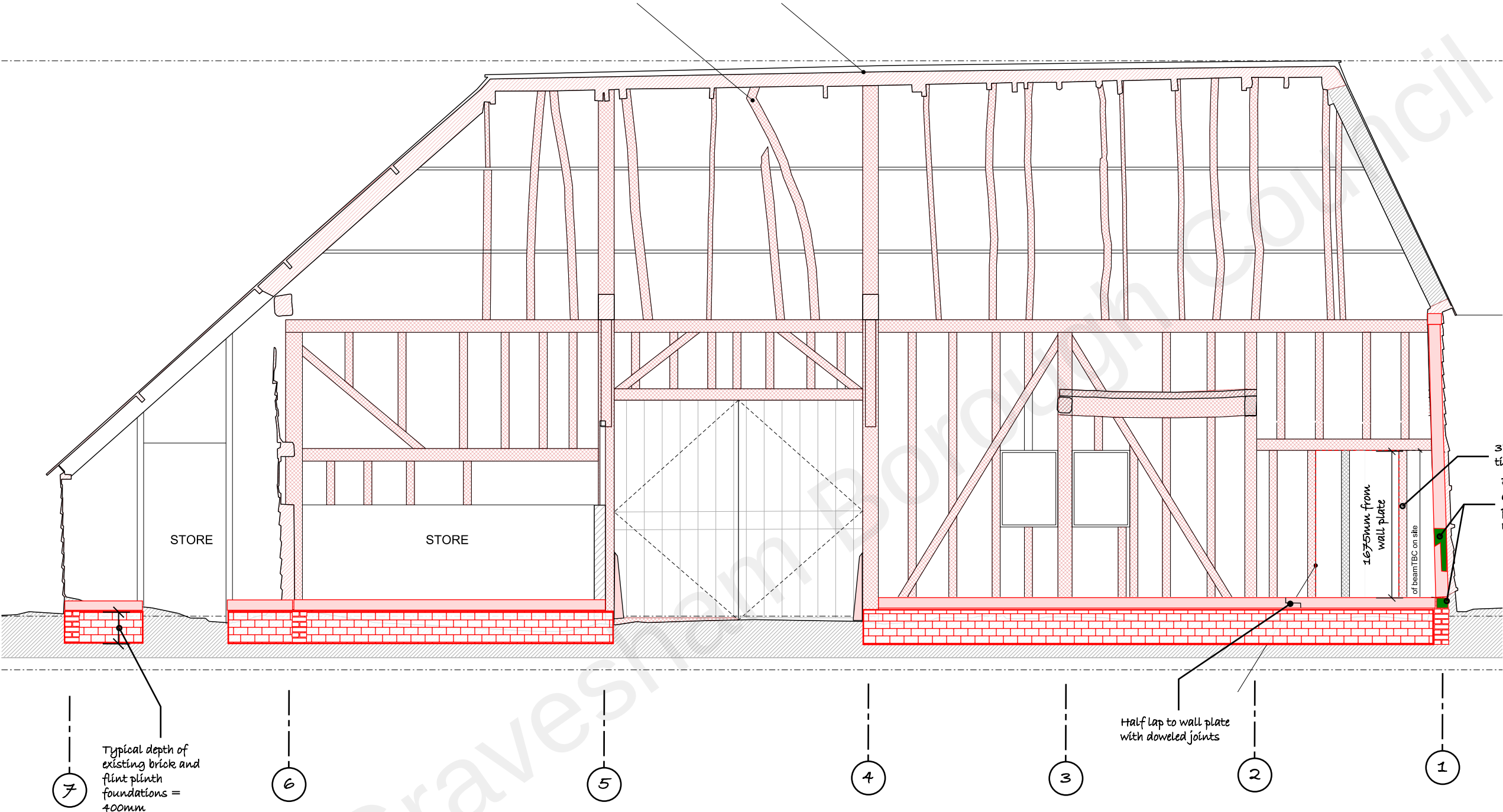
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Drawing Title:
EAST ELEVATION
SHOWING
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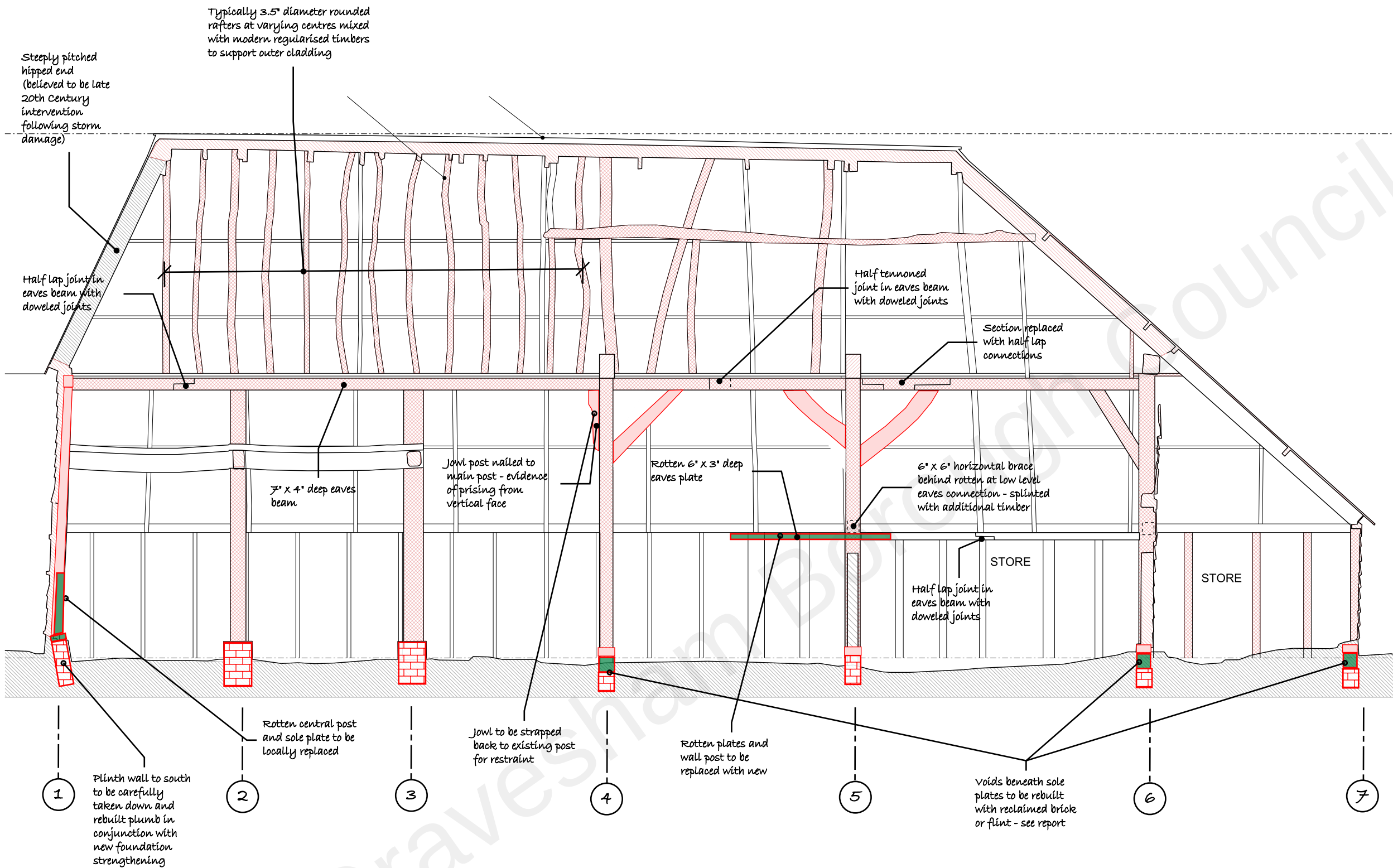
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Drawing Title:
**WEST ELEVATION
SHOWING
STRUCTURAL
COMMENTS**

