



STRUCTURAL BUILDING SURVEY

PROPOSED CLASS Q RESIDENTIAL CONVERSION

Bothy on land off Hartcliffe Lane, Hillside, Thurlstone, Sheffield, S36 9QJ

Report Ref: TH/Ridge/Bothy/Struct/01/July 2019/v01

July 2019

Responsibility Statement: *Earth-Tech Ltd has used reasonable skill and care in completing this work and preparing this report, within the terms of the brief issued by the architect and takes account of the resources allocated by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the stated scope. The report represents the expert views of Mr Timothy M. Hyett in his role as Chartered Engineer (CEng MIEI) and Building Consultant (MCIOB). The opinions and interpretations presented in this report represent our reasonable technical interpretation of the data made available to us. Subject to and in accordance with the brief, Mr Hyett accepts responsibility for the contents of this report only to persons engaged by the Company but accepts no responsibility to any other person. Any reliance placed by any other person on the report will be entirely at that person's own risk. No part of this document may be reproduced.*

(i) Terms of Reference

In July 2019, on the instructions of the Planning Consultant (Mr Tom Warren, Prism Agriculture Ltd) acting for the owner (Mrs Angela Ridge) Earth-Tech Consulting Ltd were asked to prepare a *Preliminary Structural Report* on a proposed low-scale redevelopment of an existing building (a 'bothy') on land off Hartcliffe Lane, Hillside, Thurlstone, S36 9QJ.

The proposals consist of the change of use of a small historic stone agricultural building (*not dissimilar in proportions to a remote hillside 'bothy' sometimes found in Scotland and northern England*) to create a compact residential dwelling in accordance with a proposed Class Q planning application to be submitted to Barnsley MBC (ref: tba).



Fig 1 - Location Map: Thurlstone, South Yorkshire

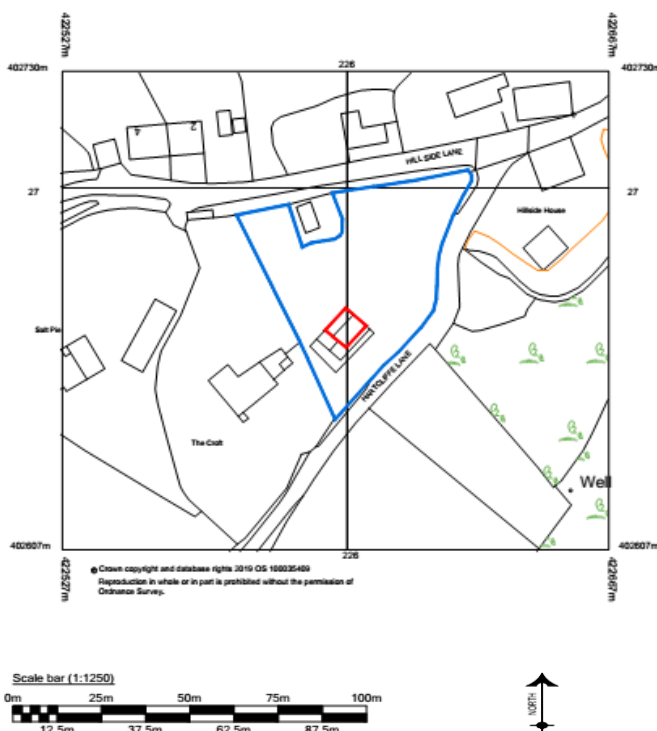


Fig 2 - Block Plan – Land off Hartcliffe Lane, Thurlstone, S36 9QJ

The client required a detailed assessment of the general suitability of the building for conversion - in particular, details of the general STRUCTURAL CONDITION was sought, specifically relating to any evidence of *historic movement, subsidence, structural cracking* and *major defects* etc.

This was required because of the age of the building (estimated to be circa 1850) and because parts of the stonework elevations exhibit visible characteristics of decay. The development works proposed relate to a *Change of Use* to residential - but works are also being considered to promote longevity and to retain the buildings' character.

(ii) The Parties

Property	Existing old stone built agricultural barn and curtilage off Hartcliffe Lane, Hillside, Thurlstone, Sheffield, S36 9QJ
Client/Owner	Mrs A Ridge
Planning Consultant	Prism-Agriculture Ltd Mr Tom Warren
Building/Engineering Consultants	Earth-Tech Consulting Ltd Mr T. M. Hyett MSc BSc CEng MIEI, MCIOB

(iii) The Site

The site is located off Hartcliffe Land, Hillside, just off the A628 Manchester/Penistone Road; elevated some 180m above sea level on a steep hillside close to the rural conurbation of Thurstone: a small village near Penistone in the metropolitan borough of Barnsley in South Yorkshire. Originally, *Thurstone* was a small farming community where older industries developed using water power from the River Don such as corn milling, wire drawing and various wool and cloth processes. Most of these are now gone and the village is now a dormitory for the urban areas of South and West Yorkshire. The village now falls in the Penistone West ward of the Metropolitan Borough of Barnsley.



