HG4 - RURAL AFFORDABLE HOUSING LED SITES (3) Wick Land at Heol Fain

Comment from Mr A Cooke, [redacted]

Summary

The proposal should be rejected because it will exacerbate risks to the Heol Fain roadway, neighbouring land, and damage the environment. The site may not offer long term geological stability for the 50 houses, with subsidence most likely, and only time and magnitude in dispute. Subsidence is already present in the field adjacent to Heol Fain opposite and adjacent to the proposed site.

In the mid 1950s, the then owners of the whole site, the 50 dwelling proposal for the RLDP and 124 dwelling 2014/01424/FUL, sought planning permission to build a number of domestic houses on the site. Glamorgan County Council (GCC) sought advice from the Ministry for Welsh Affairs and a survey was undertaken. GCC turned down the application quoting advice that the site should never be used for domestic houses, due to geological reasons[2].

In periods of high rainfall, excess surface water simply flooded Heol Fain, which is a small public road at the side of the site, and ran off into the road ditch and gulley in the field to the west, running towards the coast.

In July 2015 Barratt plc started development on the site with permission for 124 dwellings. They constructed an installation to dispose of the surface rainwater, away from their development site. The drainage installation is centrally placed to the west side of this site which is this proposal for a further 50 dwellings, adjacent to Heol Fain.

Since installation of the drain, Heol Fain no longer floods. A sink hole currently approx. 40'(12m) diameter and 3'6" (1.2m) deep, first appeared in the field to the west of Heol Fain, adjacent to roadway, opposite the site drain Barratt had installed. It is increasing in size and depth each year.

Currently there is no threat to any dwelling as none are located near the underground cavity.

Barratt were informed of the matter in 2023 and advised to contact the VoGCC in respect of the possible risk to Heol Fain as a result of their drain installation and the collapse of the ground in the field. Their legal department were sent emails and hard copy by recorded delivery. Their legal dept, have made no response to any of this correspondence, failing to even acknowledge receipt.

A geological survey of Sep 2015 based on drilling bore holes to a depth of 105' (30m) on behalf of Barratt showed that most of the site was impervious to rainwater and stated " *the test results across most of the site suggest there is typically limited or no potential for infiltration*" [1].

Drainage of surface water was achieved via a drain close to Heol Fain. At the site of the subsequent drain installation, the bore hole test report states the result "*Unable to induce a head of water ….due to rapid infiltration rate (1,000 litres used).*" [1] The testers had attempted to fill the drilled test hole with water and then measure how far the level dropped over a given

period of time. Instead, at this location, despite pumping 1,000 Litres in very quickly, the hole would not fill. They had drilled through into an underground cavity of an unknown size.

Rainwater is acidic and erodes limestone. A clay-mud layer near the surface generally prevents/greatly restricts rainwater permeating to the bedrock. The water stays on the surface and floods the land. The area is all limestone.

No scientifically reliable measurements have been undertaken of the rate of increase of the sink hole. These will commence on a regular basis this year.

The proposal to build 50 houses would generate an increase in surface water to be disposed of via the drain. This will increase the underground erosion problem

The NPPF via SuDS requires that all drainage plans supporting new developments do not exacerbate existing drainage problems.

The risk of an underground cavity, to both the Heol Fain road and the site of the proposed build, around the drain installation, is clear but the scope is not known.

As long as rainwater is allowed to enter the underground cavity, that cavity will increase in size and the risk will continue to grow.

With the risk clear and environmental damage already occurring, this proposal should be struck from the Deposit Plan.

Geological surveys should be undertaken to quantify the problems and risks.

Ref 1 **Integral Geotechnique 7 Sep2015** 11601/2/AF/15 for Barratt Homes Supplementary Bore Hole testing Land off Heol Fain, Wick

Ref 2 Advised by **Mr D James,** [redacted], whose father was Chairman of the Wick Community Council at that time. The landowners who made the application were The Dunraven Estate.

1.0 Introduction

The National Planning Policy Framework (NPPF) 2012 addresses risks from sinkholes and land instability primarily under the context of sustainable development, ensuring that new developments are safe and do not cause harm to neighbouring properties. A requirement is made that drainage plans **do not exacerbate** existing problems—including subsidence, ground instability, or sinkholes implementing Sustainable Drainage Systems (SuDS).

