

REPORT

The Potential Impact on Private Water Supplies of Filling a Steep Sided Gully Adjacent to Hog Close Lane, Hepworth, with Inert Fill and Restoring to Agricultural Land

G.H.SAUL CONSULTING ENGINEERS

G. H. SAUL,
B.Sc.(Min)
Chartered Engineer

C.G.SAUL
B.Eng.(Hons) MBA
Chartered Engineer

Woodside House,
East Tanfield,
Ripon,
North Yorkshire,
HG4 5LN

Telephone (01677) 470191
Fax (01677) 470191
Email geoffrey@ghsce.co.uk

Authors Qualifications

I am a qualified mining Engineer and held certificates of competency up to Colliery Manager Level. I have experience in Coal Mine management.

I have run a company providing private water supplies, mainly for the farming fraternity. Borehole contracts were also undertaken for major abstractors, water companies and the environment Agency.

For the last 30 years I have run a consultancy Practice specialising in handling all manner of water problems, from dewatering of old mine workings, to developing spring supplies for domestic and small farm purposes.

The work has included the exploration, development and completion of large wellfields for major abstractors in the food and related industries, development and provision of major irrigation systems for large agricultural holdings, private water supplies for remote properties. Mine dewatering schemes, to permit gas production have also been handled.

Research work has been undertaken for the Environment Agency, including geophysical surveys to identify faulting in the confined section of the Sherwood Sandstone in the Yorkshire Area.

Waste water treatment plants handling biodegradable waste have been designed and built for the leisure and holiday businesses and the food industry.

As a minor part of our work we do perform the duties of expert witness in litigation on water matters.

Proposed Inert Landfill scheme
Land Adjacent to Hog Close Lane, Hepworth

INDEX

Section	Content	Page No.
	Executive Summary	4
1.0	Introduction	7
2.0	Topography	7
3.0	Geology	8
4.0	General Hydrogeology and Hydrology	8
5.0	Water Quality	10
6.0	Potential Impact on Identified Private Supplies	11
6.1	Upper Milshaw Farm House and Hall	11
6.2	Lower Milshaw Farm and Barn	12
6.3	Snug House Farm	12
7.0	Conclusions	13
	References	15
Fig 1	Geological Section	16
Fig 2	Geological Map	17
Map 1	Topography	18
Map 2	Location of Sinks	19
	T.J.Coates Ltd map of Properties with Private Supplies	20

Proposed Inert Landfill scheme

Land Adjacent to Hog Close Lane, Hepworth

EXECUTIVE SUMMARY

Bradbury PM Ltd have submitted an application for permission to fill a steep sided gully, on land adjacent to Hog Close Lane, and restore it to agricultural land.

At the request of Kirklees Council a survey was undertaken to identify any private water supplies in the immediate area, so that the potential impact of the development could be considered.

This survey checked 31 properties, of these 5 had private water supplies. Of these 5 only one is still claimed to be used, the other 4 have converted to mains supply and the private supply has already, or is in the process of being abandoned, and capped.

An assessment of the potential impact of the development has now been completed. For completeness the potential impact on the 4 properties, which have recently abandoned the private supplies, has been assessed.

The site is situated on the eastern flank of the Holme Valley, with the land sloping in a generally western direction. Although varying the valleys of the streams also run in a generally western direction. The gully it is proposed to fill is an anomaly, as it runs in a north easterly direction. Records suggest there has been significant coal mining and stone quarrying in the area. It is possible that this feature could be the result of such activity.

The site, and the area around it, is underlain by strata of the Lower Coal Measures. This consists of layers of mudstone, sandstone and shales, with coal seams at irregular intervals. The upper bed coal is mapped as being at outcrop at the surface just to the west of the A616. The sandstone in the area of the site is thought to be the Greenmoor Rock, but this is not certain. There is a fault running along the approximate line of Cat Clough. Cat Clough is mapped as running over a thick mudstone/shale layer. This Layer will prevent water from the stream recharging and sandstones below.

The mudstones and shales are basically impervious, which means that water movement across the beds is inhibited, or prevented. Water only gets into the sandstone beds where they are exposed to rain at the ground surface. On sloping ground the area of sandstone exposed to rain is small and therefore little water gets into the individual beds. As little or no water travels between beds, the sandstones act as individual aquifers, with different water levels, the level being largely dictated by the level of the ground at outcrop. Water movement in the beds will generally be down dip. The dip in this area is mapped as being North East.

The Coal Measures are generally regarded as a poor aquifer and will only support domestic type supplies. Occasionally large supplies have been satisfied, but these are usually where pumping is intermittent and the site is in an area that has been underworked and there is enhanced fissuring of the sandstones.

The sandstone in the immediate vicinity of a fault will be broken and fissured. This creates a pathway for water to move more freely. If two separate sandstones are brought opposite each other by the fault, then water can move from one bed to another.

The quality of water coming from wells and boreholes in the Coal Measures is generally not very good, as it can be mineralised. High levels of iron are a common problem. Water from boreholes in the area of Hog Close Lane is known to be high in iron. This has been a major cause of private supplies being abandoned.

Two of the properties where private supplies (wells/boreholes) have been abandoned are Upper Milshaw Farm House and Upper Milshaw Hall. These two properties are close together and lie approximately 500 mtr to the WNW of the site. They are therefore up dip and at a higher ground level than the site. They are also on the opposite side of the fault and Cat Clough. In consequence ground water flowing down dip, would travel from the properties towards the site rather than from the site towards the properties, Surface water would have to flow up hill. If a borehole was pumped drawing water towards it, it has been calculated that this effect would get nowhere near the fill site. It has been conclude there would be no potential impact on ground water resources at Upper Milshaw Farm and Hall.