Fig 3 - Aerial photograph showing existing agricultural barn (bothy), off Hartcliffe Lane, Hillside, Thurstone, S36 9QJ

Penistone lies approximate 10km to the south-west of Barnsley, 1.5km to the east of the subject site, which is situated approximately 17km south-east of Huddersfield and 19km north-west of Sheffield.

The proposed development consists of the conversion of a small detached agricultural building of stone construction in a dilapidated but fair general order for its age, situated on a small parcel of agricultural land with well-defined boundaries. The current land use is small-scale agricultural and livestock (sheep) with grazing and there is good general curtilage.

The footprint of the building is very compact; rectangular, and it is arranged as single storey barn of solid wall construction comprising coursed squared stone outer leaf, rubble cavity fill and rough stone inner leaf. It consists of thick stone buttresses to the front (south-east elevation) and is estimated to date to at least the middle 19th Century, with some evidence that it has been repaired at various times in the past. The roof is flat/low single pitch with a basic timber rafter type skeleton and what would have been traditional tile/stone slate covering (it is presently covered with galvanised tin sheeting). The ground floor is part soil part compacted fill and the building incorporates a substantial dividing wall that, like the primary elevations, is robust and in good structural order.

The overall site boundary is around 0.4 acre and the existing building fronts directly on to Hartcliffe Lane to the south-east, with Hill Side Lane to the rear (north). The general area is *rural* and is dominated mainly by private dwellings and converted farm buildings distributed in a *low to medium* density.

The redevelopment works are limited to conversion and refurbishment of the existing building (only) which necessarily will include extensive repairs to the stonework and significant changes (as per the proposed drawings) in order for the building to function as a small-scale residential dwelling house under the rules of Class Q, but with no significant alterations to the buildings' geometry and/or footprint. The full extent of the proposed work is not yet fully determined and may be subject to findings from other investigations and planning considerations as required. In its existing condition, there are currently no specified requirements issued from Local Area planning and/or Building Control, and there are no outstanding obligations placed upon the owner with respect to the Town and Country Planning Act, 1990.

(iv) Available Information

1. Copies of Land Registry plans.
2. Old photographs and miscellaneous information collected by the owner.
3. Access to the site to carry out a detailed walk-over survey and structural inspection.
4. Use of a 3t mini-excavator to conduct intrusive investigations into the underlying soils, as required.

(v) Mandatory Guidance

- *BS EN 1997-1: 2004 Eurocode 7 - Geotechnical Design - Part 1.*
- *BS EN 1997-2: 2007 Eurocode 7 - Geotechnical Design - Part 2.*
- *Department for Communities and Local Government, 2012, Nat Planning Policy Framework.*
- *Department for Environment, Food and Rural Affairs, April 2012. Environmental Protection Act 1990, Contaminated Land Statutory Guidance. The Stationery Office Ltd.*

PART 1 DESCRIPTION & ORIGIN

1.0 HISTORY

Traditionally found in remote northern areas of Scotland, Ireland, England and Wales a 'bothy' is often a primitive, stone (and sometimes wooden) hut contemporaneously used today for hikers and hill walkers to shelter in overnight or during particularly inclement weather.

Originally, they would have been formed from a large dry-stone enclosure, often situated on an ancient cross border drove road and the buildings would have been added to over time to create a small cottage or shepherds hut (sometimes called a 'tackmans house' or 'keb house') which would have been used predominantly by hill farmers to 'set on' orphan lambs with ewes which had lost lambs. Notably, this example is still used today by the owner for low-scale sheep farming.

There are many architectural examples of redevelopment of these small, unusual buildings to create cottages and compact homes, or to retain their use as publicly accessible shelters for hikers/hill walkers in tourist locations - practical, functional contemporaneous uses that, in effect, preserve these interesting old buildings - which, in some locations and in some archaeological contexts are occasionally considered heritage assets. There is even a UK organisation dedicated to preserving their existence (see www.mountainbothies.org).

2.0 BUILDING CONTEXT

Traditionally, a '*Bothy*' is one of a number of minor or miscellaneous farm buildings that more often than not are found in Scotland - but they can also be found in the English countryside. The range of smaller buildings that could be found on any typical 19th century farmstead is large; ranging from well houses, corn mills, kennels and loom-shops, to turf-houses, slaughterhouses, smithies, and washhouses (Lake & Edwards 2006 p.67).

However, the survival of a purpose-built itinerant labourers' hut of the type found on the land off Hartcliffe Lane in Thurlstone is somewhat unusual - such buildings being most common in the Lancashire and Cheshire countryside, and quite rare in South Yorkshire. In the past, such accommodation for seasonal farm workers in the district often took the form of a separate detached building or sometimes a first-floor loft in a barn. In Lancashire and the north west they were often termed 'paddy lofts or houses' (Lake & Edwards 2006 p.76).

