

## Structural Inspection Report

### Crow Trees Farm, Chatburn, Clitheroe

Pringle Homes

Ref: K39346.SIR/001

Version	Date	Prepared By	Checked By	Approved By
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## 5. INTRODUCTION

RG Parkins & Partners Ltd, were appointed to undertake a structural inspection the various buildings within the grounds of the site with a view to reporting on the overall condition and of any remedial works required for future conversion.

The inspection was undertaken on Tuesday 10<sup>th</sup> May 2022, by Jonathan Freeman MEng (Hons) CEng MStructE. The weather was warm and dry.

The inspection was visual only, undertaken from ground and floor levels only, within the grounds of the property and no finishes were removed.

## 6. STRUCTURAL DESCRIPTION

The site is comprised of the main farmhouse, with detached garages and coal store; plus, a large two storey barn, with attached workshop, and open sided hay barn.

The farmhouse is listed under the Planning Act 1990 for its special architectural or historic interest and is categorised as a Grade II Listed Building.

The farmhouse walls have a thick pebble dash render finish, and steep pitched roofs with slate coverings. The main and upper ridge line runs east to west, with two parallel gable ended wings on the north side at a lower level. The rear portion is three storeys, and the front two-storeys. Attached to the south-eastern corner of the house is a two-storey tall building without a floor, which contains an old cheese press.

The stone built external garages are open fronted with exposed walls, and a mono-pitched roof of stone flags.

The detached single storey coal house within the gardens is set lower than the access road level, and as such acts to be a part retaining structure.

The main barn is of traditional construction with 550mm thick stone and random rubble fill walls, and a pitched roof covered with slate, supported off timber trusses. Walls have a lime pointed finish. The lower ground floor is a ground bearing concrete slab. Upper floors are comprised of boarding over timber joists. The attached workshop building is single storey with stone built and rendered finished walls.

Separate to the above, is a large open sided hay barn, with tall brick piers, a knee braced eaves structure and pitched slates roof on loose timber rafters and raised rafter ties.





*Figure 6.1.1: Ariel view of the farmhouse (south & rear), cheese room, coal house, with main barn and workshop to the west*



*Figure 6.1.2: Ariel view of the main barn, workshop, and hay barn with the farmhouse beyond*





*Figure 6.1.3: Ariel view site*

## 7. FARMHOUSE

### 7.1 EXTERNAL OBSERVATIONS (SOUTH, REAR)

The roof is steeply pitched with slate coverings, and ridge tiles. The slates look to be stable and intact, along with the visible lead flashing to gable copings.

The ridge line looks to be reasonably straight on the western side of the house, however the eastern side displays a slight central rise and dip with undulations along the length, falling towards the upper chimney stack. Undulations within the slope of the rafters can also be seen more prominently towards the eastern end of the roof.



*Figure 7.1.1: Rear, south elevation of the farmhouse and cheese press building*

At eaves level, there is a raised stone parapet, assumed to conceal a lead flashed box gutter, with a single rainwater pipe outlet. Small gaps in the flashing and joists between the eaves stones can be seen, and are in need of general maintenance. At ground level the gully outlet is blocked / soiled up.

Chimney stacks of exposed stone (west) and rendered (east), look to be in a reasonable condition. The wall corner to the western gable looks to be reasonably straight and plumb.

Grey render dashing to the external walls looks to be in a reasonable condition with no spalling or delamination. Only minor cracking / crazing in the render to the top of the first floor - to second floor window can be seen.



*Figure 7.1.2: Render cracking between windows*

To the left of the door is a 5-panel window with rebated and chamfered stone surrounds. The stone surround and central mullion pieces appear to be heavily weathered and deteriorated and should be replaced with equivalent sections and materials. All other stone mouldings and surrounds look to be weathered, but in a reasonable condition with only minor cosmetic repair and surface treatment being required.