I own the field in Heol Fain directly opposite where the plan proposes that 50 dwellings be constructed. I am obviously biased and, when the sink hole first appeared and was smaller, I knew all my complaints would be discounted and ignored because of that bias. That is why I informed Barratt, invited them to inspect it and asked that they contact the VoGC. They have not inspected it.

I will now try and write not as the owner, but will write through the eyes of a young person with a young person's view of the scientific concepts. The purpose will become clear as the reader progresses and, I hope will dispel the natural criticism of bias.

I am not a farmer with many hundreds of acres for whom this is a trivial inconvenience. [redacted]. I purchased the two fields in 1999. I own no other land. It was meant to be the retirement joy for my wife and myself.

The proposed dwellings are to be built around the existing drainage point for surface water from the existing estate constructed from July 2015 on. The surface water flows from this unit, under the road and under the field headed towards the coast some 2km distant. It is relatively high c. 90m above sea level so there is a good loss of height to enable passage of water to the sea.

2.0 Sink hole first appears

In 2023 I first noticed a sink hole in the field close to the hedge, opposite the drainage point. Since that time it has become wider and deeper. It is currently around 40' in diameter and around 3'6" in depth, There was a single deepest point but in recent days, as I have been writing this, it has been very wet and another deep point has started to develop.

In 2023 I formally informed the developer of the site Barratt plc of the situation. I have copied officers within the LDP planning office with some of the correspondence.

To date Barratt have not engaged substantively with the matter in any way. Their Head Office have ignored all correspondence I have sent to them, including recorded delivery hard copy letters. There has been no acknowledgement. I wrote to them warning of the risk to Heol Fain and advised that they should contact the Vale of Glamorgan Council. They have not done that.

3.0 Nature of the problem

I write not about the sink hole and Barratt's refusal to engage. Undoubtedly there will be a long drawn out legal affair with Barratt attempting to deny and shift blame onto their drainage

consultants or the Local Authority, even myself, or perhaps God, acting as he wants. I understand they will attempt to use time, expense and all manner of corporate obfuscation to avoid being held responsible for the damage the drain they designed and constructed is causing. This is not about that, which is a related but totally separate event.

Here we just need to look at simple facts rather than any hard argued opinions about the geology or legal/procedural issues that will reflect any liability. There is a NPPF which is quite clear in its guidance that existing drainage problems must not be worsened. We have a problem which, whilst currently clear in its nature, its scope is undefined. We have clear science and clear geology and I will show using the most simple, Year 7 school science the outcome that is both inevitable and unstoppable. Whether the damage will be a) limited to the field, b) the field plus the road or c) the field plus the road and part of the site on which it is proposed to build 50 houses is unknown at the current time.

Beyond simple problems of drainage there exists undefined but real doubt about the suitability of the site – is it stable, will it be safe?

Supporting the idea that the site is not suitable for building is also the historic account of Mr James of [redacted] that in the 1950s a development of this same site was turned down by Glamorgan County Council due to reasons of geology which I referenced in the summary. His father was Chairman of the Local Wick Council at the time and he recalls his father explaining it to him.

4.0 Scientific explanation of what is going on.

What is definitely understood is the sequence of events, but not their scope.

I will explain using Year 7 science. The basics elements of the events are so settled that the sequence I will describe is that which a child could understand and, therefore, only a charlatan could suggest an alternate. We do not need to have "our expert" v "your expert", or wait for another report by another body or any other obfuscating argument, it is all basic.

My expertise is in mass component manufacturing and design. Employment in this field drew me to this part of South Wales 45 years ago but job opportunities in that field are long defunct. I love living in the Vale and so stayed. An acquaintance suggested there was a shortage of Science teachers and I became Head of Science at Cowbridge Comprehensive School after being Head of Science at Maesteg. Thus whilst not a geologist, I have expert knowledge on what Year 7 pupils, the first secondary year, are taught, the basic framework around which all other science they will learn, is hung. Here I will use that to describe our problem and the process.

Pupils are taught about atoms and molecules. They understand molecules are an assembly of atoms and that what type and how they are joined changes their properties. Hydrogen is a gas, they do the pop test to prove its presence. Oxygen is another gas, the candle extinguishes in the closed container when all the oxygen is burnt. However oxygen and hydrogen combine in one molecule to form water – a liquid. By electrolysis we break water back into two separate gases and we prove their type by doing the tests for each gas. They then learn about solids

liquids and gases and that some solids can dissolve in liquid, such as sugar or salt. They then do an experiment to evaporate off the liquid and recover salt as a solid. Year 7 pupils understand the solid was held in solution in the liquid.