There have been few (if any) individual academic studies on buildings of this type in Yorkshire to my knowledge, and most recorded examples having been surveyed as part of wider studies in the north west regions (e.g. *Eltonhead Hall Farm*, Sutton Lancashire built in the late 19th century (Lewis & Warhurst 1987), *Green Lane Farm*, Dunham Massey, built around 1931 (Nevell, Arrowsmith, Grimsditch, Bell & Hradil 2008) and *Little Heath Farm*, Dunham Massey, built around 1910 (Hradil, Arrowsmith & Nevell 2007)). The two *Dunham Massey* examples were known locally as 'Irishmen's huts', and all four examples referred to above were single storey, two-room, stone-built structures - exactly like the building subject to this Class Q planning application.

The existing stone building on the land between Hartcliffe Lane and Hill Side Lane in Thurlstone is very typical of these stone structures and is equally unusual. In its primary form, it would have been a single storey structure very like the examples referred to above. From its physical appearance alone, it would seem to have been built in the middle 1800s, making it quite an early example of a building of this type in Yorkshire.

The evidence indicates that later, most likely in the early 20th century, it was altered by various infilling and moving certain openings etc., but there are no peripheral indications that it had been lived in permanently in the past. This suggests that its role as a traditional *bothy* building (assuming this to be the case) most likely ended with its 20th century modifications, and for the purposes of the proposed Class Q planning application, it is definitively categorised as an *agricultural* building in current use.



Fig 3 - Front elevation of the existing stone barn (bothy), off Hartcliffe Lane, Hillside, Thurstone, S36 9QJ

PART 2 BUILDING SURVEY METHODOLOGY

2.0 INTRODUCTION

This building survey warrants (and has followed) the broad guidance contained in '*Understanding Historic Buildings. A guide to good recording practice*' (English Heritage 2006) and the Institute of Field Archaeologists '*Standard and Guidance for the archaeological investigation and recording of standing buildings or structures*' (IFA, Revised Edition 2001).

In brief this work comprised of:

- Some initial historic research including a *historic map regression exercise* (scaled to a large, uniform size), brief examination of archive records and local history sources (where available).
- A photographic survey showing general view of the building's exterior and setting; the overall appearance of the building, its rooms and circulation areas; detailed coverage of the buildings external and internal appearance; and structural features relevant to the building's evolution.

- A written report including a **structural survey**; a description of the structure; a discussion of the site's development and potential for reuse; and a brief photographic catalogue.

Structural Survey

It was decided that, in order to meet the client's primary objectives, the building would be inspected and structurally surveyed by a Chartered Engineer and any potential defects recorded so that appropriate repairs could be properly planned, designed and carried out by the client, subject to any scheme approved by Barnsley Metropolitan Council (BMC).

Particular attention was drawn to the overall structural condition of the primary elevations; an investigation of possible foundation movement, and checks for tolerances/deviations from perpendicular etc., and an informed attempt to answer the question of whether the building is capable of full retention in its current state. The roof skeleton was also considered (although this could have previously been pitched), and a basic crack assessment methodology was proposed using the accepted industry convention, in accordance with best practice (see below), for substantial movement indicators.

Other Indicators

In addition, general information was also requested, including information regarding the land parcel (as a whole) and comments were invited on the likelihood of instability of near surface soils due to natural geological features and/or past coal mining activity etc., and if applicable, how this might affect the proposals for future conversion.

2.1 CRACK ASSESSMENT CONVENTION

Cracks are Indicators

Cracks occur in buildings for all sorts of reasons and the methodology adopted in this report is that cracks in buildings are the **visual symptom** of possible problems, not the problem itself.

Cracks are a mechanism for releasing stresses that have built up within a particular structure that will naturally exploit any inherent weaknesses in the building fabric.

Size convention of cracks

Negligible - hairline; with a dimension of less than 1 millimetre. Of little concern other than aesthetic and nuisance.

Slight - over a period of time, if structural movement has ceased and stabilised, cracks that are between 1mm and 5mm in width can normally be dealt with through filling the voids and re-decoration only.

Moderate - 5mm to 15mm; generally requiring building work to remedy; requiring the involvement of a professional to establish the real cause of the cracks; associated problems also likely, perhaps requiring the localised replacement of fractured elements such as cills and lintels. Work may also be required to remedy any associated concerns regarding the weather-tightness of the building that may have been compromised through disturbance of roof coverings and rainwater goods as a result of the movement.

Severe - 10mm to 25mm; usually indicates extensive structural repairs are required; involving possible replacement of affected sections of the building; cracks of this dimension are usually accompanied by a variety of lesser dimensioned cracks. Professional advice is required on the cause of the failure and the extent of remedial work. The installation of interim temporary support scaffolding or propping may also be necessary until the remedial works are carried out.

Very Severe - In excess of 25mm; usually indicates very severe structural damage requiring major repair works that could involve the partial or complete rebuilding of the affected area; structural underpinning may also be necessary due to the danger of associated collapse and instability. Professional advice is required immediately and the building should not be occupied or inhabited. Temporary support is likely to be required immediately.