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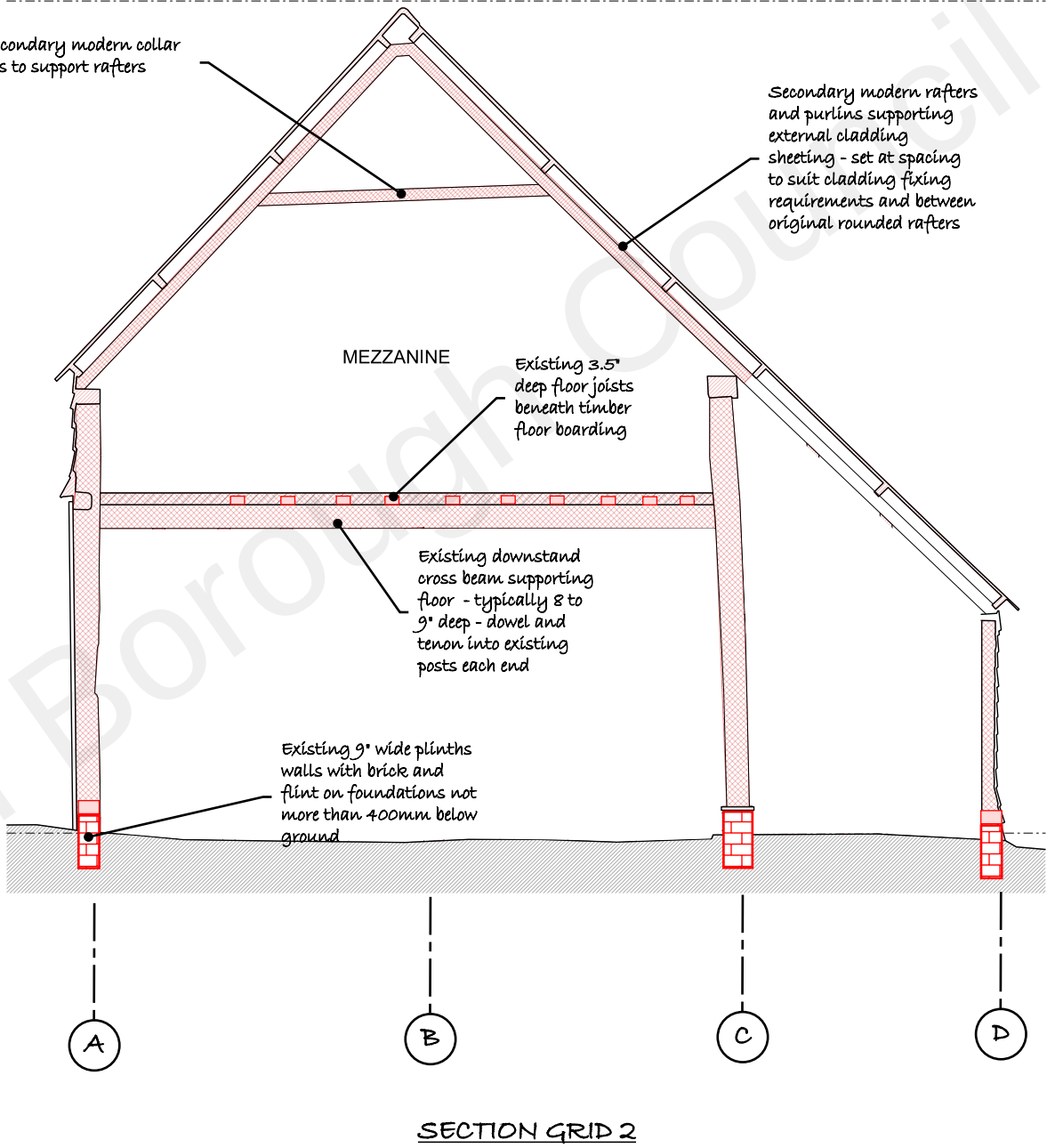
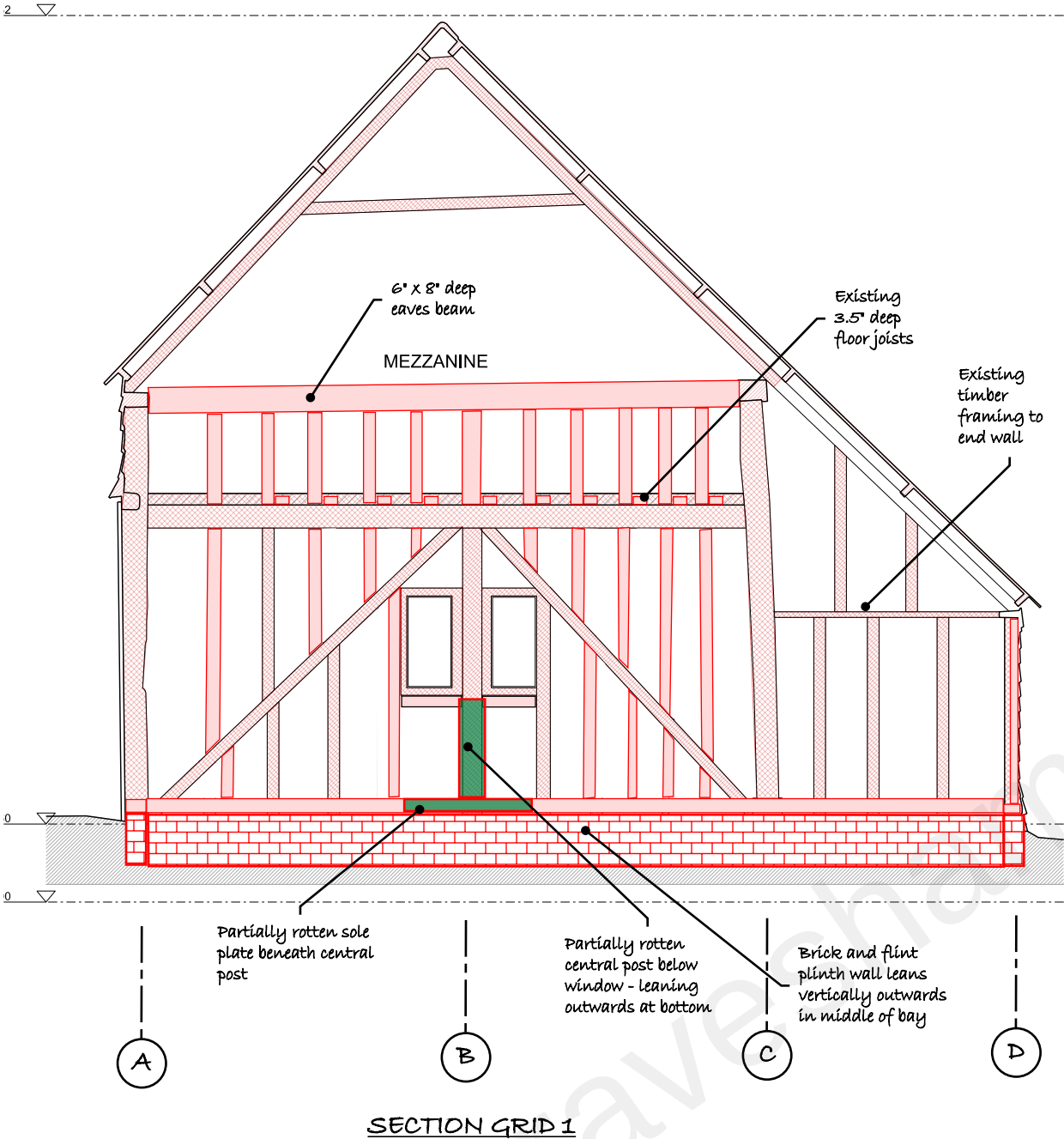