Similarly, the other two properties where private supplies have been abandoned, Lower Milshaw Farm and Lower Milshaw Farm Barn, which lie about 500 mtr due west of the fill site, are up dip. Water will therefore move from the properties towards the fill site and because of the dip and difference in topographical level, the strata from which the supply was taken, will be >50 mtr below the base of the fill site. This strata will be protected by the impervious beds immediately below the site, which will prevent site water getting to it. Again at a distance of 500 mtr it is well outside the limit of any pumping effect. Again it is concluded that there will be no potential effect of the fill site on water supplies in the vicinity of Lower Milshaw Farm and Lower Milshaw Farm Barn.

Snug House Farm is the property, which it is claimed takes a water supply from Cat Clough. Whether it does actually get water from Cat Clough is uncertain. To the east of the A616 Cat Clough goes underground through a mapped sink. To the west of the A616 There is a spring, which has been taken as Cat Clough water re-emerging. This water then again goes underground approximately 120 mtr east of the abstraction point for Snug House Farm. The evidence available suggest that this assumption is incorrect and the water abstracted by Snug House Farm is water from a different source and not the water flowing down Cat Clough near the fill site. However as this is not certain the potential effect on the Snug House Farm supply has been considered on the assumption that it is taking the water flowing down Cat Clough near the fill site.

The water quality of Cat Clough is unlikely to meet Potable standards at the moment, as it is open to contamination by grazing animals using it, and from run of from areas grazed by animals.

By definition the gully is to be filled with inert material. It should not contain any soluble contaminants. The springs feeding Cat Clough are all being diverted round the fill site so that they cannot be polluted. Water actually arising from the site is being drained separately and passed through a reed bed and ponding area. The reed bed and ponding area will ensure that all suspended solids are removed, and the reed bed will treat any biodegradable matter. The area of the fill site represents only 3% of the Cat Clough

Catchment to the west of Snug House Farm. This is a very small contribution and there will be massive dilution by the other 97%.

It is concluded that the filling of the gully will have minimal or no impact on the water supply to Snug House Farm.

The overall conclusion is that filling the gully adjacent to Hog Lane Close, with inert fill will have no effect on the on the groundwater, or surface water flow volumes, or quality in the area of the site.

G.H.Saul August 2019.

Proposed Inert Landfill scheme

Land Adjacent to Hog Close Lane, Hepworth

1. Introduction

- 1.1 Bradbury PM Ltd, on behalf of a client, have applied to Kirklees Council for permission to fill a steep sided gully at Hog Close Lane, Victoria, Hepworth, Holmfirth, HD9 7TE, with inert material and restore it for agricultural use.
- 1.2 At the request of Kirklees Council, T.J.Coates Ltd., undertook a survey to identify private water supplies in the immediate area. Of the 31 properties considered, 26 were on mains supply and 5 had private supplies, though 4 of these were due to be abandoned in favour of a mains supply. The location of all 5 properties is shown on the map in appendix 3 of the T.J.Coates Ltd Report¹, and which is reproduced in this report.
- 1.3 An assessment of the potential impact of the development on groundwater and surface water supplies has been undertaken, with a detailed assessment of the likely impact on the 5 sources identified in the TJ Coates Ltd report¹. It is recognised that four of the properties have, or are being redeveloped and the private supplies for these properties are being abandoned in favour of mains supply.

2. Topography

- 2.1 As will be seen from Map 1, the site is close to the top of an E – W spur from a NNW – SSE ridge. The ridge is the watershed for the eastern slope of the Holme Valley.
- 2.2 The approximate line of the main ridge and the watershed has been marked in red on the map.
- 2.3 The flanks and nose of the spur, slope to the N, S, & W, into Cat Clough, Old Hey Clough, and Hepworth and the valley of the river Holme, respectively, at gradients of 1:5 and steeper.
- 2.4 Where it has not been improved, the area is generally rough scrubby pasture with wet marshy areas. Springs and issues are mapped on the NE boundary of the area to be filled.
- 2.5 Mining records from the early 1800s suggest there was significant activity in the area, with coking coal been mined through pits and shafts. Evidence of this activity is still present. A disused mine shaft is mapped at NGR SE 175 058, and in the Geology of the Yorkshire Coalfield, published in 1878², there are references to coal exploration and working in the vicinity of Hepworth, and in particular Tinkers Hill. The records also suggest that, the Hepworth Iron Company mined ironstone and fireclay in the general area.
- 2.6 As would be expected, all the valleys in the immediate area slope in a generally westerly direction into the Holme Valley. The gully it is proposed to fill does not fit this pattern, as it slopes to the NE. It is possible that this was created during

mining exploration operations, or quarrying. The level area at the NE end would fit the construction of an exploratory Adit.

3. Geology

- 3.1 The area is covered by map 83 Glossop, in the BGS 1:50,000 series³.
- 3.2 The map shows the site to be on the bottom section of the Lower Coal Measures, between the Greenmoor Rock and the Upper Band Rock. The published Geological Section is shown in Fig 1. It will be seen that the strata consists mainly of Mudstones and Shales, separating the two leaves of the Greenmoor Rock and the Upper Band Rock. The geological map is shown in Fig 2.
- 3.3 Although the Greenmoor Rock (Further west it called the Elland Flags) is classed as a sandstone, it does contain mudstone bands.
- 3.4 Although the dip does vary, it is mapped as being in a NE direction. The mapped dip is about 3°.
- 3.5 The geological memoirs² indicate there is some uncertainty about which sandstone is actually at outcrop immediately to the west of the site, however it will be seen from Fig 2 that the Upper Band Coal (UB), which lies immediately above the Upper Band rock is mapped with certainty. This is shown to the west of the site, i.e up dip. This would suggest that the actual site is cut into the upper leaf of the Greenmoor Rock.
- 3.6 Immediately to the north of the site a WSW – ENE fault is mapped. This down throws to the S and runs along the approximate line of Cat Clough. The displacement is estimated to be 10/15 mtr. This fault could induce fissuring in the competent sandstones in the immediate vicinity of the fault. The mudstones and shales are likely to undergo plastic deformation, with little or no fissuring.