*Figure 7.1.3: 5-panel window with heavily weathered stone surrounds*

The original external walls are assumed to be of solid local stone with rubble fill, have received a render finish for weather protection. The render has been taken down ground level on all elevations, leaving the walls vulnerable to water penetration.

## 7.2 EXTERNAL OBSERVATIONS (WEST, SIDE)

The side wall is part gable ended to the rear portion, and part square topped at the eaves level of the northern wing. A lead flashed valley divides the two ridge lines, which looks to be in a reasonable condition, taking roof water to a similar hidden eaves gutter and single downpipe.



*Figure 7.2.1: Side, west elevation. Northern wings to the left*

At the intersection of the valley to and eaves there is a clear vertical crack in the render, emanating from eaves level, and continuing down the face of the wall. The cracking is hairline but requires further investigation to the underlying material.



*Figure 7.2.2: Vertical cracking in the render at wall / roof junctions*



Render behind the rainwater pipe and soil vent pipe is also cracked, although is likely associated with the expansive corrosion of metallics fixings, or a weak point in the render where water has been allowed to enter.

At ground level a foundation/wall plinth outstands the wall. The capping to this display's areas of spalled and delaminated masonry that have fallen away.

### 7.3 EXTERNAL OBSERVATIONS (NORTH, FRONT)

To the front elevation, twin ridges to the northern wings of the farmhouse can be seen. To the top of the wall, it is apparent that a short parapet and box gutter has been formed to take all roof water into the central down pipe. This area of roof should be inspected further for longevity and condition of the existing roofing and gutter materials. The outlet pipe and downspout funnel look to be stained and heavily corroded, possibly creating a pathway for water ingress to the walls below.



*Figure 7.3.1: Front, north elevation. Twin northern wings, with central valley gutter and downpipe*

On the right-hand side, between the first and second floor window there is a vertical hairline crack in the render. The cracking also looks to continue below the ground floor window, through the concrete plinth and to ground. Render removal is required for further investigation.



*Figure 7.3.2: Render cracking between windows*

Above and to the left of the front door, and up to the landing window, there is a diagonal hairline crack in the render.



*Figure 7.3.3: Render cracking between door and window*

On the eastern wing, there is a large vertical crack from the ground floor window lintel up to the roof line, with evidence of a previous crack repair having been filled. The ground floor window lintel and cill are noticeably dipped to their left-hand side indicating that there has been some settlement of the north-eastern corner of the house. This wall panel also has a slight bulge at mid height, which should be investigated further along with the wall cracking.



*Figure 7.3.4: Large vertical crack to the eastern wing*

In close vicinity to this corner, there are numerous foul and surface water drains, an external yard gully, and manhole chamber. The chamber lid was not lifted.



*Figure 7.3.5: Numerous drainage elements in close vicinity to the north-east corner*

#### 7.4 EXTERNAL OBSERVATIONS (EAST, SIDE)

Much like the opposite side elevation, there is an almost full height vertical crack in the render at the change in roof lines between the true gable and northern wing wall. The wall panel also displays a slight bulge at first floor level at the intersection with the cheese press building.





*Figure 7.4.1: Bulge to the east wing wall*

The raised gable copings to the cheese press room looks to have externally rotated and should be re-set to ensure stability.

The gable wall to the cheese press room looks to be reasonable straight and plumb, although displays areas of cracked, spalled, and delaminated render, with vegetation growth.



*Figure 7.4.2: Cracked and spalled render to the cheese press gable*

The slate roof coverings and ridge stones look to be in a good condition. Rainwater goods (gutters and downpipes) will require suitable replacement, and as per all other below ground drains on the site, will require inspection via a CCTV drainage survey.

## 7.5 INTERNAL OBSERVATIONS - CHEESE PRESS ROOM

To the external gable wall, the internal plaster coverings have spalled and are damp throughout. The coverings are loose and should be removed as part of any renovation works.