Shape convention of cracks

Fine - hairline cracks running across the face of a wall often indicates that a small degree of shrinkage has occurred in the fabric of the wall. Most buildings can accommodate such fine defects without undue concern. These cracks can also be seasonally driven, appearing and disappearing depending on climatic conditions.

Diagonal - stepped cracks often indicates that structural settlement is happening, possibly due to upheaval at foundation level or some other form of change in effective stress in the soil beneath the foundation. If foundation settlement is evident, this type of crack often grows in width with time. Professional advice is usually required at an early stage.

Vertical - often a sign of serious problems; if wide at the top and tight at the bottom this usually indicates that one or both ends of the buildings' foundation are dropping. Vertical cracks also usually indicate that the stresses have been sufficiently severe to crack individual elements (bricks) in the wall to such an extent that could make the broken elements unsafe. Professional advice is usually required at an early stage.

Horizontal - cracks following the masonry beds between brickwork should always be treated with concern and often indicate that walls are in an early stage of failure, particularly if they are retaining walls. Professional advice is usually required at an early stage.

2.2 DAMP, INSECT AND FUNGAL INFESTATION

Rising and Penetrating Damp

In old agricultural barns, where there is no damp-proof course, it is common for buildings to suffer varying degrees of rising and penetrating damp caused by the absence of any form of DPM: the solid and/or open cavity wall construction and the deterioration of the roof covering can give rise to water ingress into the building(s) and the wall core. These problems can be resolved by the introduction of solid concrete floors with a DPM (where practicable) on the ground floors and the injection or introduction during refurbishment of a suitable damp-proof course (where practicable) and re-pointing of the external brickwork using a suitable cement mortar (or full/half rendering).

Insect and Fungal Infestation

Buildings of this type do frequently exhibit varying degrees of *mould growth* (occasional white furry deposits and black spots on timbers) and occasional forms of wet rot in exposed timbers that have been open to the elements over a period of time [i.e. usually in the form of *Coniophora Puteana* - a brown rot that favours wet conditions produced by persistent water leakage ; *Fibroporia Vaillantii* and other *Poria* species - brown rots that prefer higher temperatures causing cuboidal cracking of the wood where the mycelium appears as white or cream sheets, and strands (aggregations of *hyphae*) remain flexible when dry].

- *Wet rots can be grouped together collectively, and the above are typical building defects associated with old, redundant and dilapidated agricultural buildings that have been left exposed to weather, and in particular heavy precipitation, and have been poorly maintained for a considerable period of time. In all cases the presence of wet rot indicates that the MC (moisture content) of the timber on which they are growing has been well in excess of 20% for a considerable period.*
- *Wet rots are unable to colonise an area away from wet timber. If the source moisture can be eliminated, for example by roof repairs and/or re-roofing and the extensive refurbishment work as proposed, then as MC gradually drops below 20% any significant rot will become quiescent, and eventually die.*

Where observed, appropriate remedial action should be recommended, which usually includes provisions that all structural and non-structural timbers exhibiting signs of wet rot are removed where practicable during the refurbishment phase, and all remaining and new structural timbers treated with a suitable course of preservative, as a matter of good building practice. Any but the most serious infestation can be treated very easily during a comprehensive refurbishment program using a simple chemical insecticidal eradicant combined with the careful removal and replacement of defective timbers or parts of timbers as identified during the construction phase of the works.

2.3 POTENTIAL FOR GROUND INSTABILITY

The area is not known as being subject to historic coal mining, and there are no occurrences of properties in the vicinity having suffered degrees of subsidence in recent years, however the building is situated on a steep slope (Hill Side Lane).

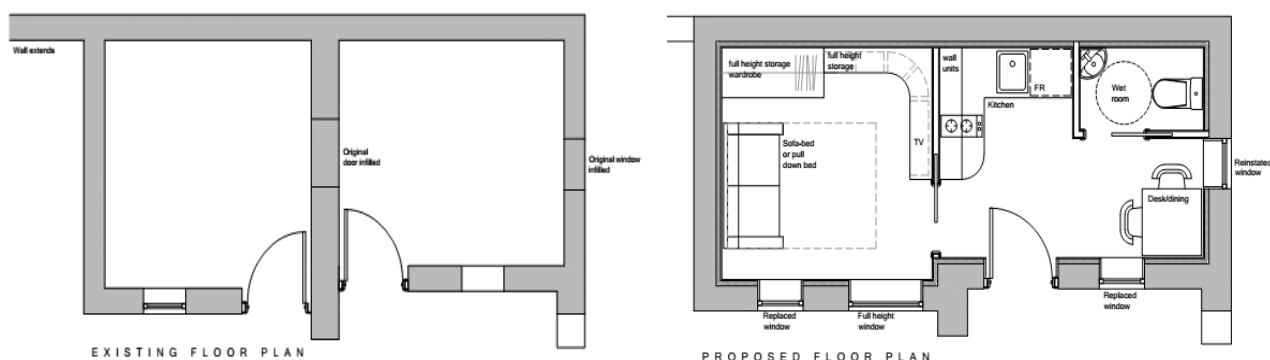
Because of this, the client, Mrs Angela Ridge, requested that Earth-Tech consider the above influences with particular reference to the structural integrity of the building and as part of the structural survey that had been commissioned, and asked the author of this report to comment and make recommendations as appropriate. The site was inspected on Friday 26th July 2019 by a professionally qualified Chartered Civil Engineer (Mr T. M. Hyett MSc CEng MIEI CGeol FGS MCIOB).