4. General Hydrogeology & Hydrology

- 4.1 The coal measures are generally regarded as a poor aquifer and it is unusual for them to support major abstraction. This is for two reasons:
 - 4.1.1 The sandstones are generally fine grained and water movement through them is slow, unless there is enhanced fissuring.
 - 4.1.2 The mudstone/shale bands are basically impervious and inhibit or prevent movement between sandstone beds. There are also mudstone/shale beds within the sandstones.
- 4.2 Because there is little vertical movement, recharge has to come from the outcrop of the individual sandstone beds. The area of outcrop in this area is generally small and therefore only small abstractions can be supported. The confined nature of the beds is exhibited by the differences in water level in the individual beds.
- 4.3 Ground Water movement is generally down dip and therefore will be the to ENE.

- 4.4 The fault is likely to have two effects on water movement in the strata. Because the sandstones will be fissured in the immediate vicinity, water movement will be easier and therefore a preferential flow path will be created parallel with the fault, and where sandstones are opposite each other on the two sides of the fault water can easily flow across it. Where a sandstone is opposite a mudstone the fault will act as a barrier and limit water movement within the sandstone bed.
- 4.5 Cat Clough and Old Hey Clough cut into the upper beds of the spur, and effectively drain them, hence the springs and issues shown on the OS map. The spring level is at 330/335 mAOD. Anything above this will be drained. This is corroborated by the Standing water level in the records of Martins Nest Borehole, which was measured as about 9.5 mbgl, i.e 330/335 mAOD. Anything above 330/335 mAOD and up dip, will therefore be drained.
- 4.6 Cat Clough is flowing over the impervious mudstones and shales, along the approximate line of the fault. Also along the fault line are most of the springs and issues where it crosses the sandstone beds and of particular importance is a sink at SE1764 0625, just to the east of the A616, where Cat Clough disappears underground. At this point there is a sandstone link across the fault and the enhanced fissuring provides a flow path. This point is shown on Map 2.
- 4.7 There is evidence of old mine workings just the west of the A616, These almost certainly worked the Upper Band Seam, possibly causing fracturing in the Greenmoor Rock, which would enhance the flow characteristics in the immediate area, and could be a contributory factor in the formation of issues and sinks.
- 4.8 Old Hey clough also disappears back underground, through a sink, just to the east of the A616. The sinks of Cat Clough and Old Hey Clough are both on the mapped line of the outcrop of the Upper Band Coal Seam, and the sandstone that lies immediately under it. Mining could have played a part in this, providing drainage channels. The location of the sinks is shown on Map 2.
- 4.9 The gorge to be filled with inert material is naturally drained into Cat Clough. It is proposed to install 3 levels of drainage in the fill, which will pick up any springs or issues coming from the sandstone, as well as any rain falling on the fill material. The risk of recharge to the sandstones, in the immediate area of the fill site, with water that has been in contact with the fill, is minimal, as the upper strata, above the base of the gully is drained and the sandstones below the base are protected by the mudstones and shales.
- 4.10 As indicated above Cat Clough disappears down a sink, approximately 50 mtr east of the A616. This is on the north side of the fault, where the Upper Band Sandstone is at outcrop. It has been suggested that it has been culverted under the A616 and reappears through the issues mapped to the west of the A616. Although possible it is thought more likely that this is a natural phenomena and the water coming out of the issues to the west of the A616 is at least partially from a separate source, for the following reasons:
- 4.10.1 The sinks to the east of the A616 are on the north side of the fault draining into the sandstone, which could be part of the lower leaf of the Greenmoor Rock The fault cuts through this sandstone, and virtually opposite on the south side of the fault the Upper Band Sandstone is at outcrop. As sandstones

are competent rocks they will have been shattered by the fault, providing a flow channel across it, allowing water entering the sink to drain in a southerly direction, after entering a sandstone lower in the sequence, with a lower water table.

4.10.2 The sinks and issues are shown as such on old OS maps. If it was a culvert it would not be mapped as a sink.

4.10.3 To start culverting 50 yards back from a road is unusual, the maximum is usually about 10 mtr.

4.11 The base flow for the eastern section of Cat Clough is the groundwater from the springs, in and around the fill site. Because of the relatively small storage capacity of the rock feeding the springs flow is highly variable. In times of heavy rain there is also an element of surface water run off.

4.12 The section of Cat Clough to the west of the A616 originates as an issue at SE1757 0622 and then goes underground again at SE1738 0619. It is possible that the water flowing in this section is partially water flowing down the eastern section, however in its passage through the strata it will have undergone natural filtration and mixing with, and dilution by, water present in the strata.

4.13 The western section of Cat Clough is flowing over strata that contains a number of coal seams, some of which have been developed in the past. The effect of old mine workings cannot be discounted.

5. **Water Quality**

Groundwater from the Coal Measures tends to be hard, with relatively high levels of iron and sometimes manganese. The high level of iron presents two problems to modern day private water supplies:

5.1 It is above the permissible potable limit, necessitating iron removal systems.

5.2 It renders uV sterilisation systems inefficient as it blinds the very fine prefilters, and or coats the lamp with a film, cause a significant reduction in the effectiveness of the lamp, without frequent cleaning.