*Figure 7.5.1: Cheese press external gable wall*

The gable wall to the farmhouse has a similar plaster covering that is loose and cracked throughout. Daylight can be seen at the top of wall-to-roof junction, and it is evident that water has been allowed to enter at this roof intersection. Internal wall finishes should be removed to allow for closer inspection of the underlying stonework, and roof flashings upgraded.

The external gable wall itself is a tall double storey wall, and only restrained at eaves level via the inbuilt roof structure. Timbers forming the ridge and purlin sections to each slope are old and twisted sections, with signs of rot and infestation although appear to be acting suitably given their relative short spans. They should, however, be inspected by a timber specialist.

Rafters to the southern side look to have been replaced, with a felt membrane installed. Slates to the northern side are seated on battens only, with no torching being present.

At the rear wall corner (south-east) there is vertical cracking, indicative of a lack of tie / stone bond between the wall junctions. Proprietary wall corner stitching will be required. This is adjacent to the external downpipe and gulley, so as a precautionary measure inspection of the formation to the foundation stones should be undertaken.



*Figure 7.5.2: Cheese press south east wall corner with lack of tie in*

Adjacent to the rear door there is a uniform vertical crack on the farmhouse to wing wall junction, indicative of some differential movement between the different walls, and a lack of adequate tie in.



*Figure 7.5.3: Cheese press to farmhouse wall vertical cracking*

## 7.6 INTERNAL OBSERVATIONS – GROUND FLOOR

Within the main house, particularly to the north facing rooms there is a general feel of cold and damp throughout. The ground floor comprises a concrete slab, walls have a thick paper-lined finish. There are low ceilings with down-stand beams, boxed out in the kitchen and exposed timbers in the south facing lounges. The large down-stand timber beams look to be in a reasonable condition, with no adverse deflection, but as with all timbers should be inspected by a timber specialist.

Internal door heads are low, but appear to be boxed out between the floors, making any proposals for increasing the opening heights a simple task with little structural intervention.

The ground floor bathroom in the north-east wing shows signs of significant damp and water ingress issues from the northern wall. There is cracking that surrounds the lintel head, which may be indicative of local movement to the lintel section. If this is timber that has been subject to water ingress, rot and swelling of the timber may be present and should be investigated further.



*Figure 7.6.1: North east wing, ground floor bathroom water ingress*

The small basement cellar is formed with a vaulted stone ceiling which looks to have retained its form and shape. The basement is understandably damp, and dependent upon its future used will require suitable waterproofing / tanking measures to be installed.



*Figure 7.6.2: Basement cellar with stone arch ceiling*



To the stair half landing there is cracking to the window jambs, and significant water ingress surrounding this wall panel. Viewed externally this is immediately adjacent to the central valley gutter and downpipe between the northern wings.



*Figure 7.6.3: North east wing, water ingress at half landing level*

## 7.7 INTERNAL OBSERVATIONS – FIRST FLOOR

First floor timbers generally have a solid feel to them, although have dipped through long term creep deflection of the timbers.

Within the front bedroom (north-east corner), there is major damp / water staining to both the external and internal cross walls indicating water ingress at roof level and possibly from within the walls themselves.



*Figure 7.7.1: North east wing, first floor water ingress*

The floor is noticeably dipped towards the north-east corner (30mm in 1200mm, 1:40) in both directions. Rather than a central sag of the timbers that would be expected, the dip of the joists towards the wall corner suggests that some vertical movement of the north-east wing corner to have taken place.



*Figure 7.7.2: North east wing, floor dip to external corner*

Walls to the north facing bathroom are similarly damp through water ingress. Timber floors within the bathroom exhibit a hollow feel.

To the rear master bedroom (eastern gable) at the intersection of the cheese press room there is diagonal and vertical cracking to the wall panel. Although the wall finishes are in place, as the wall cracking was also observed externally this is believed to have continued through the full section of the wall.



*Figure 7.7.3: East gable wall cracking*

**7.8 INTERNAL OBSERVATIONS – SECOND FLOOR AND ROOF STRUCTURE**

The southern wing of the farmhouse has a second floor that is part within the eaves of the roof structure. A 600mm thick stone cross wall separates this into two rooms, each at the east and west end of the house.