PART 3 STRUCTURAL BUILDING SURVEY

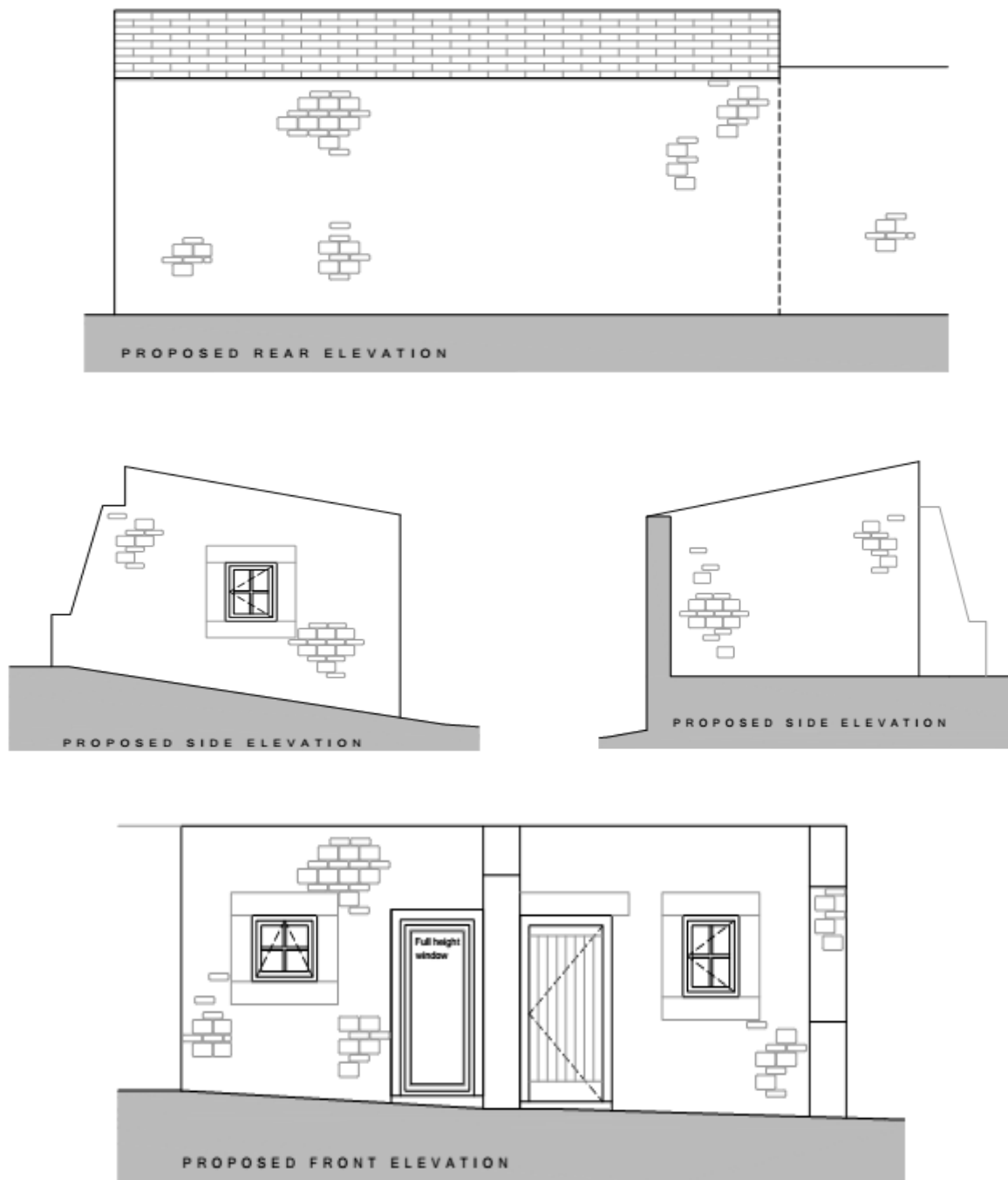
3.0 EXISTING - BLOCK PLAN



3.1 PLANS - EXISTING & PROPOSED



3.2 ELEVATIONS - PROPOSED



2.1 OBSERVATIONS

The main building is single storey, rectangular and is built of solid wall construction (500mm thick in parts) comprising traditional, random, locally sourced stone in a mixed pattern outer and inner leaf with a rubble wall core. It is evident that it has been repaired and sections have been infilled, built and rebuilt at various times in the past, although this has been done using only reclaimed stone, most likely local in origin. The existing roof is semi-flat (or low single pitch) and consists of primary purlins and timber rafters with a galvanised tin sheet covering. The building may have had a traditional pitched roof in the past, but more likely it would have been as existing, with a stone-slate covering.