It is the presence of iron that has caused many private water supplies to be abandoned.

Many springs and issues also exhibit high levels of iron, with red deposits at the point of issue. The extent to which this is evident is dependent on the ratio of true groundwater to surface drainage water.

The water quality of Cat Clough is unlikely to meet Drinking Water Standards as:

5.3 There will be biological pollution from stock and animals using it, and surface run off from where they have been grazing.

5.4 There could be high levels of iron from the springs feeding it.

5.5 There is likely to be chemical pollution carried in run off from tracks, roads, etc.

It is possible that the water quality of the groundwater and Cat Clough is adversely affected by drainage from old mine workings.

The likely impact, of the development, on the water quality of Cat Clough will be minimal as:

- 5.6 It is proposed to capture and divert the feeder springs around the working area, so that these feeders will not come in contact with the fill material, or flow over any of the working area.
- 5.7 The actual working area will be drained separately, through drainage systems at three levels. Water picked up by these systems will pass through a reed bed and ponding area before being released to Cat Clough. The reed bed and ponding area will remove any suspended solids, and the reed bed will treat any biodegradable matter.
- 5.8 The fill material will, by definition, be inert and will not contain any soluble potential pollutants.
- 5.9 Once the fill operation is complete, it will be capped with an impervious clay layer, preventing water entering the fill, or coming into contact with it.

6.0 Potential Impact on Identified Private Supplies.

Originally 5 properties in the area were identified as having private water supplies. This number was subsequently reduced to 3 as a number had been connected to mains supply. For completeness all five properties have been considered.

6.1 Upper Milshaw Farmhouse & Upper Milshaw Hall (Wells)

Both these properties lie at least 500 mtr up dip, on a significantly higher level, on the northern side of the Cat Clough Catchment and to the north west of the proposed fill site. It is acknowledged that both these properties are being redeveloped and will be connected to the mains supply. The ground water source will be abandoned and as part of the development capped. However the potential impact on groundwater in the immediate vicinity of the properties is considered below.

- 6.1.1 Groundwater movement is basically down dip and the dip is to the ENE. Flow from the fill area will start down dip of the properties and move even farther away.
- 6.1.2 Surface water drainage from the properties will be approximately S, into Cat Clough, i.e. Away from the properties towards the development.
- 6.1.3 Any water coming from the development site will drain NE into Cat Clough. To reach these two properties the water would have to flow north, across Cat Clough and rise by about 30 mtr.
- 6.1.4 Any well or borehole at either of these two properties would have to be sunk through the drained zone into the underlying saturated zone. This

zone is protected from the surface water by the layer of impervious mudstones and shales, which forms the bed of the stream.

6.1.5 These properties lie to the north of the fault, which may act as a barrier or partial barrier, to ground water flowing along the strike to the north from the fill site.

6.1.6 When a well is actually being pumped, flow will be induced towards the well. Using typical coal measure values of T & S, the potential radius of effect has been calculated and is <300mtr. It will not reach the development area, or Cat Clough. There is no risk of water, which has been anywhere near the development area, being drawn towards towards the properties.

It is concluded that there is no risk to groundwater, or surface water supplies at these two properties, if it were decided to redevelop them.

6.2 Lower Milshaw Farm and Lower Milshaw Farm Barn(Wells)

As covered in the T.J.Coates Ltd Report¹, these two properties have been converted and are changing to mains water supplies. The private supplies are being capped and abandoned. However the potential impact of the development on ground water in the immediate vicinity of the properties has been considered.

They are sited approximately 500 mtr W of the proposed fill site, and are therefore up dip of it. The potential for the site to have any effect on the water quality of these two sites is minimal, for the following reasons:

6.2.1 The properties are to the N of the fault and are mapped as being on the strata below the bottom leaf of the Greenmoor Rock. Due to the difference in topographical height and the dip, this strata will be at a depth of > 50 mtr below the base of the fill site. The impervious mudstones and shales will prevent any water from the site getting down to this depth.

6.2.2 The natural groundwater flow will be down dip, which is towards the fill site. Water from the site will not come up slope.

6.2.3 If a well was actually being pumped, flow will be induced towards the well and could reverse the natural down dip flow, within the immediate vicinity of the pumping well. Using typical coal measure values of T & S, the potential radius of effect has been calculated, and is <300mtr. It will not reach the development area, or Cat Clough. There is no risk of water, which has been anywhere near the development area being drawn into the vicinity of the properties.

6.3 Snug House Farm

Although the source of this private supply has been stated to be Cat Clough, this is by no means certain. Cat Clough flows E to W, from springs at the Northern end of the development site. It then goes underground approximately 50 mtr to the east of the A616.

The section of Cat Clough to the west of the A616 originates from an issue 15/20 mtr to the west of the A616, before going underground approximately 120 mtr east of the Snug House Farm Supply.

If the water close to Snug House Farm originates partially from the springs near the development site it will certainly have undergone natural filtration, mixing and dilution by water held in the strata.

Even on the basis that the water reaching Snug house Farm all originates from the springs near the development site, the impact on water quality at Snug House Farm of the development will be minimal as :

- 6.3.1 By definition the fill material is inert and should not contain an soluble pollutants.
- 6.3.2 The feeder springs are all being diverted away from the development site and will not come into contact with any part of it.
- 6.3.3 Three drainage arrays will be installed in the fill, as filling proceeds. These systems will collect all the water arising from the development site. This water will be passed through a reed bed and ponding area, which will remove any suspended solids and treat any biodegradable material in it.
- 6.3.4 The development area represents < 3% of the Cat Clough Catchment, between the source springs and Snug House Farm. Water from the development area represents a very small proportion of the total flow. There will be a major dilution effect.
- 6.3.5 Further dilution and filtration is likely in the underground section of the water course.
- 6.3.6 Once the filling operation is complete the site will have a clay cap, preventing any water entering, or coming into contact with the fill.