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EXISTING SECTIONS SHOWING
STRUCTURAL COMMENTS
SHEET 1

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A8542-SK06
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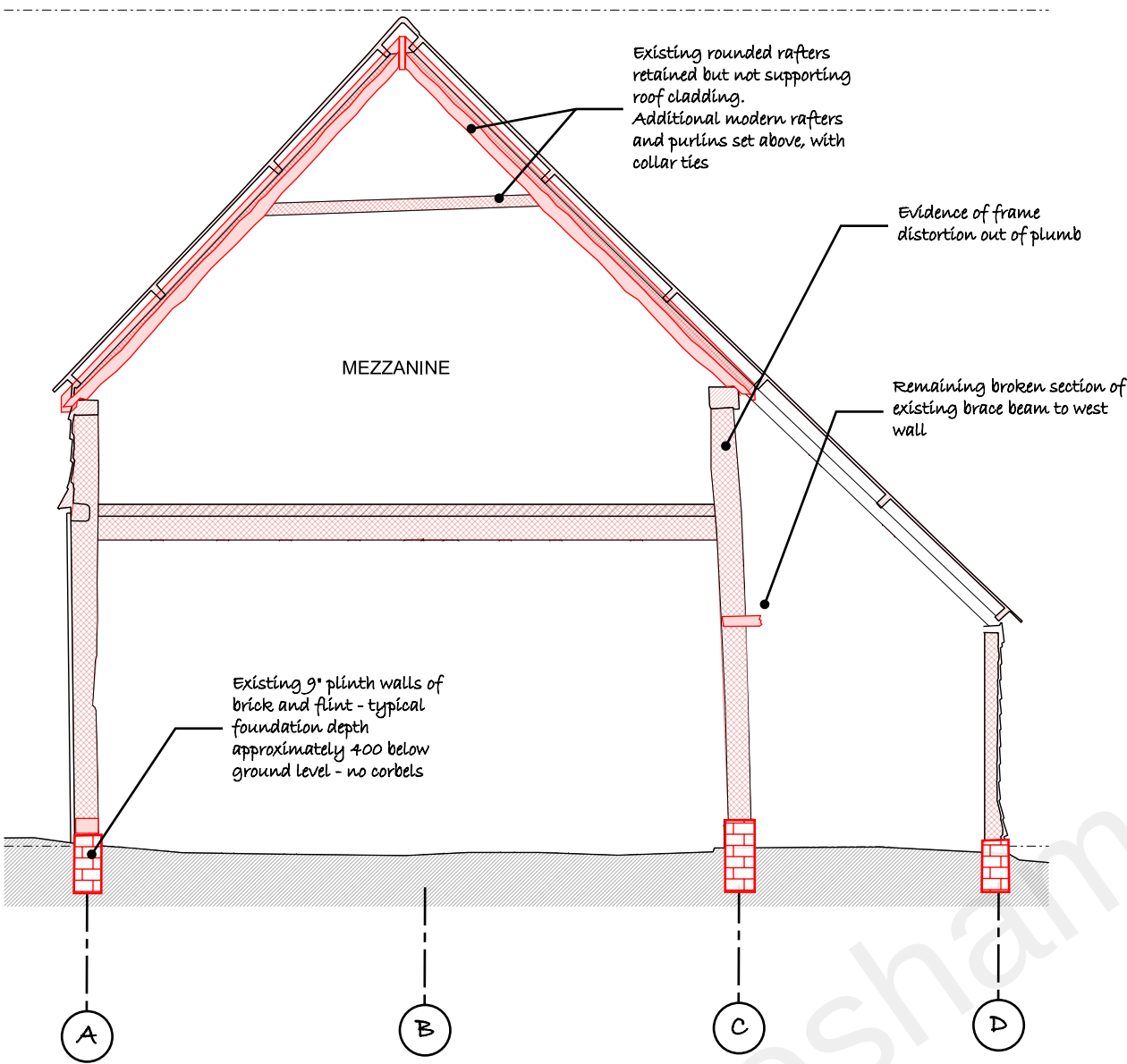
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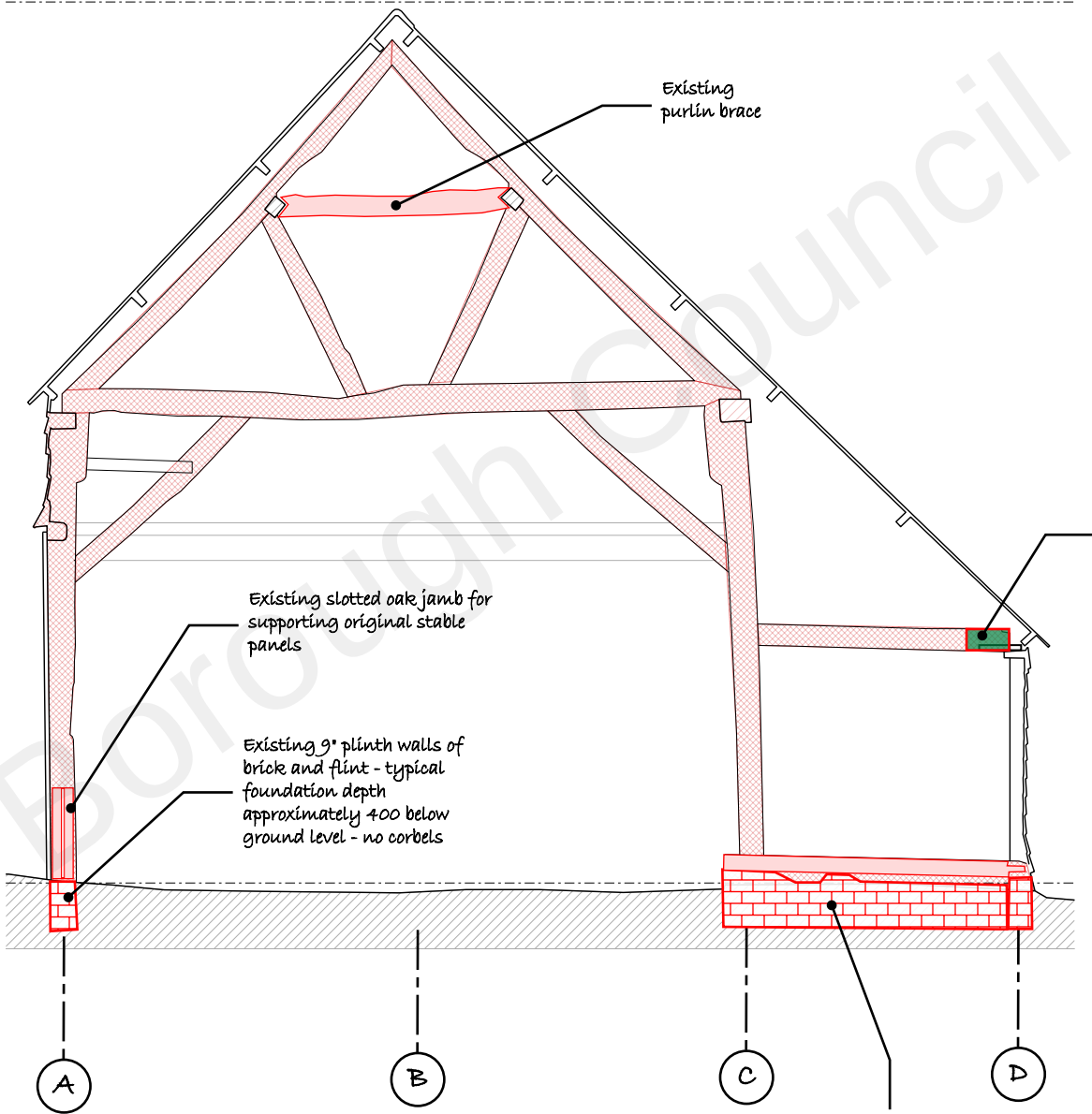
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SECTION GRID 3