The building appears to date to around the middle of the 1800s, and due to its thick, robust stone walls and its generally low profile setting within a naturally sloping landscape, it is in surprisingly good structural order, albeit the outer stonework exhibits varying degrees of dilapidation and disrepair that has developed over time. The building is currently used for animal welfare, low-scale farming, lambing etc., and at the time of the survey there were sheep both inside and freely using the amenity space outside. There is good curtilage surrounding the building, and the site is well-bordered with dry-stone walling around the whole of the perimeter. All the primary elevations are intact, and no sections have collapsed, nor do they exhibit signs of foundation failure and/or serious deviation from plumb.

South East Elevation (Front)



The south east elevation (front) facing Hartcliffe Lane is generally plumb and exhibits no signs of significant historical movement and no significant signs of extensive damage.

Remedial works are required to the stonework, pointing and heads & sills but the elevation is fully capable of retention with no visible or obvious areas of bulging. No immediate requirement to repair by extensive dismantling and/or rebuilding.



Some pointing defects and external cracking is evident on the outer leaf at the front - the crack convention is *Moderate* and the elevation is plumb and stable.

Should be fully capable of repair/retention with no areas of excessive bulging and no requirement to dismantle wholesale and/or rebuild except in isolated areas.



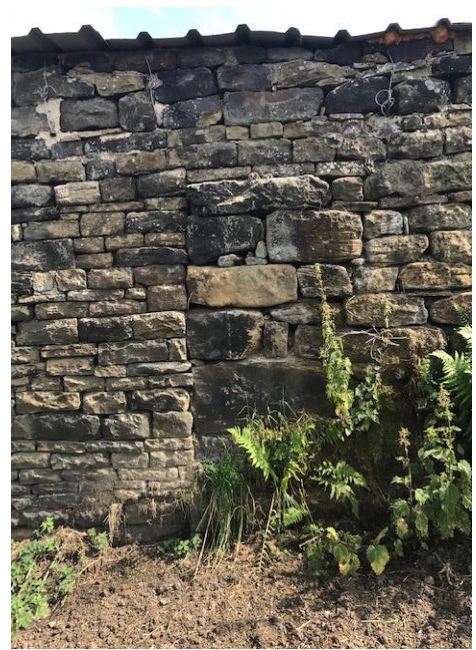
The south east elevation (front) facing Hartcliffe Lane is generally in good general order. Repair work is required, but much of this is cosmetic, relating to the external buttresses which offer substantial additional support to the elevation.

All the stonework is capable of full retention with no areas of bulging or structural failure observed.

North West Elevation (Rear)



The north west elevation (rear) facing Hill Side Lane is generally plumb, but it does exhibit some moderate signs of dilapidation and very slight structural movement - most likely due to reconfiguration of openings. There is some slight separation of the joint at the gable, but there are no signs of significant bulging or structural failure. Repairs will be required in isolation (only) and the overall elevation should be fully capable of retention.



The north west elevation (rear) shows the original rear wall extending further than the front elevation, indicating that the front has been modified at some point in the buildings' past. There is also a rear opening (shown on the right) which has been blocked up in larger coursed stone. There are some defects; dilapidation and minor cracking across the rear (*Moderate*) but it is generally plumb and structurally sound. It should be capable of full retention, with no areas of bulging and no immediate requirement to dismantle and/or rebuild (except in isolated locations).

North East Elevation (Side Gable)



The north east elevation (gable) facing into the plot is robust and constructed of thick stones in the outer leaf. The extrados of the gable wall tapers outwards slightly, creating a strong buttress like effect, and whilst there are some general signs of dilapidation; mortar-less joints and pointing defects etc., this is most likely how the gable would have been constructed, and there is obvious no deviation from it is original profile. The gable is therefore fully capable of full retention, with no areas of bulging and no immediate requirement to dismantle and/or rebuild.



The north east elevation (gable) as viewed from the front shows some irregularities in the stonework of the outer leaf, and there is some separation between the larger quoin-like stones of the gable and the thinner coursed stone of the front elevation itself. It is unclear whether this relates to erosion; a lack of mortar and/or pointing defects.

Internal



The stonework inside the *bothy* is covered liberally with a limewash, and there were no signs of bulging of the inner leaf or any evidence of spreading of the wall core.

There were no signs of significant structural damage and whilst there was some nominal cracking observed inside (categorised as *Moderate*) the inner leaf structure is generally intact, plumb and is capable of retention.