7.0 Conclusions

It is concluded that:

- 7.1 The development site lies on a spur, running E-W from a N-S ridge to the East of the site.
- 7.2 The valleys in this area fall in a generally westerly direction into the Holme Valley. The gully it is proposed to fill does not fit this pattern as it runs north northeast. It is possible that it was created during mining, or quarrying activities.
- 7.3 The spur is drained by two watercourses, Cat Clough to the North and Old Hey Clough to the South.
- 7.4 The development site drains north into Cat Clough. All strata above 330/335 mAOD is drained.

- 7.5 The development area is situated on the bottom section of the Lower Coal Measures, which contains a number of coal seams. Some of these were mined in the early 1800s. Old working could affect water flow.
- 7.6 The Coal measures consist of interbanded sandstone, mudstones and shales, with intermittent coal seams. The coal measures are generally regarded as a poor aquifer as the impervious mudstones and shales inhibit, or prevent vertical water movement, between the sandstones, and the sandstones are fine grained making inter granular flow difficult.
- 7.7 The strata dips to the ENE and groundwater flow is generally down dip, in the saturated section.
- 7.8 Groundwater from the coal measures is variable in quality and can be high in iron.
- 7.9 Groundwater, which fed the redundant private water supplies at Upper Milshaw Farm and Upper Milshaw Hall comes from the north side of the Cat Clough Catchment and the properties are up dip. The development will have no impact.
- 7.10 The groundwater, which fed the redundant private supplies, at Lower Milshaw Farm and Lower Milshaw Barn was from up dip of the development and therefore there will be no impact.
- 7.11 The source of the supply to Snug House Farm is uncertain, but even if it is from Cat Clough there will be minimal or no impact.

G.H.Saul July 2019

References

- 1 Proposed Inert Landfill Scheme at Land Adjacent to Hog Close Lane – Study of Private Water Supplies – T.J.Coates Ltd 2nd October 2018
2. Memoirs of the Geological Survey – England and Wales - The Geology of The Yorkshire Coalfield – Published by the Geological Survey of England and Wales in 1878.
3. Geological Survey of Great Britain (England and Wales) 1:50,000 series, Sheet 86 Glossop Solid and Drift Edition.