To the western room, there are ceilings in place at the lower purlin level, that have served as ties to the roof structure and prevent eaves spread. It was not possible to inspect the roof structure within the ceiling void. Water staining is present at the intersecting valley lines of the northern wings, with minor hairline cracking to the western gable wall.



*Figure 7.8.1: Western room ceilings and staining at valley connection*



To the eastern room, there are no ceilings with the exposed roof structure above. This comprises a ridge beam and two no. purlins to each side, with rafters and a felt membrane. As a result of the lack of (or historic removal of ceiling ties) outward thrust on the purlin sections is evident with stepped cracking in place at the purlin bearings. This is most evident at the bearing of the lower purlin on the north side of the roof that is more heavily loaded carrying the ridge and valley of the northern wings.



*Figure 7.8.2: Eastern room cracking at purlin bearing*

The effect of roof thrust can also be seen at the wall corners, with minor separation from the gable, internal cross wall, and dividing wall between north and south wings.



*Figure 7.8.3: Eastern room wall corner separation*

The eastern gable wall is damp, particularly on the line of the central chimney line, with spalled plaster throughout. Daylight can be seen through the roof at the wall junction. A vertical crack is evident in the centre of this wall panel, worsened by the water ingress down the face of the wall.



*Figure 7.8.4: Eastern room water ingress below chimney and wall cracking*

## 8. GARAGES

### 8.1 OBSERVATIONS

The external garages comprise three open fronted bays and an enclosed store, constructed with 450mm thick natural stone walls. The roof is mono pitched, falling towards the open bays, with thick stone roofing flags on loose rafters spanning between timbers purlins and eaves beam sections.



*Figure 8.1.1: Open fronted stone garages*

Due to the heavy nature of the roof finishes, there are signs of purlin movement down the roof slope, that has resulted in cracking of the stonework to all but one of the open sided bays. Laterally, the walls look to have retained a relatively plumb and vertical level, with stability provided by continuity of the rear wall, and the substantial thickness of masonry walls.



*Figure 8.1.2: Cracking at purlin bearings*

Within the third bay, at the bearing point of the lower eaves beam a large crack is evident in the stonework, with a significant outward lean on the wall. This was measured as 40mm in 1200 (1:30).



*Figure 8.1.3: Wall settlement / cracking to front side*

All timber sections look to be deteriorated, and suffering from rot and infestation, and should be replaced as part of any renovation works. Inspection of the store was not possible with the door being locked.



## 9. COAL STORE

### 9.1 OBSERVATIONS

The coal store comprises natural stone walls with a pitched slated roof on battens, rafters, and ridge beam. The walls look to be in a reasonable condition, except for the rear side wall (part retaining) which abuts the access driveway. This wall displays a vertical crack in the gable wall.



*Figure 9.1.1: Coal store rear wall cracking*

Timber wall plates, and gable barge boards are deteriorated and rotten. There are areas of loose and missing slates, and rainwater goods are missing.



*Figure 9.1.2: Deteriorated timber sections*

## 10. MAIN BARN

### 10.1 EXTERNAL OBSERVATIONS

To the front elevation of the barn there is a significant outward bulge in the centre of the wall panel. The bulge covers an approximate 2.5m width from the right-side door jamb to the right side of the window, and up to roof level. The lean of the wall is most evident measured against the stone door jamb, and the surrounding stonework, as 80mm in 1200mm (1:15).