SECTION GRID 4

PRELIMINARY

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EXISTING SECTIONS
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STRUCTURAL
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NOTES

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PRELIMINARY

P1	Report Issue	23-04-22
Revision	Amendments	Date Rev'd Chk'd
Created by:	Date created:	Discipline
-	-	STRUCT



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Project Title:

BAILIFFS BARN
BAILIFFS HOUSE
CAMER PARK ROAD
CAMER PARK

Drawing Title:

EXISTING SECTIONS
SHOWING
STRUCTURAL
COMMENTS
SHEET 3

Drawing Number:

A8542-SK08

Scale
1: @A3
Unless Noted Otherwise
Revision
P1

CDM 2015 RESIDUAL RISKS

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Appendix D – Proposed Alterations on Existing Structure

NOTES

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New window opening required in north wall. Position to minimise intervention with existing structure and to avoid braces

PRELIMINARY

P1	Report Issue	29-04-22
Revision	Amendments	Date Rev'd Chk'd
Created by:	Date created:	Discipline
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CAMER PARK ROAD
CAMER PARK

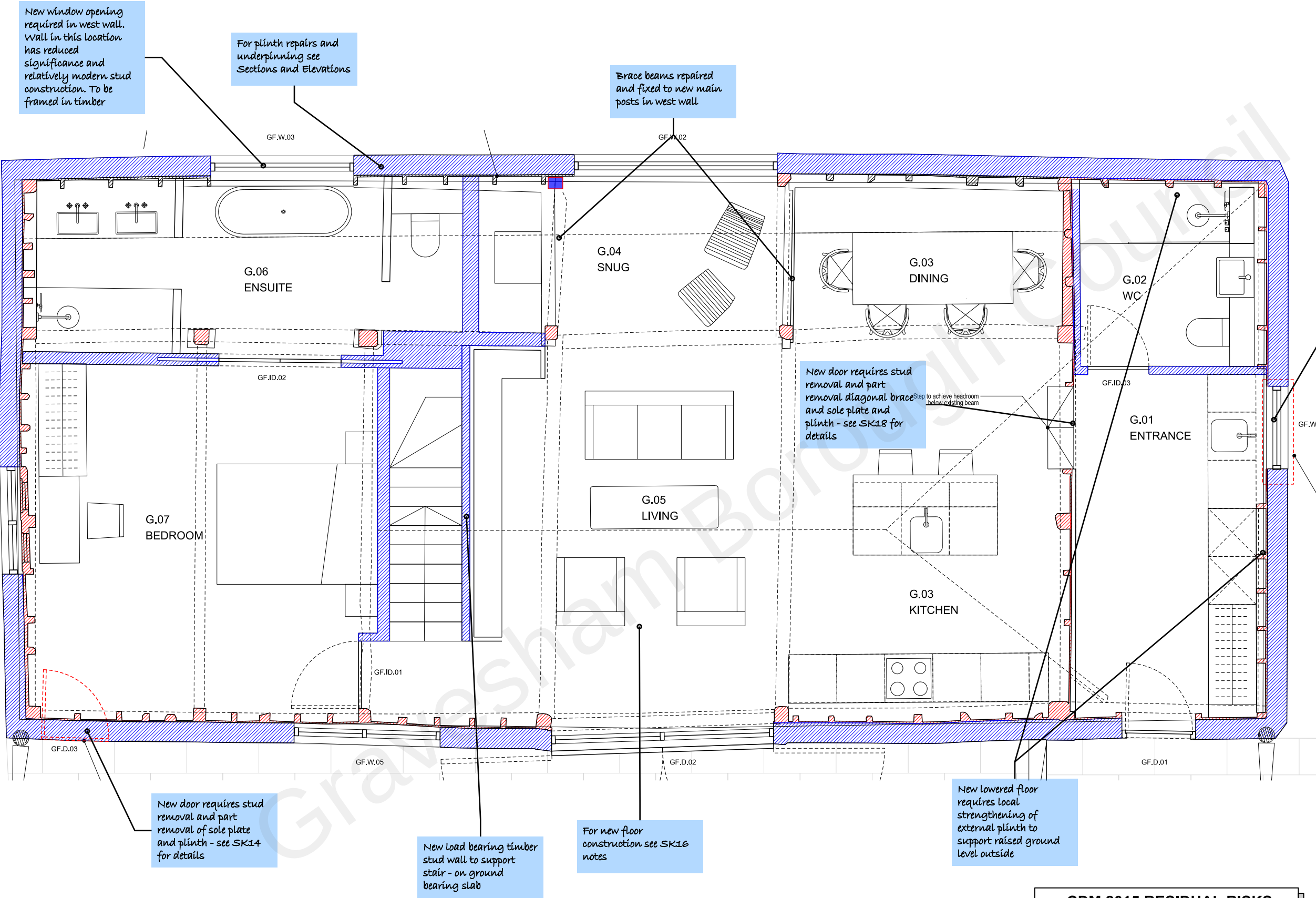
Drawing Title:

PROPOSED STRUCTURE
FOR GROUND FLOOR

Drawing Number:

A8542-SK11

Scale
1: @A3
Unless Noted Otherwise
Revision
P1



CDM 2015 RESIDUAL RISKS

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PRELIMINARY

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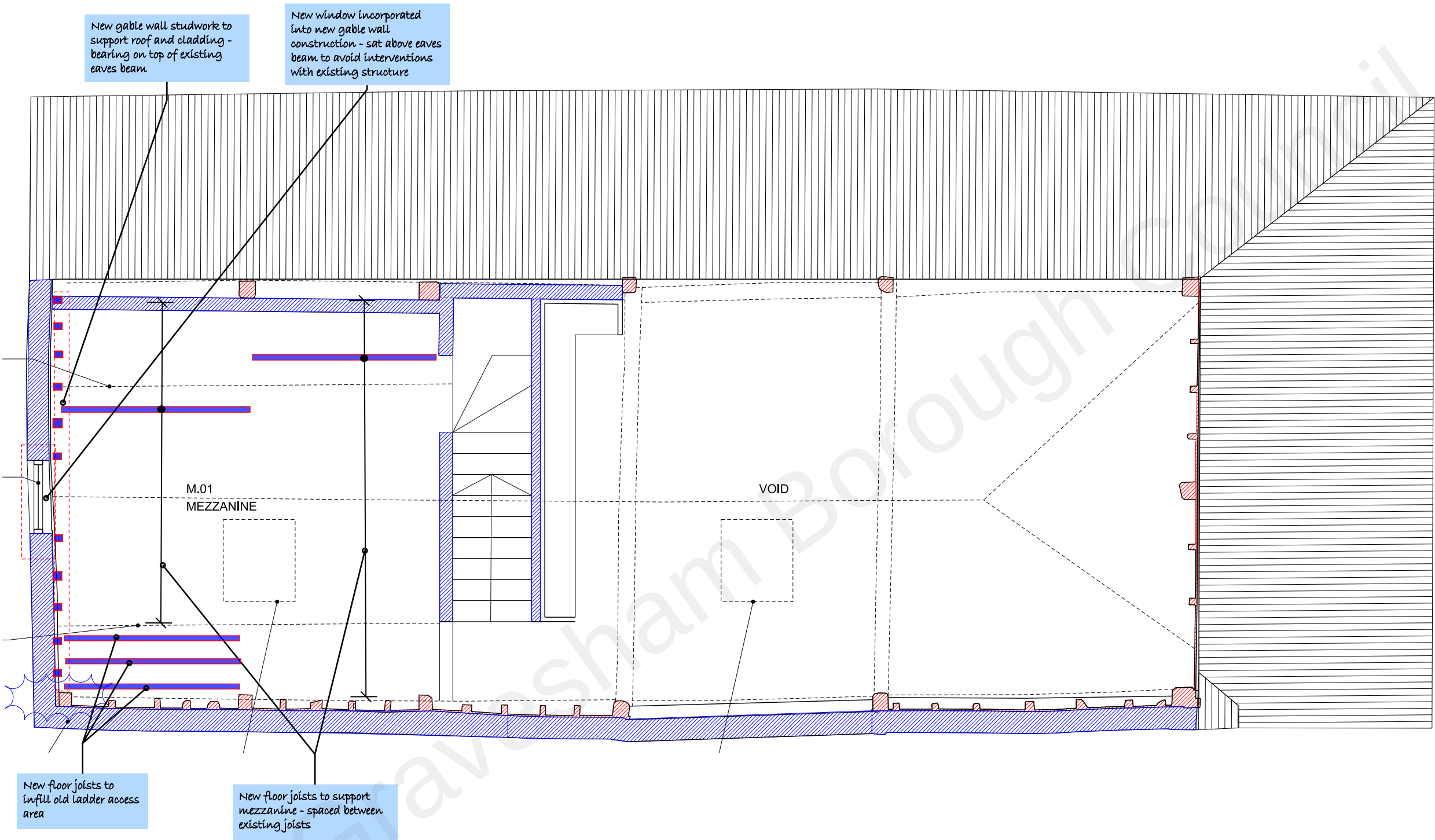
Drawing Title:

PROPOSED STRUCTURE
FOR FIRST FLOOR

Drawing Number:

A8542-SK12

Scale
1: @A3
Unless Noted Otherwise
Revision
P1



CDM 2015 RESIDUAL RISKS

- 1.
- 2.
- 3.
- 4.

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New rafters set between existing rounded rafters to suit support requirements of new insulating roof cladding system

PRELIMINARY

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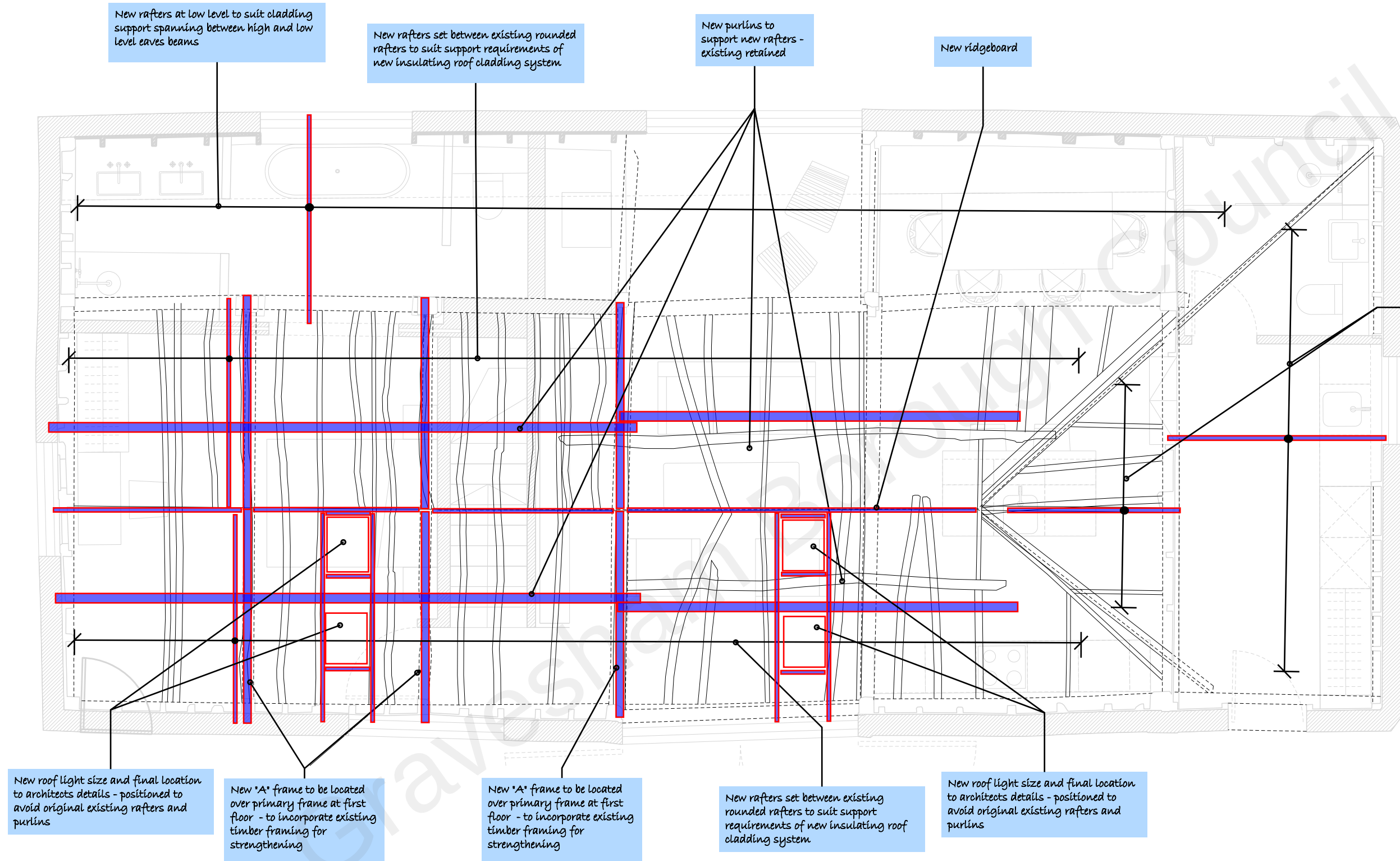
Drawing Title:

PROPOSED STRUCTURE
FOR ROOF

Drawing Number:

A8542-SK13

Scale
1: @A3
Unless Noted Otherwise
Revision
P1



New rafters at low level to suit cladding support spanning between high and low level eaves beams

New rafters set between existing rounded rafters to suit support requirements of new insulating roof cladding system

New purlins to support new rafters - existing retained

New ridgeboard

New rafters set between existing rounded rafters to suit support requirements of new insulating roof cladding system

PRELIMINARY

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BAILIFFS HOUSE
CAMER PARK ROAD
CAMER PARK

Drawing Title:

PROPOSED STRUCTURE
FOR ROOF

Drawing Number:

A8542-SK13

Scale
1: @A3
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Revision
P1

New roof light size and final location to architects details - positioned to avoid original existing rafters and purlins

New 'A' frame to be located over primary frame at first floor - to incorporate existing timber framing for strengthening

New 'A' frame to be located over primary frame at first floor - to incorporate existing timber framing for strengthening

New rafters set between existing rounded rafters to suit support requirements of new insulating roof cladding system

New roof light size and final location to architects details - positioned to avoid original existing rafters and purlins