The exposed purlins were dry, and the roof covering was completely intact with no evidence of excessive water ingress.

Rising and Penetrating Damp

There is no damp-proof course in the existing building, and consequently it has suffered modest degrees of rising and penetrating damp caused by the absence of any form of DPM: the solid wall construction and the slight deterioration of the roof covering over the years prior to replacement would have given rise to water ingress into parts of the wall core, but there was no evidence of structural damage as a result. Some of the minor separation between the inner dividing wall, and possibly the minor separation observable outside relating to the side gable, could be attributable to these causes and effects. Problems of this nature can be resolved by the introduction of solid concrete floors with a DPM (where practicable) and the injection or introduction during refurbishment of a suitable damp-proof course (where practicable) and re-pointing of the external stonework using a suitable lime/cement mortar.

Insect and Fungal Infestation

The building does exhibit some very minor signs of *mould growth* (occasional white furry deposits and black spots on timbers) and occasional forms of wet rot in exposed timbers that may have been open to the elements over a period of time as might be expected [i.e. manifesting in the form of *Coniophora Puteana* - a brown rot that favours wet conditions produced by persistent water leakage; *Fibroporia Vaillantii* and/or other *Poria* species - brown rots that prefer higher temperatures causing cuboidal cracking of the wood where the mycelium appears as white or cream sheets, and strands (aggregations of *hyphae*) remain flexible when dry]. As a precaution it is recommended that all structural and non-structural timbers exhibiting any signs of wet rot are removed where practicable during the refurbishment phase, and all remaining and new structural timbers should be treated with a suitable course of preservative, as a matter of good building practice.

There is no visual evidence of woodworm (*woodworm being the generic term used to describe all kinds of woodboring insect*) although the presence of old "flight holes" would not be unusual for a building of this type. In timbers where old flight holes are identified post strip-out, any observable attack is likely to be minor, and if present, no structural deterioration appears to have been caused in the primary purlins as a result. At this preliminary stage, it is not possible to accurately identify the species (if any) giving rise to a former (or) historic infestation, although if it is the case it is likely to be either *Anobium punctatum* (the common furniture beetle); *Hylotrupes bajulus* (the house longhorn beetle) or *Xestobium rufovillosum* (the much rarer death watch beetle). In all cases, the above are less likely to attack dry timber and water penetration is the most likely cause of any problem that later becomes evident in the building, along with the occasional occurrence of fungal decay and *mould growth*.

It should be noted that the roof skeleton does not incorporate extensive or elaborate timber elements - and any but the most serious timber infestation can usually be treated very easily during a full, bespoke program of refurbishment using a simple chemical insecticidal eradicator combined with the careful removal and replacement of defective timbers (or parts of timbers) as identified carefully during the construction phase of the works.

PART 4 BASIC GROUND STABILITY ASSESSMENT

4.0 BEARING CAPACITY

During the site inspection on 26th July 2019 two trial hole excavations were carried out in front of the subject building and to the rear and side, to identify the near surface geology; comment on bearing capacity of the soils for the existing foundations, and to ascertain whether the ground has been affected in any way by its former usage.

Typically, buildings of this type and age are built on large foundation stones, laid directly onto the formation layer at a shallow depth. There are likely to be significant cosmetic repairs to the existing stone elevations proposed in the final scheme, and this may include for the careful dismantling and rebuilding of small sections, but in terms of foundations it is not considered necessary to replace any section of foundation in order to maintain the structural integrity of the building - similarly, it is considered that there will be no significant additional loading of the ground any more than has been imposed historically during the buildings former use, and the existing foundations can be considered to be adequate for the development as proposed. .

A walk-over survey and 2No. 1.2m deep trial holes was considered adequate to provide the necessary geological information to report on the general ground stability and the bearing capacity of the soils. From these observations, the geology can be described and classified as: *'firm to stiff slightly silty CLAY with sands and gravels - gravels are angular tabular fine to medium sandstone and mudstone litho-relics - (GLACIOFLUVIAL DEPOSITS)'* to a depth of circa 1m, overlying natural bedrock: *'Weathered Sandstone'* (GRENOSIDE SANDSTONE and PENISTONE FLAGS SANDSTONE), with less weathered, moderately strong mudstone, siltstone and sandstones of the *Pennine Lower Coal Measures Formation* at greater depths. .