They learn that salt cannot be dissolved indefinitely, even though it can't be seen in the water. When saturated, the water will hold no more salt. Salt will readily dissolve into water that currently has no salt in it.

They then learn about another property of substances, acids and alkalis. The very first test they do to exhibit an acid is to put drops of acid onto limestone. Each pair in the class have a chip of limestone and a small bottle of acid and they observe the effect of acid on the hard limestone rock. They watch the rock "disappear" They observe some bubbles and then understand that the products are carbon dioxide (gas) a salt, calcium carbonate, and water. They know, without being told, from the science they learnt days earlier, that the salt readily dissolves into the water as previously there was no solute present. The chip of hard limestone rock "disappears" during the lesson.

They understand that reactions do not go on forever. When a reaction runs out of one of the reactants it slows and then stops. If you put a little acid on the limestone it only reacts for a short time and then stops. You would need more acid to make it continue.

After an introduction to acids and alkalis they are then introduced to the PH scale using a range of fluids found in most homes, washing up liquid, vinegar, toilet cleaner, fruit juice, milk, and rainwater are always used, amongst others. **Every single child in the UK in their first year at secondary school learns that rainwater is acidic. This always generates conversation back to the limestone chip/acid experiment a few days before and then, for the schemes of work used for all the children for whom I was responsible for educating, they were shown multiple pictures of statues and buildings that had suffered decay due to the effect of acid rain on the rock.**

Every Year 7 child knows rainwater is mildly acidic and limestone reacts with it. Nothing can stop this reaction and under no natural circumstances can it be reversed. More water, more chemical reaction. The only way limestone will not suffer significant chemical erosion is if only tiny amounts of rainwater come into contact with the limestone, contact is restricted. Keep it dry in a jar on the shelf and the limestone does not react at all.

A fact all adults in Glamorgan concerned with building industry and construction should be aware of is that the Heritage Coast, like the Jurassic Coast in Dorset, is formed from Blue Lias of the Jurassic period, a geological time period made famous by the series of movies. Blue Lias, as every western Vale householder who has dug below the topsoil of his garden for a fence post footing or washing line footing knows, is layer after layer of limestone separated by thin layers of clay-mudstone and shale. Dig even a modest hole and one has a small pile of limestone, And when it rains, the hole fills up to the bottom of the topsoil level and does not drain away, the hole has a muddy impermeable clay, a bit like the clay they line canals with, it does not let the water out, so the bottom of the hole stays damp for weeks, even if it does not rain again. That is the experience of every householder along the Heritage coast. So again that

is not something for fine lawyers and geologists to argue about it is basic science every single Year 7 pupil in Wales can understand.

St James' Church in Wick is full of limestone spoil from the graves. A 12 year old child would tell us that if they put rainwater on it, there would be a chemical reaction, if that child put more rainwater on it there would be a greater reaction. Seal it with something that stops the rainwater getting to it and it lasts…..millions of years, from the time the dinosaurs roamed the Earth. They know it as fact because so many have walked the Heritage Coast and collected fossils from the age of dinosaurs. Keep the rainwater off limestone and it lasts. Mudstone clay protects the underlying limestone. It does a good job of it around Wick which is why it is so high.

Those that would deny we have a very serious problem at Heol Fain would have to deny simple settled science that every child has been taught in their first year at secondary school and proven with simple experiment.

The geology is not in dispute, the science is not in dispute.

5.0 Drilling of test boreholes on the site

Now for our next set of facts we must thank Barratt plc contracting **Integral Geotechnique** to conduct a series of drillings and experiments. The report is available on Vale of Glamorgan Website. I sent a copy of the report to the LDP office with my correspondence. It runs to 138 pages. That might appear intimidating so I will explain it so that our Year 7 pupils would understand it.

Across the original site they drilled 16 bore holes with a drilling machine that pulled all the waste material out so there was a clear deep hole. Each hole was drilled in four stages, to different depths, 8m (27 feet), then 16m (53 feet), 24m (78 feet) and finally 32m (105 feet).

For each of the 16 holes, after each stage of the drilling, they removed the drill and filled the empty hole up with water very quickly from a very big container, with a powerful pump. They then measured how the water level went down over time. This is a standard test, with the process published by the Building Research Establishment. There is nothing unusual about what they did, apart from, perhaps, the depth to which they were drilling. The aim was to find an area on the site for a sustainable water drain.