*Figure 10.1.1: Barn front elevation*



*Figure 10.1.2: Severe lean to the centre of the front elevation walls*

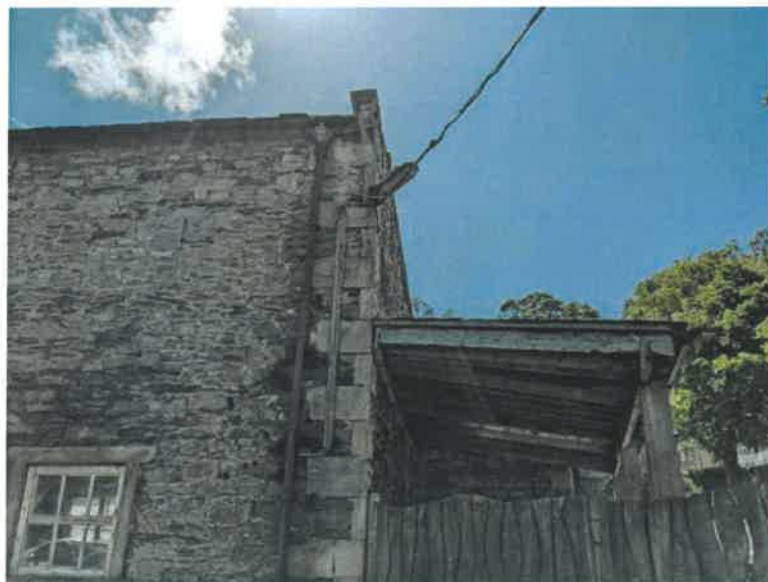
The rainwater gully to the right-hand side is blocked, along with an internal slab drain which outfalls adjacent to the entrance door.

The stone window lintel to the left of the door displays a vertical crack, which is most likely a result of the differential horizontal movement of the wall panel.

Both gable corners to the front elevation at ground floor level look to be reasonably straight and plumb, although both gable wall panels (and the rear elevation wall) look to have twisted anticlockwise on plan. The gable panel to the adjacent property appears to display an inward bow, and the gable panel over the attached workshop unit displaying a racking / twist of the upper gable wall.



*Figure 10.1.3: Southern gable with a twist to the upper storey*



*Figure 10.1.4: Northern gable with an inward bow to the upper storey*

Gable coping stones look to be unstable and should be removed and reset as part of any renovation works.

The rear elevation side wall contains minor undulations, but no major lean or bulge. Timber lintels are in a poor condition and should be replaced. Rainwater goods are missing and should be replaced.



*Figure 10.1.5: Rear elevation*

The existing roof structure looks to be in a reasonable condition, with slates and vented ridge stones intact. It is assumed that a new roof structure and / or roof repair works have been previously undertaken.

## 10.2 INTERNAL OBSERVATIONS

The first-floor structure is formed with boarding over timber joists. Joists are carried by longitudinal timber beams (two central and two adjacent to the side walls), that are in turn supported on internal steel posts, and onto corbel stones on the external walls.





*Figure 10.2.1: Propped timber floor structure*

Within the barn, there are no internal cross walls or piers, with the walls effectively unrestrained up to roof level. Against the front elevation it is evident that there has been inadequate connection between the corbel stones and the floor structure. As the wall has rotated externally this has left a gap between the floor timbers, providing little to no restraint to the walls.



*Figure 10.2.2: Front elevation wall corbel stones separated from the floor structure*

At first floor level, various wall cracking was evident, to both gable wall panels and both side walls. The two large cracks in the northern gable, are representative of the inward bow of the wall as viewed externally.



*Figure 10.2.3: Northern gable with cracking to the side of the inwards bow*

The roof structure is supported by two kingpost style trusses, with ridge and purlin sections, and loose rafters. The timbers all look to have been replaced more recently, displaying newer sections that look to be in a reasonable condition. No immediate concerns with the timber roof structure were highlighted, only to the supporting masonry and lack of adequate roof to wall tie / strapping.

Close inspection of the walls was not possible due to safety concerns over the strength of floorboards that were covered with hay/straw, whilst displaying areas of soft and rotten boarding. Inspection of the roof structure was limited due the height of the trusses, with no safe access to roof level.

## 11. WORKSHOP

### 11.1 EXTERNAL OBSERVATIONS

The workshop building is single storey, which abuts the southern gable of the main barn. The rear and southern gable is built with natural stone, while the front elevation appears to be of rendered brick with a large double door, and single personnel door. The internal cross wall is also assumed to be of single leaf brickwork.