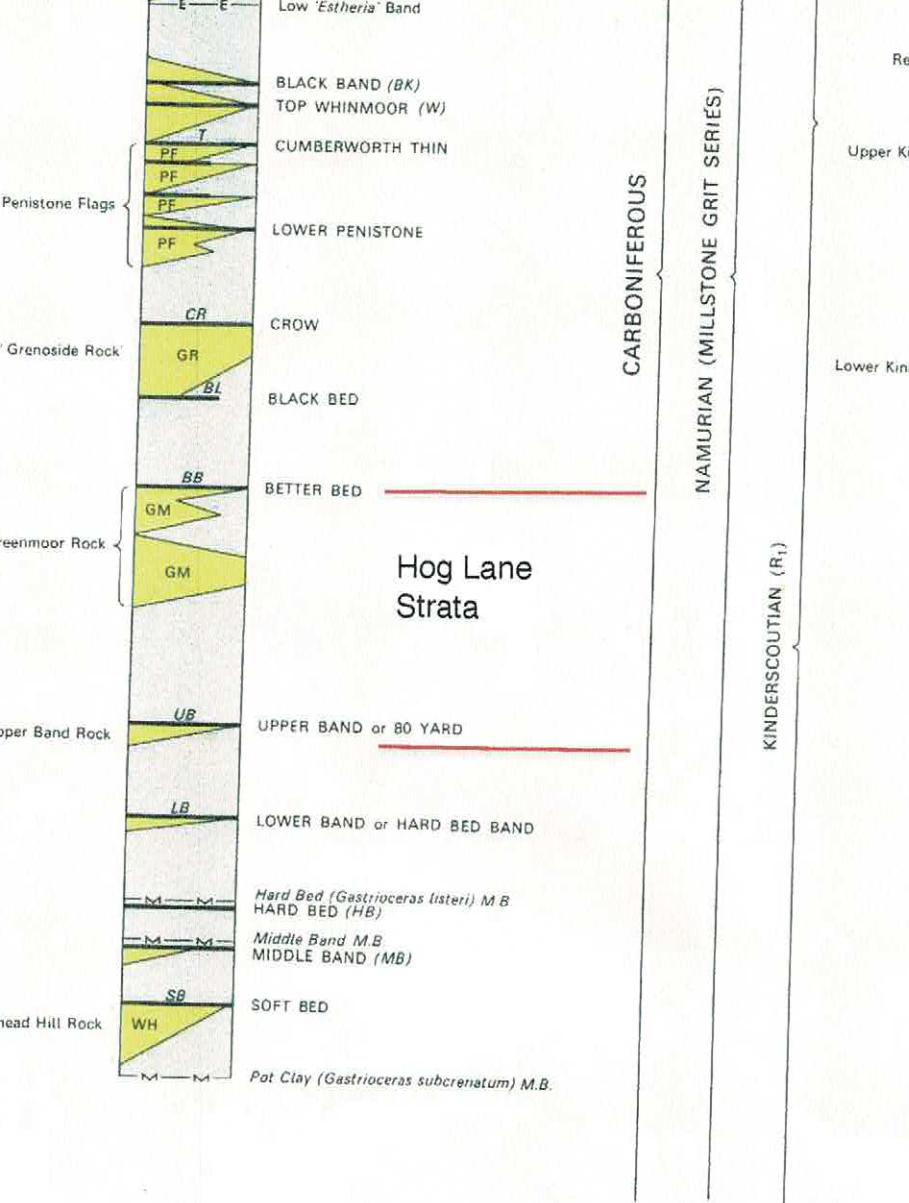


Fig 1
Hog Lane Strata Section

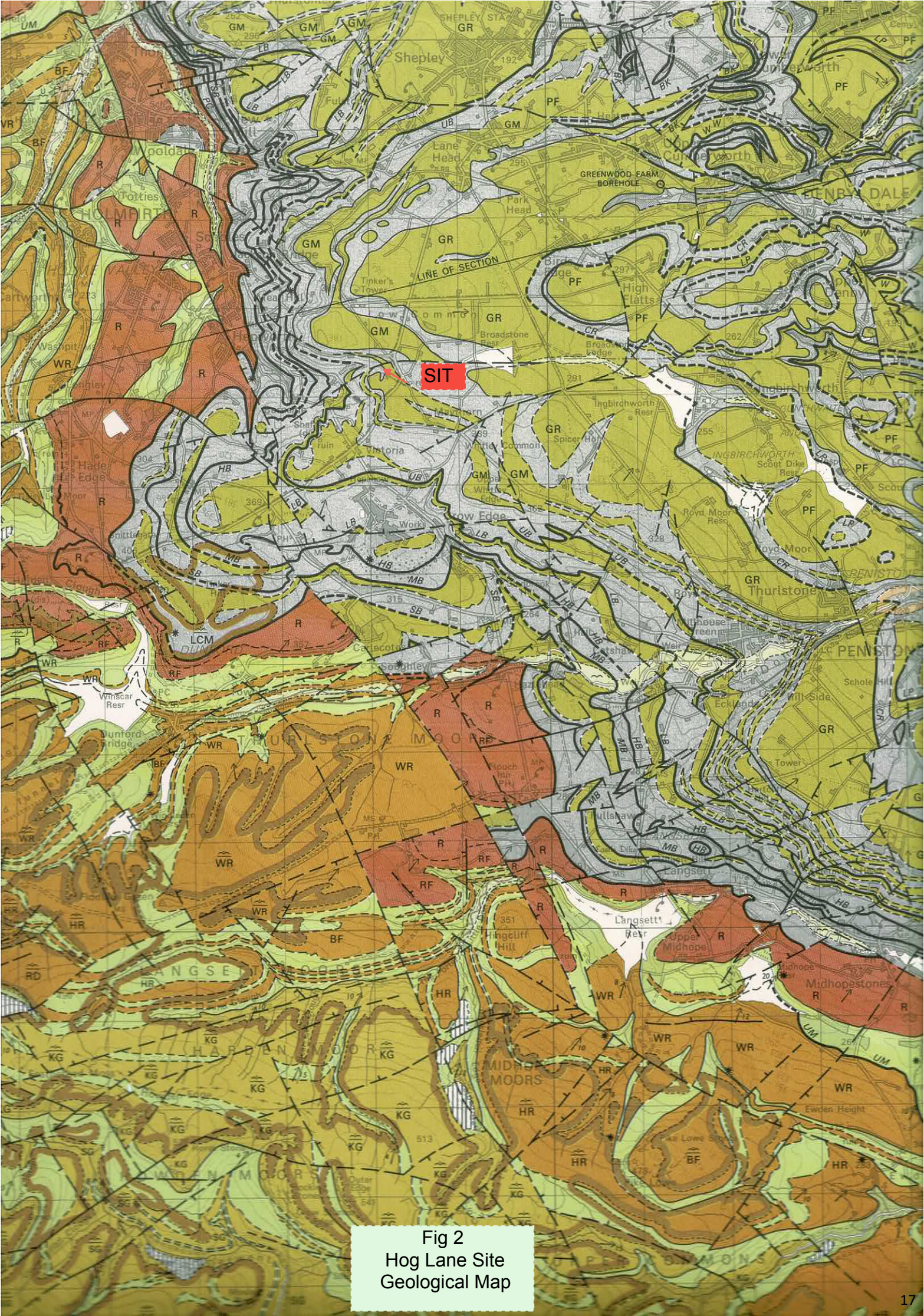