Page 4 is attached. It shows the results for all the holes. Also attached is Figure 1, their site plan. They are respectively pages 11 and 12 of this submission.

Children, understanding about dinosaur footprints and fossils being preserved in a limestone rock that they know will react with rainwater, will have a clear expectation that there is unlikely to be much drainage through the rock because it is somehow sealed with a special mud called clay. The results support their understanding.

Hole B9 – "*Unable to calculate an infiltration rate due to negligible fall in water level.*" The same note is recorded for hole B7. That is clear enough, the water does not drain away, even if one were to drill down over 105' deep where the water pressure would cause a sub-sea diver

to get the bends, pressure three times atmospheric pressure, enough to crush a steel can (pupils would have done an experiment using about half atmospheric pressure to crush a steel can, when doing the atoms and molecules section; educational suppliers sell a special steel can for exactly that demonstration that is done with every class, every year.) Those pupils would understand that at 105' there is an enormous pressure and still water was not draining out of the hole.

Now for most of the rest, the results are written in a scientific notation, a form not used in common language. I will explain. Let us take B5 as a sort of median (middle of the pack) example with a column of 105' of water where the pressure is over three times atmospheric pressure the rate of water infiltration into the rock is ***"1.7 x 10-5m/s"***

That is 0.000017m /s or if we think of a finger nail being about 1mm thick then this is a drop in water level 0.017 of a finger nail or about **1/20th of the thickness of a finger nail each second**. So in 20 seconds **the water level** in a hole 105' deep would have fallen by the thickness of a finger nail and **in a whole minute** it **would have fallen**, provided we watched it very, very, carefully, **by the thickness of three finger nails**.

Every Year 7 pupil would understand that was totally in line with what they expected, water could not escape into the rock sealed with clay mud and even when forced at great pressure the amount leaking is so small they would not be able to see it.

Those are the results for most levels of most holes and the report concurs " *the test results across most of the site suggest there is typically limited or no potential for infiltration*".

The report advises Barratt in terms our pupils and adults living in the area would understand *"The lack of infiltration potential at these locations is likely to be due to the high clay content of the residual soils and weather mudstone beds within the upper layer of the bedrock and is compounded by the …nature of the underlying limestone …"* Nothing not in line with our Year 7 scientific understanding.

The fine technical report by **Integral Geotechnique** and our Year 7 science are in total agreement .

6.0 Why build a drain in the first place?

Let us pause there. If Barratt could not offer a sustainable drainage system then either they would not be allowed to construct on the site because adequate drainage could not be provided or, they would have had to lay in pipes and pumps to get the water to somewhere else where it could be discharged or drained away, a natural stream or to a waste water processing plant. That would cause significant extra site development cost to Barratt

7.0 Bore hole test results alongside Heol Fain

Now let us move to hole B1 and holes B 12, 13, 14 & 15, those alongside Heol Fain opposite to where the sink hole has appeared on the other side of the road. I have outlines their markers with a red box on the site plan on page 12 of this document.

When B1 was drilled the results at 23' and 53'were like those in the rest of the field. Then the report states this *"A cavity with loss of flush was recorded in B1 between depth of 21.5 and 22.1m"* So at around 72' below the surface the report states they drilled into a *"cavity"*, a big underground hole, such that when they pumped the 1,000 litres of water into it, equivalent in size to to 1,000 one litre containers of juice, very quickly, it all just went into the hole and no level of water was observed in the hole, it had just all gone. We have no idea how big the hole is without information from further geological surveys.

B1 is of no interest to us as it is well away from the proposed site and Heol Fain, and, Barratt plc have already built some houses on top of it. Those houses are sold with a 10 year warranty. Barratt plc did not inform the Vale of Glamorgan Council about the problem of the sink hole when I sent them a recorded delivery letter. They did not even acknowledge my letter. Very soon all those houses they built above the underground cavity B1 drilled into, will be out of warranty. All of these things are facts.

Let us now move to the 4 holes drilled in the proposed site for the 50 houses of the RLDP, those close by Heol Fain and near to where the 40' wide sink hole appeared in the field on the other side of the road. B14 is like most of the other holes and there is little drainage. B12 states that at 16m, 53' they were *"unable to induce a head above 14.8m"*. This means they could not fill up the hole with water even though they used 1,0000 litres, it drained away so quickly they could not measure the rate. Like B1 that means there is a very big hole under the ground and they have just drilled into it. B15 is virtually identical. At B13 the very big hole under the ground is deeper at around 105' down.