Due to the close proximity of bedrock to the surface, it is entirely likely that the buildings' foundations stones are situated directly onto rock, but even if they are founded in the overlying superficial soils the stiffness of the clay observed in the trial holes is more than adequate for the development as proposed. In a worst case the soil characteristics could be assumed to be as follows:

Typical Soil Parameters (from Index Testing)

Bulk Density	1980 Kg/cu.m
Unit Weight (γ)	19.4 Kn/cu.m
Angle of Internal friction	30 degrees
Cohesion	0 Kn/sq.m

Bearing Capacity Factors (Shallow Foundations) - (BS 8004 : 1986)

Nc	- 47
Nq	- 35
N γ	- 40
Approximate Foundation width B	- 0.7m
Approximate Foundation depth D	- 0.6m

Approximation / Check on Bearing Capacity (after Terzaghi)

$$q_f = 0.5\gamma B N_\gamma + c N_c + \gamma D N_q$$

$$q_f = 0.5 \times 19.4 \times 0.7 \times 40 + 0 \times 47 + 19.4 \times 0.6 \times 35$$

$$q_f = >> \text{than the existing and/or proposed loading} = \text{acceptable for domestic usage} = 0.K$$

4.1 RISK OF NATURAL GROUND INSTABILITY / SHALLOW MINE WORKINGS

The geological information derived from the relevant geology map for the site and surrounding area, as extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale, shows there are no records of landslips within 500m of the site, and the risk is categorised as being *Low*. The risk of Ground Instability by reference to an assessment of the *Shrink Swell Clay* information is categorised as being *Very Low to Negligible*.

- This means that there are no significant natural ground instability issues indicated in the vicinity of the site: namely weak or unstable rocks that could slip downhill on steep slopes (greater than c. 5 degrees) or into excavations ('Landslides (slope instability)') (LEVEL C).
- There is also no evidence of *running sands*, and no specific need to check for *plasticity of clay soils* (PI). It is not likely that any *collapsible* (loessic) deposits will be encountered and the buildings' foundation loads are unlikely to exceed the *safe bearing capacity* of the soil during or after construction as observed.

A preliminary *Coal Mining Risk* desk study was also carried out alongside the walkover survey, trial holes & the structural assessment. This CMRA was performed by a qualified Chartered Engineering Geologist (Mr T. M. Hyett MSc CEng MIEI CGeol FGS MCIOB) and Earth-Tech Consulting Ltd archives were consulted, along with published British Geological Survey 1:50,000 Mapping and Coal Authority Datasets (available under the Open Gov. License v3.0), and a basic Coal Authority CON29M report.

The site lies just on the edge of the 1000m boundary of a known coal mining area, and along with the obvious topography of the site, there is therefore *No Risk* of shallow mine working being present beneath the site, and a *Negligible* risk of other non-coal mining related cavities, or cavities associated with mineral extraction etc., which could affect the site (or) the development proposal.

PART 5 CONCLUSIONS

- a. From my Structural Building Survey of the building on the land off Hartcliffe Lane, Thurlstone, South Yorkshire, I can confirm to any third party that there are no observable *structural hazards* present as at the date of the inspection carried out on the 26th July 2019.
- b. The building is in a general dilapidated condition, and it does require a comprehensive scheme of refurbishment and updating - but the existing fabric of the building is intact and structurally sound, and it is suitable for conventional repair in accordance with current building best practice.
- c. Externally, there are no observable problems with respect to *structural instability* that is considered to be insurmountable on all the primary elevations, although the proposal will necessarily require a comprehensive scheme of repair.
- d. The building should be re-inspected by a suitably qualified, competent Building Engineer following initial strip-out and during the works, and should the initial strip-out expose any significant movement indicators, or should any structural concerns be identified as the initial work progresses, it is strongly recommended that the building be re-assessed, and the findings evaluated to enable a suitable repair/refurbishment program to be designed to meet any unforeseen eventualities.
- e. The buildings are not currently at risk from any extreme *damp, insect or fungal infestation*, and there is no potential for unexpected settlement during construction due to *compressible loessic soils* or any other external geological feature (from preliminary field observations). However, further consideration should be given to investigating the ground conditions for the risk of potential Land Contamination, and the potential risk due to historic coal mining i.e. by way of a separately conducted *Phase (I) Potential Contaminated Land & Risk Assessment Report*.

TESTIMONY OF INDEPENDENCE

I am a professionally qualified Chartered Civil Engineer and Consultant Engineering Geologist. I am a Fellow of *The Geological Society* (FGS), Member of the *Institute of Engineers Ireland* (MIEI) and Member of the *Chartered Institute of Building* (MCIQB). I hold a post-graduate degree in *Engineering Geology*; a degree in *Mathematics and Physics* and undergraduate qualifications in *Civil Engineering*, and I have more than 30 years of experience working in construction and specialise in the fields of underground space, mining and foundation engineering.

I confirm that under para. 2.E.2 of Appendix 2E of *Planning Policy Guidance Note 14 (PPG14) – Development on Unstable Land, DoE, 1990* I am suitably qualified to make these statements, and I understand that my overriding duty is to present independent and impartial expert analysis, and I believe I have complied with that duty. The facts I have stated in this report are true and the opinions I have expressed are correct and they are entirely my own, based upon the evidence I have been shown and my own observations.

Signed



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Tim Hyett MSc CEng MIEI CGeol FGS MCIQB
Building Consultant & Chartered Engineering Geologist
Earth-Tech Consulting Ltd
29th July 2019

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