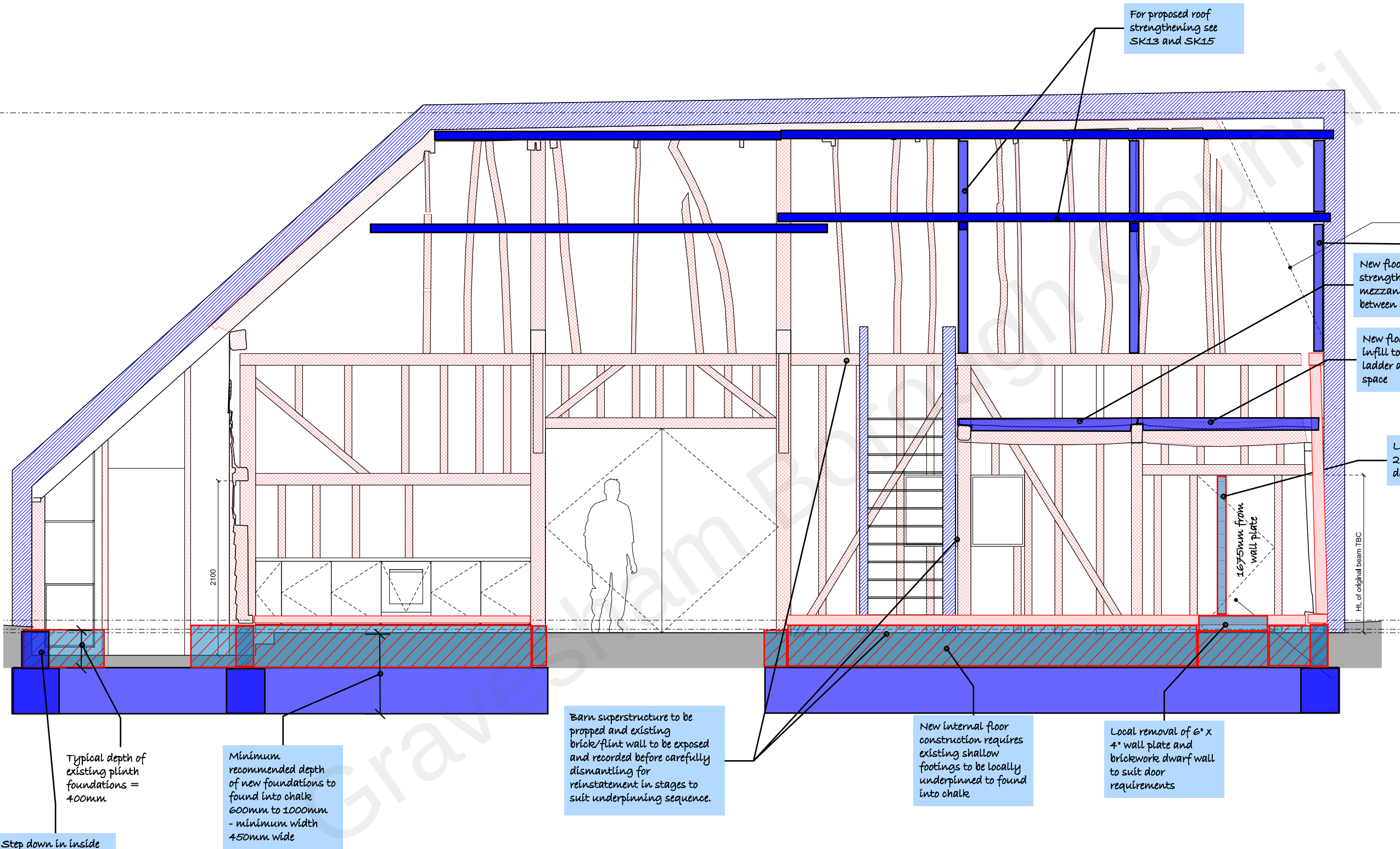
CDM 2015 RESIDUAL RISKS

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NOTES

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PRELIMINARY

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CAMER PARK ROAD
CAMER PARK

Drawing Title:

PROPOSED STRUCTURE
FOR EAST ELEVATION

Drawing Number:

A8542-SK14

CDM 2015 RESIDUAL RISKS

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PRELIMINARY

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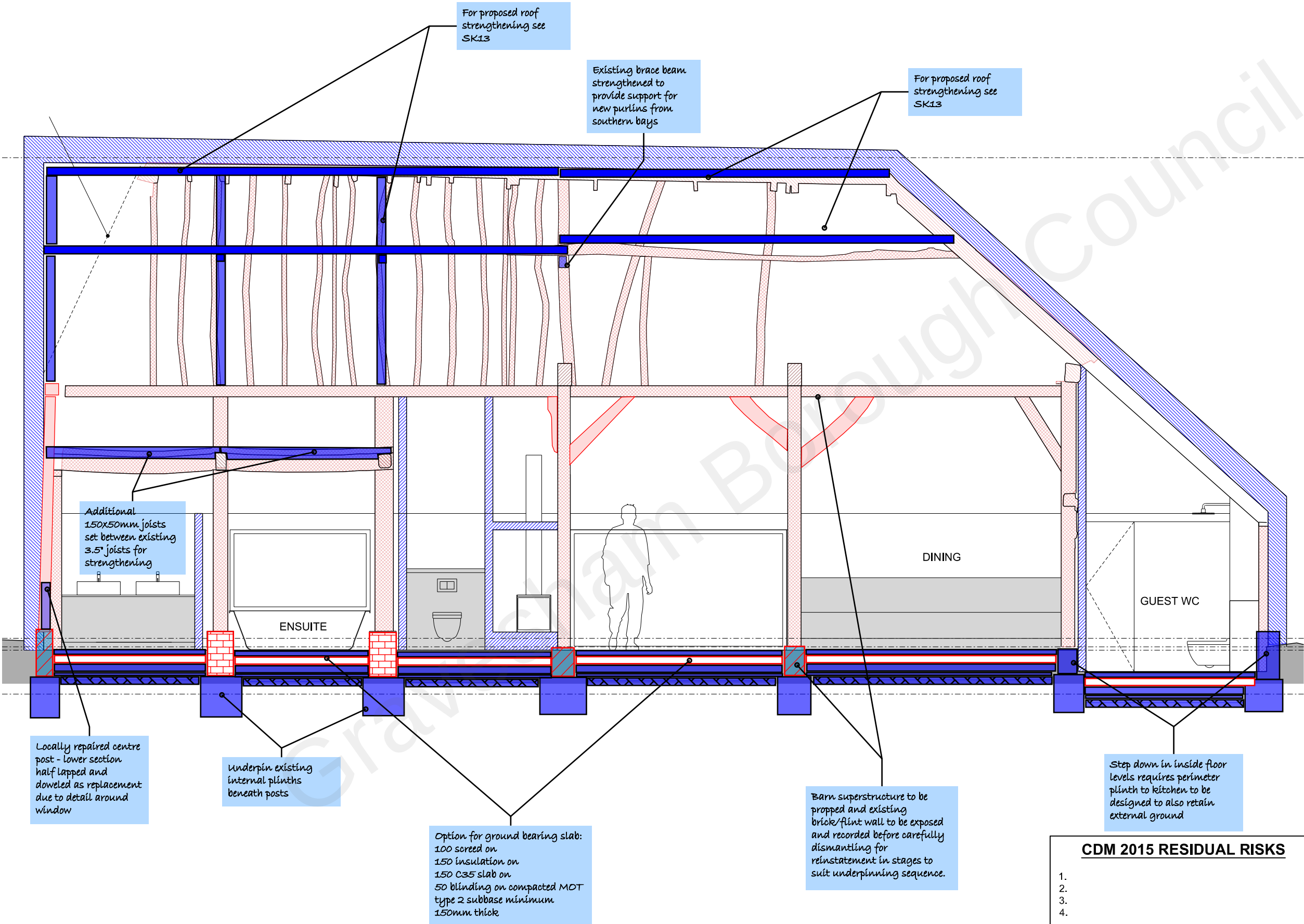
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Project Title:
**BAILIFFS BARN
BAILIFFS HOUSE
CAMER PARK ROAD
CAMER PARK**

Drawing Title:
**PROPOSED STRUCTURE
FOR WEST ELEVATION**

Drawing Number:
A8542-SK15

Scale:
1: @A3
Unless Noted Otherwise
Revision:
P1



CDM 2015 RESIDUAL RISKS

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Drawing Title:

PROPOSED STRUCTURE
SECTIONS - SHEET 1

Drawing Number:

A8542-SK16

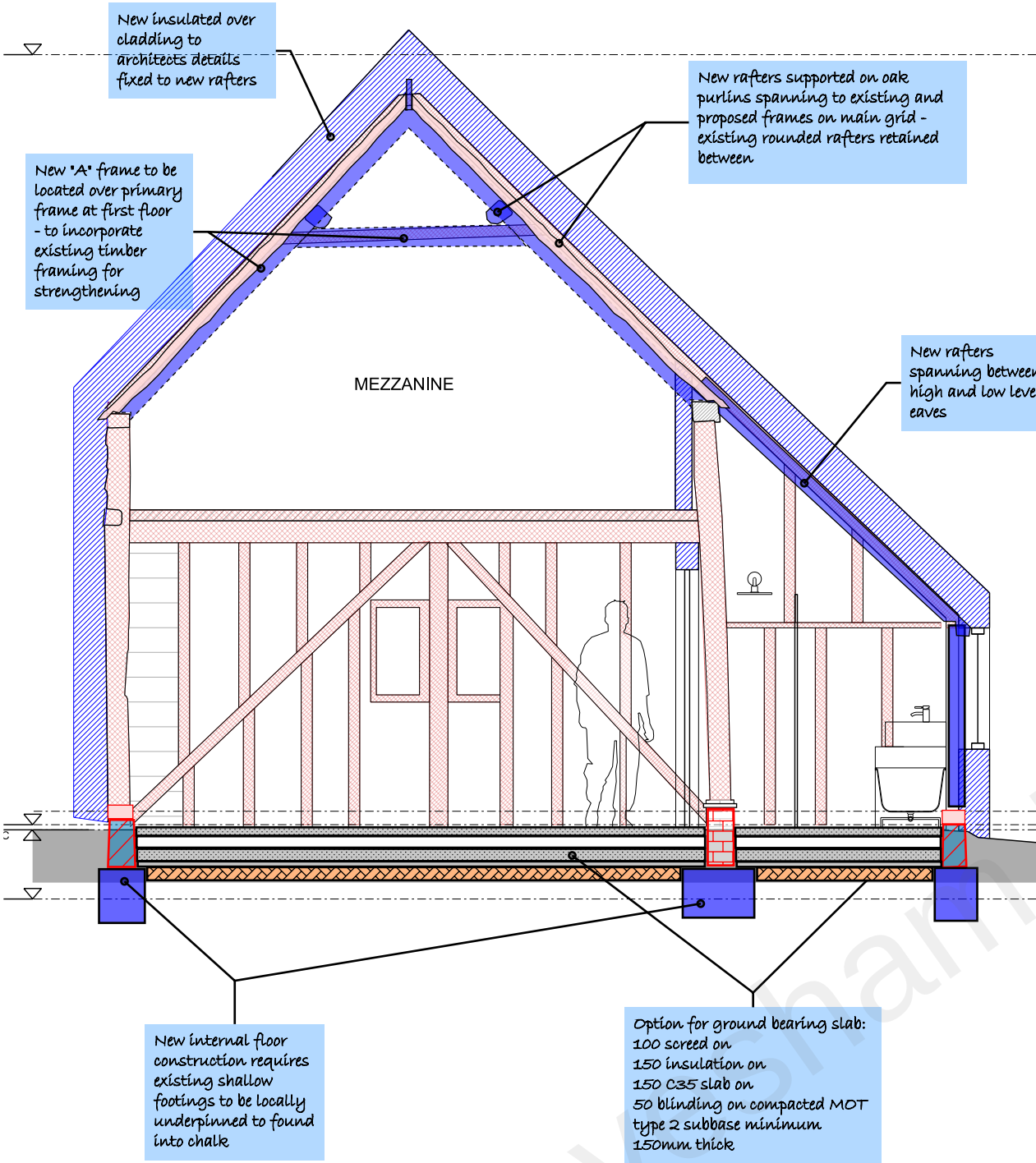
Scale: 1: @A3 Unless Noted Otherwise

Revision: P1

CDM 2015 RESIDUAL RISKS

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SECTION GRID 2

NOTES

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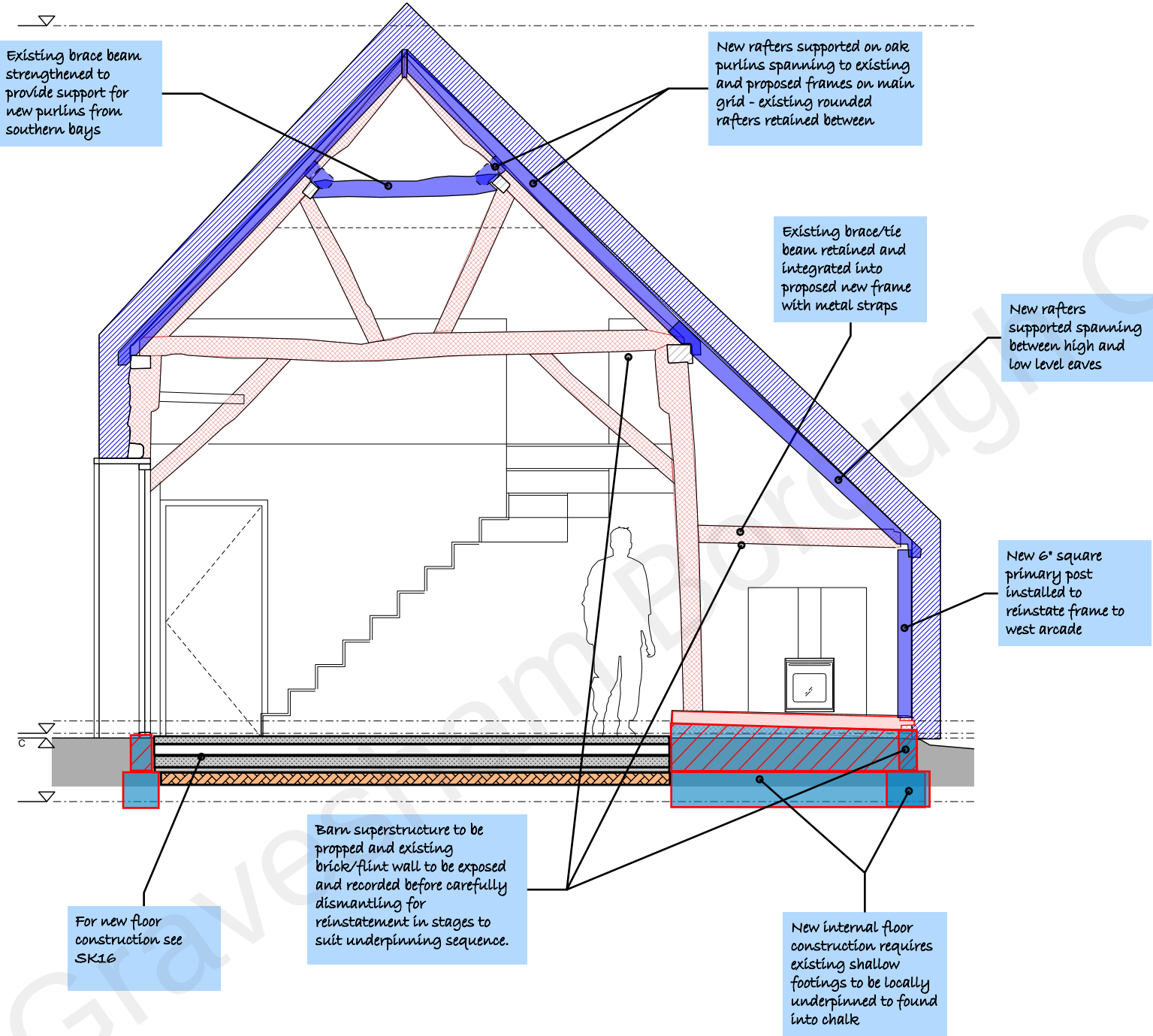
Drawing Title:

PROPOSED STRUCTURE
SECTIONS - SHEET 2

Drawing Number:

A8542-SK17

Scale
1: @A3
Unless Noted Otherwise
Revision
P1



CDM 2015 RESIDUAL RISKS

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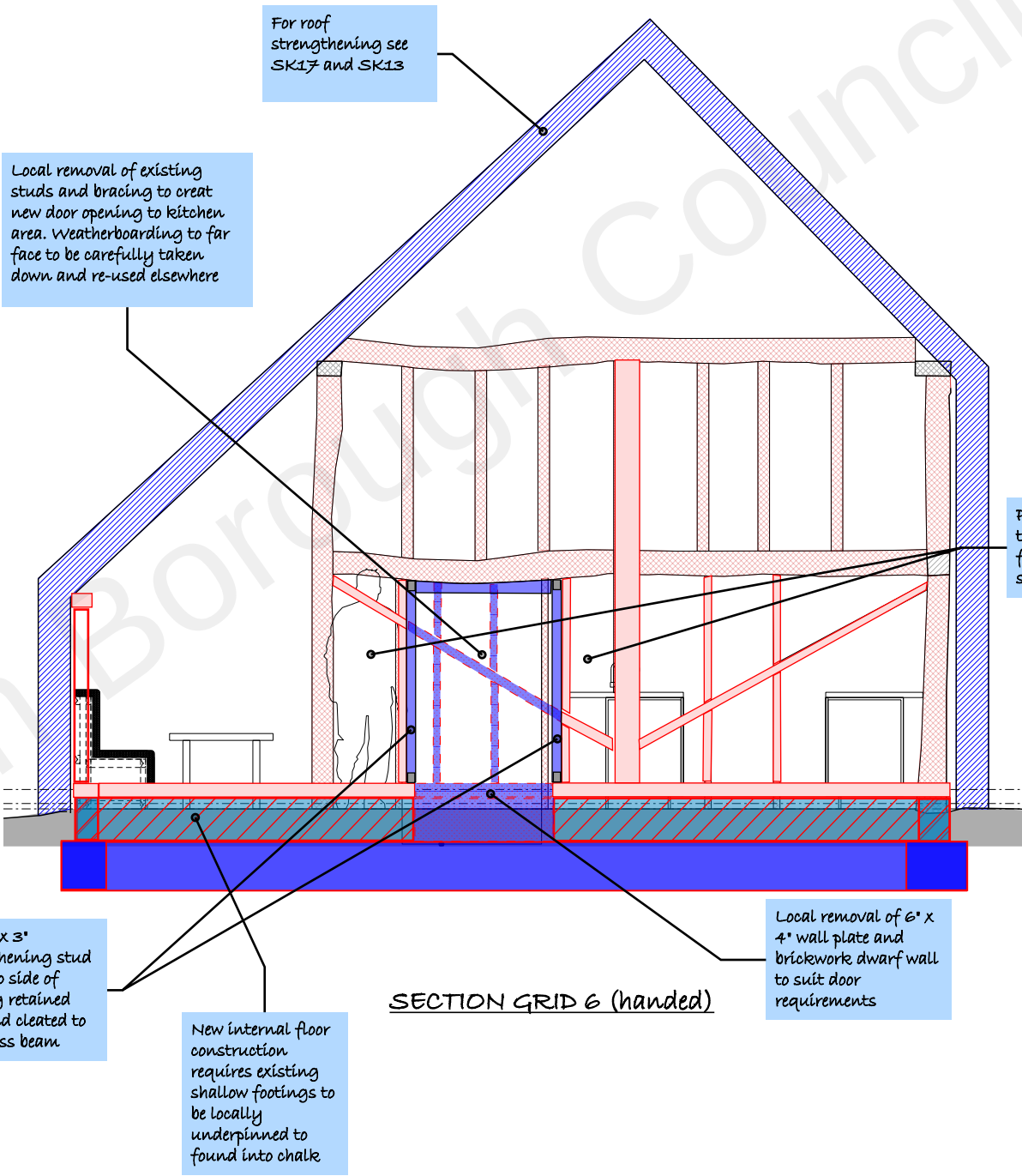
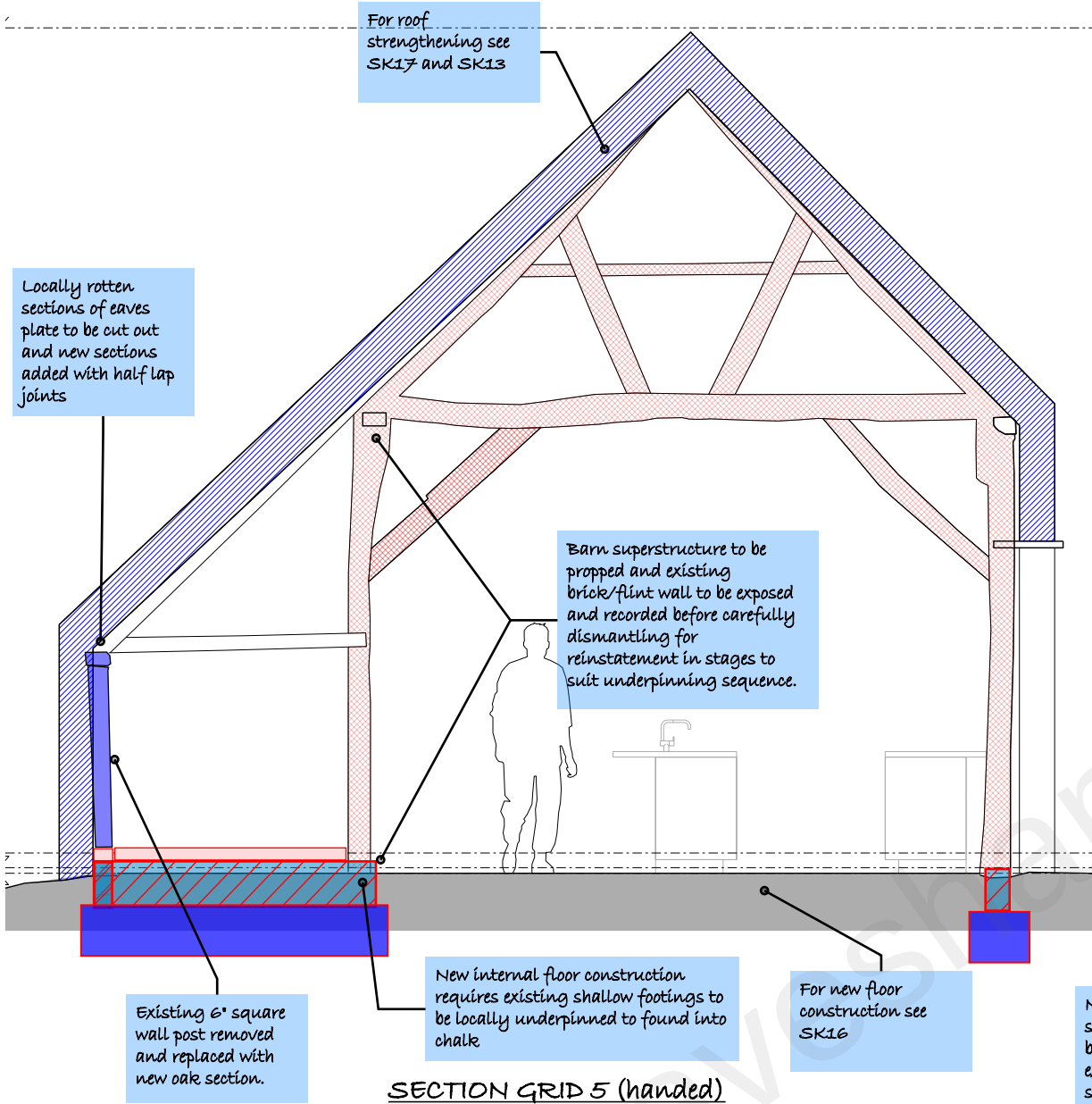
Drawing Title:

PROPOSED STRUCTURE
SECTIONS - SHEET 3

Drawing Number:

A8542-SK18

Scale
1: @A3
Unless Noted Otherwise
Revision
P1



CDM 2015 RESIDUAL RISKS

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