B12, 13, 14 & 15 are close together. The report describes the hole into which 1,000 litres of water would flow too quickly to measure its movement in, as *"localised open fractures in the form of joint sets, fissures, cavities or bedding fractures present with the limestone bedrock…"* and then recommends to Barratt, "*..the results demonstrate that in general where open clean discontinuities "closely spaced" high angle or sub vertical bedding are encountered, the potential for soil infiltration is increased"* The report does not suggest a site drainage system is installed over it and therefore does not discuss the consequences of doing so.

The facts that followed are that Barratt constructed the drainage for the surface water, the rain water from the site, to be moved offsite, via the underground cavity discovered via those drillings.

Barratt will have submitted calculations to the Planning Department for drainage. The formal approval 2014/01424/FUL stated *"4. Notwithstanding the submitted plans, full engineering details of the new…..surface water drainage ….shall be submitted ….before commencement of development.*" Well I am not quite sure how that works out because the tests were reported in September 2015 and building work had started in July, but we can ignore that apart from to imagine the urgent need by September to find somewhere, anywhere to dispose of all that rainwater, the waste surface water. It had to go off site a location needed to be found.

So there will exist calculations for the annual volume of rain water to be removed from the site.

Acidic rainwater is going to be pumped into a large hole around 50 to 80' under the ground alongside Heol Fain. Vast quantities of acidic rainwater are going to be pumped in every month of every year – into limestone. And every Year 7 pupil in the country knows that acid causes a reaction with limestone to form a salt in solution in water. Rainwater is a weak acid but there is an awful lot of it now going in one location. Rainwater that would have fallen on a huge area and simply flooded Heol Fain, is now passing through a smallish area of limestone. The acid may be weak but there is a never ending huge amount of reactant which will react with a similarly huge amount of limestone.

The rest of the science requires only the basics. The surface at Heol Fain is 90m above sea level, the sea is about 2km distant. At 78' or 24m down it is still 65m above sea level, that water with all that dissolved product in it, the calcium carbonate salt, that was previously limestone, will simply flow downhill to the cliff face and pour out over it. In fact follow the mild valley down parallel to Trepit Road, and across the fields and at the iron stairs onto the beach there is both a stream that appears out of the ground at when it is around 15 m above sea level and the rock face all along the coast features areas where on the driest summer day it is still damp and perhaps oozing water. Well now those damp patches will have a great deal more water with salt solution in it, to ooze out.

Ask a Year 7 pupil that has followed this saga and they could clearly identify the sequence of consequential events. The hole that is underground will get bigger and bigger as the rainwater reacts with the limestone and the salt solution drains away to the sea. As the underground hole gets bigger so there will be risk of collapse of the surface into the cavity.

That is witnessed by the 40' diameter sink hole that has appeared in the field. That collapse has first appeared in the field and the drilling and waste outlet are the other side of the road would suggest that already the cavity extends in some form, from the waste water processing unit, under the road and across into the field.

The Year 7 pupil would suggest the most likely progress would be that local collapse would be likely for both Heol Fain roadway and the ground around the waste water processing unit in future. Nothing can stop that happening.

8.0 Conclusion

The Year 7 pupil would warn of the dangers of building some new houses around such a location.

Those constructing the revised LDP have a duty via the NPPF to ensure the ground is stable and safe and that drainage plans **do not exacerbate** existing problems. Well we certainly have an existing problem that is not going to mend itself and adding even more acidic rain water is going to increase the rate of reaction of the limestone with the acid, so even more will become salt to be deposited in the sea.

How the problem might/might not be solved is irrelevant to the matter in hand. The issue is should 50 new houses be built on this site.

I have written this, explaining each factor in basic terms a child could both understand and explain so that readers will comprehend, no "expert" can write a report such that with a magic wand and some fine words, he/she might be able to make such basic facts of chemical science disappear.

A charlatan might deceive or deny, but those words would only find a home in the mind of those wilfully denying a reality clearly understood by a child.