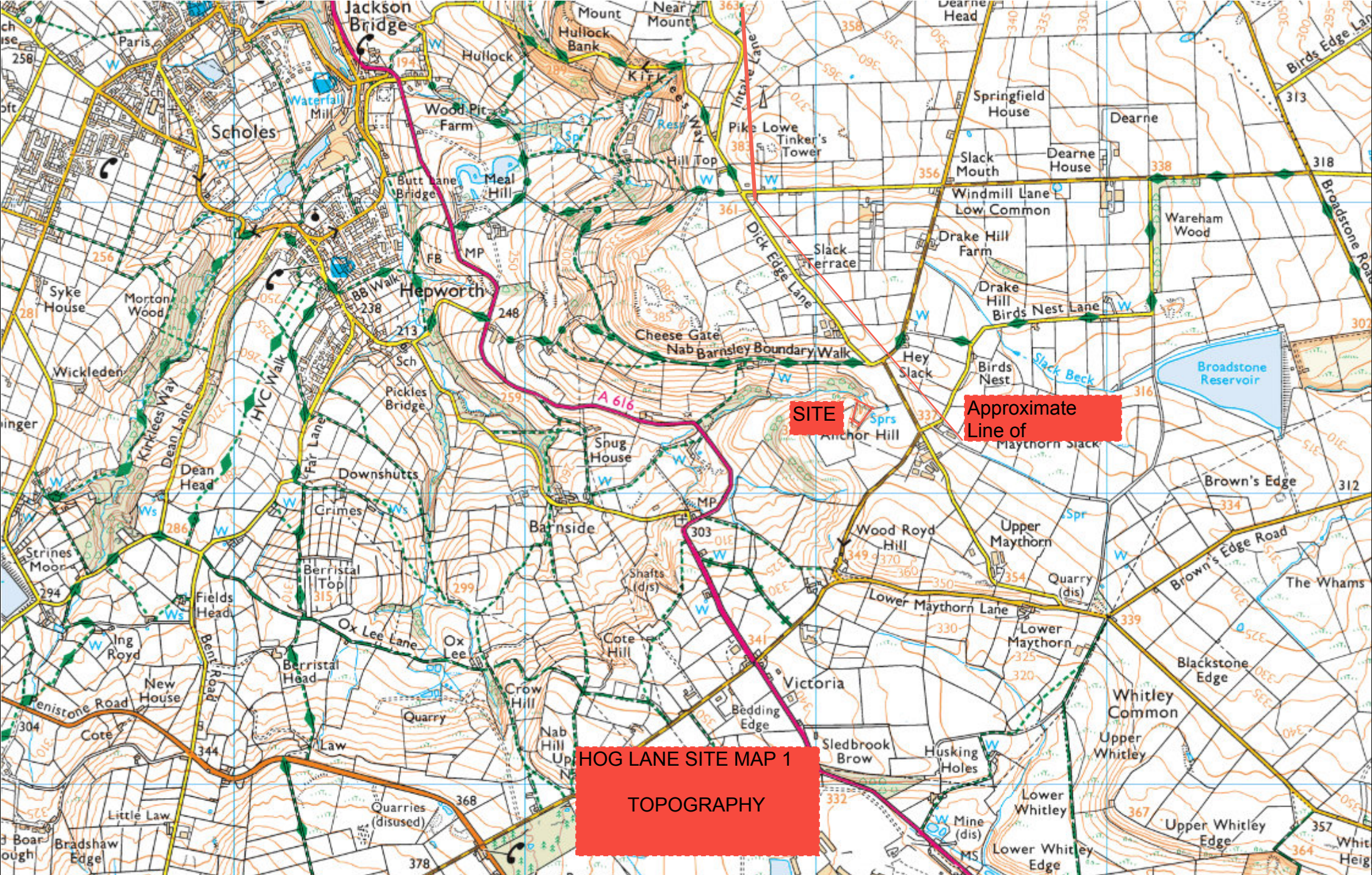
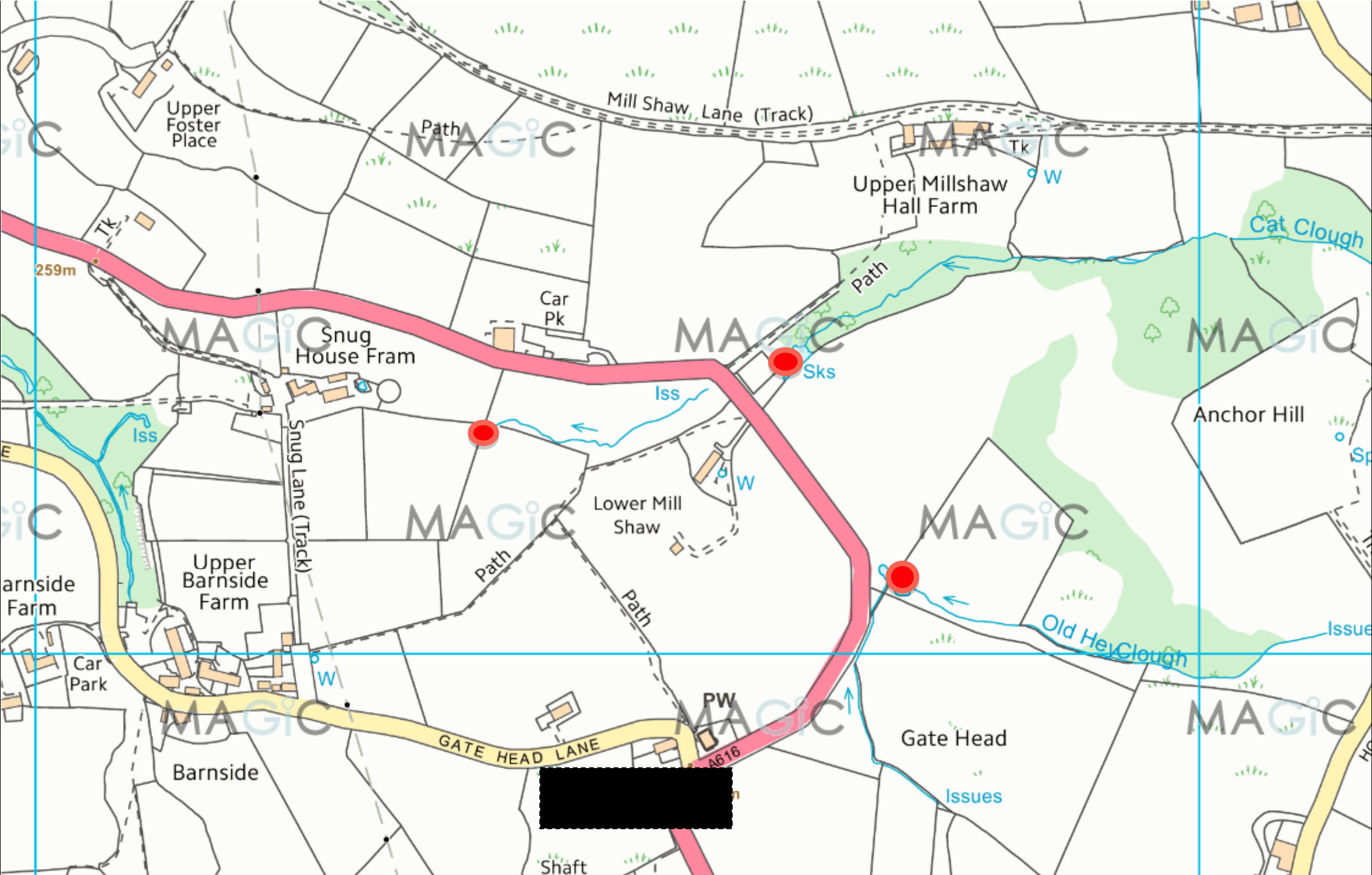