*Figure 11.1.1: Workshop front elevation*

The ridge line appears to be reasonably straight to the northern end, however dips considerably over the central cross wall support, and has a hole in the roof. There are only minor undulations down the slope of the roof, except for the damage surrounding in the hole towards the ridge line. There are a few areas of loose and slipped slates, and concrete ridge tiles.

Eaves and gable timbers are in a poor condition with severe deterioration and section loss. To the rear elevation this has resulted in movement and loss of the slate coverings. Rainwater goods are in a poor condition / missing and require replacement.



*Figure 11.1.2: Deteriorated timber sections*



The walls themselves, appear to be in a reasonable condition, with only minor separation of the rendered brick panel to the corner quoin stones.



*Figure 11.1.3: Wall / render cracking to corner quoin stones*

## 11.2 INTERNAL OBSERVATIONS

The ground floor comprises an existing concrete slab.

Ceilings are in place and covered with boarding, obscuring inspection of the roof structure. Below the hole in the roof, the timber sections that were visible were in a poor condition from exposure, and water ingress.



*Figure 11.2.1: Internal view with ceilings present*

No significant cracking to any of the wall was noted internally.

## 12. HAY BARN

### 12.1 OBSERVATIONS

The hay barn is a large open sided building, with six square brick piers, and a knee braced timber eaves structure. The walls are open to the front elevation, with loose corrugated sheeting and vertical timber boarding providing protection to the gable and rear elevations.



*Figure 12.1.1: Open sided hay barn with brick piers and knee braced timber eaves structure*

Brick piers are c.475mm square and 3.40m tall above ground level. The extent of any foundations to the piers is unknown. All piers were measured to be reasonably straight and plumb with a 1.2m spirit level, with only the central rear pier being out of plumb, leaning to the rear by 15mm over 1200mm (1:80).

The rear store roof structure is a makeshift lean too, reliant on the barn piers for stability. This is not suitable to modern design standard and is to be removed.

The slates roof and ridge tiles looked to be in a reasonable condition with no major undulations. Loose timber rafters are connected with raised ties on alternate rafter sections. Gutters are in place although heavily corroded. To the gable and rear elevation, rainwater pipes have fallen away. The outfalls are unknown.



*Figure 12.1.2: Tied roof structure*

## 13. DISCUSSION / CONCLUSIONS

### 13.1 SUMMARY

Overall, the Farmhouse would be fit for re-use and renovation subject to the key areas highlighted to be investigated further, and remedial actions undertaken. Investigations are required to determine the cause of the settlement of the northern wings, and associated wall cracking. Remedial works to the structure include traditional wall and corner stitch repairs, replacement of timber sections with remedial ties installed to the eastern portion of the main roof.

The main barn will require the most works to stabilise the front and upper walls sections. Any future renovation works with the inclusion of suitably designed and tied walls, floors and roof structure will help to improve the overall robustness of the barn.

### 13.2 FARMHOUSE

The dip of the north-east wing wall corner and the cracking observed both internally and externally at the Cheese Press room intersection suggests that the corner and eastern wings wall return has settled. The presence of numerous drains in this area may be a contributing factor to the potential softening of the ground, and along with trial pit investigation should be investigated further.

Due to the ingress issues observed on the north elevation, there may be an underlying issue of water penetration into the cores of the stone walls – specialist advice should be sought to provide advice on remedial measures to suitably weatherproof the wall for future use. It is anticipated that complete removal of the external wall render, and internal plaster finishes will be required for these works.

Due to the water ingress issues observed, the end of the existing timber floor joists at their respective wall bearings should be inspected for condition.

Dependant on the proposed layout of the second-floor rooms, remedial rafter ties should be installed between the purlin section, or strapping installed between the purlin ends to omit the outward thrust at the bearings. The timbers will need to be checked for capacity to suit upgraded roof finishes, with stitching and patch repairs undertaken to the cracked masonry and stitching of the wall corners.