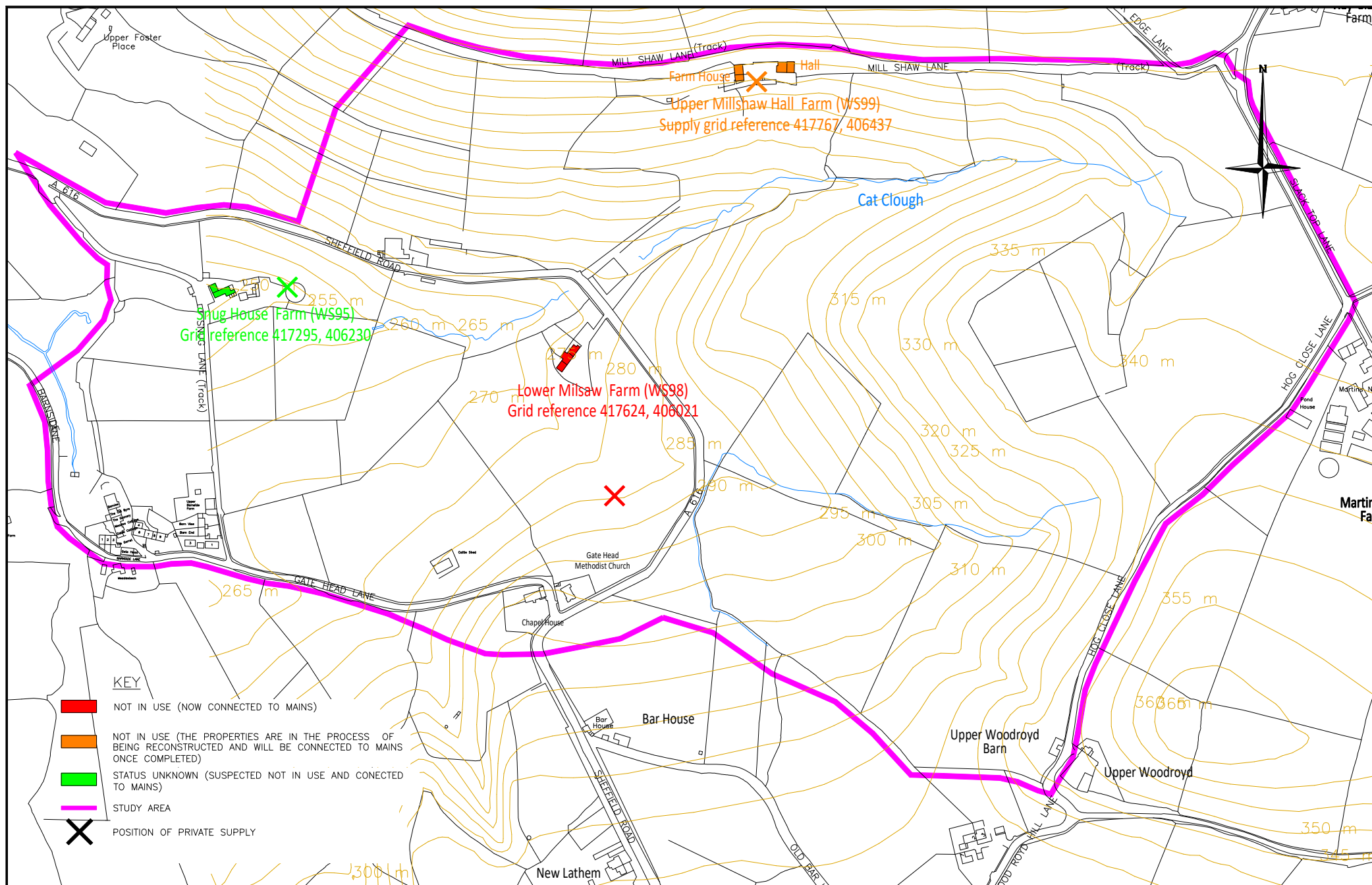
Fig 2
Hog Lane Site
Geological Map



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PROJECT STUDY OF PRIVATE WATER SUPPLIES	TITLE SURVEY PLAN	DATE 01.10.18 SCALE 1:5000 DRAWN BY MC	CHECKED DRG NO 314-WS-P01 REVISION	T J COATES LTD 2 UNITY HALL COURT, HAIGH MOOR ROAD, WEST ARDSLEY, WAKEFIELD. WF3 1BE TELE 0113 2525825 / EMAIL mick@mjcoates.com DESIGN LAND SURVEYS - CONSTRUCTION DESIGN - STRUCTURAL ENGINEERS - QUANTITY SURVEYORS - BUILDING SERVICES
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