Adjacent to the eastern gable wall, floor boarding should be removed for inspection of the existing joists, and to allow for remedial wall strapping to be installed to provide wall restraint at floor level.

### 13.3 GARAGES

Cracking to the cross walls is a likely result of the heavy roof finishes carried by the timbers, creating thrust at the purlin bearings. It is also unlikely that there are any foundations to the stone walls, which in combination with potentially soft ground may have led to the cracking.

Once the wall and repair and roof replacement works have been undertaken the form of the original garages will remain unchanged.

### 13.4 COAL STORE

Cracking to the rear gable is likely result of the differential loadings between the driveway retaining wall, and the otherwise lightly loaded gable. The movement is likely to have slowly progressed over a long period of time and does not appear to have had a detrimental effect to the structure elsewhere. The missing gutter, and potential surface run off from the driveway may also have directed water to the base of the base causing a softening of the ground. Traditional wall stitching to this corner as a remedial repair should suffice.

The traditional timber roof structure should be suitable replaced, and finishes reinstated to match the original form of the coalhouse.

### 13.5 MAIN BARN

The outward lean to the front elevation wall may be associated with a few factors. A lack of effective lateral restraint at floor level has resulted in long and tall unrestrained wall panels, with numerous openings (door and central circular window). This coupled with possible settlement of the ground to the front elevation could have worsened the wall movements.

Twisting of the gable wall only appears to be present and at first floor level, with the front and rear walls of the workshop providing a beneficial buttress effect at ground floor level.

Cracking to the upper northern gable (adjacent to private property) poses a concern to the remaining stability of the wall panel given that it already displays an inward bow. Apart from the front central panel, the remaining walls at ground floor level appear to be in a reasonable condition.

It is not known whether the wall movements are longstanding, and whether this has been reduced since the installation of the more recent roof structure.



### 13.6 WORKSHOP

Walls to the Workshop appear to be in a reasonable condition and require little upgrading works. Dependent on the future proposals, it may be that the front elevation wall is taken down entirely to accommodate new opening positions, which would allow for the wall to be suitably tied to the southern stone gable where the separation / cracking was observed.

Whilst the roof structure appears to be largely ok, repair works to the damaged portion to the south of the internal supporting wall are required.

### 13.7 HAY BARN

The connection of the existing roof structure to the top of the piers is unknown but should be considered to allow the roof to act as a stiff diaphragm. Vertical bracing to the gable is not presently in place but will be required for any future proposals.

Although the stability of the barn appears to be adequate for its current usage, any conversion proposals with infill wall panels will require a review of the current stability system, and an assessment to the subtlety of the existing brick piers. Infill wall panels could be framed and tied into the sides of the piers, with head restraint introduced at eaves level as part of an upgraded roof structure.

## 14. RECOMMENDATIONS

### 14.1 GENERAL

A drainage CCTV survey should be commissioned for the entire site, to assess the route, condition, and form of all below ground drainage. Blockages are to be expected due to the system having not been maintained in many years. Adequate provision should be made for reinstating all rainwater goods and discharging roof water into gully's connected either to a drainage system or to a soakaway at least 5m from the property.

A scope of intrusive ground investigation via trial pit excavations and selected areas of in-situ testing should be undertaken to provide further detail on the underlying ground conditions and existing foundations.

Removal of selected areas of external render, and internal paper and plaster finishes will be required to allow for inspection of the underlying masonry at the wall cracking locations.

The advice of specialist contractors should be sought on the extent of any timber-rot/insect attack to existing timber sections.

### 14.2 FARMHOUSE

Deteriorated stone surrounds and mullion pieces should be replaced with equivalent sections and materials. All other stone mouldings and surrounds look to only require minor cosmetic repair and surface treatment.

Existing roof coverings, and particularly the hidden gutters should be inspected further for longevity and condition of the existing roofing and gutter materials.

Whilst internal damp has not been measured, it may be worth upgrading the external render finish by cutting it back and installing a bell-cast bead where the render meets the external ground. This would serve to ensure that risks posed by penetrating damp in the future are minimised. Dampness penetrating in around the windows should be managed via maintenance and replacement of the windows/ reveals.

Further investigation via trial pit excavations is recommended to the northeast wing corner and return wall, which should look review the ground conditions and check for wash out or soft spots.

Within the cheese press room, preparatory wall corner stitching, and crack stitching is required, in addition to general roof upgrade works to ensure a watertight building. Loose render on the external gable should be removed for inspection of the wall.

External render and internal plaster finishes should be removed within the rear master bedroom (eastern gable) and at the intersection of the cheese press room where the diagonal and vertical cracking is present.

To achieve the roof strapping and wall stitching works described in 13.2, it is anticipated that complete removal of the roof coverings to the eastern end of the southern wing will be required.

## 14.3 GARAGES

As part of any renovation works, the roof finishes and structure should be removed, to allow for suitably designed timber sections to be installed. Nominal wall takedown will be required to stabilise any loose stonework to the head of the walls and allow for strapped down wall plates to be installed, and padstone bearings to purlins sections. Trial pit investigations should be undertaken to confirm the ground conditions, allowing for partial re-built to the cracked wall sections onto a new foundation, and proprietary wall stitching to be carried out elsewhere.

## 14.4 COAL STORE

Traditional wall stitching to the rear wall corner should be undertaken. The timber roof structure should be suitably replaced, and finishes reinstated to match the original form of the coal store.

## 14.5 MAIN BARN

Although the more recent roof structure appears to be in a reasonable condition, this would need to be completely removed as part of any works to stabilise the walls to the barn. A replacement roof structure will require a suitably designed arrangement to be tied into the walls to help provide overall lateral restraint. Subject to closer inspection some members may be re-instated as decorative sections following appropriate wood treatment / preservative.

All existing floors are to be removed and replaced as part of the renovation works. The new floors should provide a suitably designed arrangement and be tied into the walls in line with current Building Regulations standards to help provide overall lateral restraint.

Due to the cracking and out of plane nature of the gable walls, it is recommended that the walls of the barn are taken down to first floor level to allow for effective and sympathetic re-build. The front elevation wall which displays a significant outward lean should also be taken down to ground level over a width of c.3.0m.

A series of ground investigations to the barn foundations should be undertaken to ascertain the ground conditions, and to determine if any remedial works will be required to the front elevation foundations where the most movement has taken place. These investigations can also serve to determine the level to the underside of the wall foundation stones, which will be required for the installation of new ground bearing slabs and the required construction build ups. Further to trial pit excavations and inspection, nominal traditional underpinning works may be required to stabilise the foundation stones.

## 14.6 WORKSHOP

It is recommended that the roof coverings are removed to allow for inspection and repair of roof structure within the damaged and surrounding area. Due to the timber sections observed, it is anticipated that a complete overhaul of the roof will be required to ensure that the new roof is effectively tied to the existing walls.

Dependent on the future proposals to the front elevation, new strip foundations may be required to accommodate an upgraded wall construction, including the installation of replacement lintel section to the main openings.

## 14.7 HAY BARN

The out of plumb brick pier should be taken down and rebuilt on a suitable foundation.

A new ground bearing slab can be installed to suit to the proposed use of the hay barn. Trial pits will be required to determine the depth of the piers below ground.

New infill wall sections should be built on a suitable perimeter foundation, subject to the ground conditions. Typically, the underside of the foundations would be placed at 450mm below ground level for frost protection – care will be needed not to undermine the brick piers. If via trial pit excavation the piers are at a shallow depth, and above the level of proposed foundations, then pier take down and rebuild may be more appropriate than underpinning the brick sections.

Adequate provision should be made for reinstating all rainwater goods and discharging roof water directly into a gully's connected either to a drainage system or to a soakaway at least 5m from the property.