I understand relocating the allocation of houses to another site will be a blow to the RLDP team and will be a headache they do not want. Let me advise. That headache is trivial by comparison to my wife and I watching a literal huge hole appear in our dream retirement project and rubbing salt in our wounds, we as the landowners are responsible for making the sink hole safe even from those who would trespass on our land. We must pay for and maintain a fence around the hole for the perpetuity. Now that headache has been thrown at us by a builder who months after he had started the build on the site was still casting around for a location, anywhere, where he might dispose of the rainwater from his site onto, or more correctly, under, an unsuspecting neighbour, rather than pay the costs of installing a pump system to dispose of it safely. That is a headache and thank you very much I would appreciate it not being made even worse.

9.0 Future events – site inspection

In the first instance you will want to come and inspect the sink hole to ensure Mr and Mrs Cooke are not making it all up.

I have not yet constructed the cast concrete measuring points for conducting accurate measurement for the rate of sinkage. I purchased a new cement mixer, hardcore, cement and theodolite, in 2024 but care for my 94 year old mother has deflected me from the work. I will now do it because circumstances have changed and I know you will need an accurate set of data to inform the decision.

I will cast some concrete measuring points in and around the hole and I will use my theodolite, to measure the depth as it changes over time. I have spoken to the local vicar, father Craig Vaughn, who lives in Heol Fain and he is willing to observe and measure with me and sign off as witness so that Barratt plc will have no ground for discounting my observations as "unbelievable and entirely fabricated". As with my offer to Barratt, I will welcome your attendance to observe but will have no one on our land unaccompanied, so we need to arrange dates and times in advance. You have my contact details. I look forward to your engagement.

Perhaps the Survey Team from the Welsh Office who apparently, in the mid 1950s declared the site unsuitable for development and reported that to Glamorgan County Council, could foresee the drainage problems.

The results of the soil infiltration and falling head permeability tests, extrapolated from the data obtained during the soakaway testing, are presented in Table 1.

Table 1: Soil Infiltration/Permeabilty Test Results (m/s)

Borehole	Test 1 (8.00m)	Test 2 (16.00m)	Test 3 (24.00m)	Test 4 (32.00m)
B16	4.7 x10-5	3.5 x10-5	1.5 x10-5	1.4 x10-5
B7	1.1 x10-4	Unable to calculate infiltration rate due to no fall in water level below 3.50m after 90 seconds.	7.1 x10-5	5.6 x10-5
B6	1.7 x10-5	1.2 x10-4	1.1 x10-4	7.5 x10-5
B5	1.3 x 10-4	7.5 x10-5	4.0 x 10-5	1.7 x10-5
B4	1.4 x10-3	2.1 x10-4	2.9 x10-5	2.7 x10-5
B3	6.4 x10-5	8.4 x10-5	1.7 x10-5	1.5 x10-5
B2	5.2 x 10-5	4.2 x 10-3	3.9 x 10-4	3.3 x 10-4
B1	3.9 x 10-4	6.8 x10-5	Unable to induce a head of water above 23.10m due to rapid infiltration rate (600 litres used). Test repeated with the same result.	
B8	9.6 x10-5	3.6 x10-5	3.1 x10-5	2.5 x10-5
B9	Unable to calculate an infiltration rate due to negligible fall in water level below 2.40m after 4 minutes. Water level dropped 600mm in 12 minutes. NB: Infiltration rate calculated over first 4 minutes of test (GL - 2.40m) is 2.9 x10-4.	Unable to calculate an infiltration rate due to negligible fall in water level below 2.39m after 4 minutes. Water level dropped 700mm in 12 minutes. NB: Infiltration rate calculated over first 4 minutes of test (0.80 - 2.39m) is 4.9 x10-5.	Unable to calculate an infiltration rate due to negligible fall in water level below 2.37m after 5 minutes. Water level dropped 500mm in 11 minutes. NB: Infiltration rate calculated over first 5 minutes of test (GL - 2.37m) is 3.9 x10-5.	Unable to calculate an infiltration rate due to negligible fall in water level below 2.42m after 5 minutes. Water level dropped 400mm in 11 minutes. NB: Infiltration rate calculated over first 5 minutes of test (GL - 2.42m) is 2.2 x10-4.
B10	2.2 x10-4	9.2 x10-5	2.9 x10-5	1.1 x10-5
B11	4.7 x10-5	2.0 x 10-5	1.3 x10-5	4.6 x 10-6
B12	2.3 x10-5	Unable to induce a head of water above 14.80m due to rapid infiltration rate (1000 litres used). Test repeated with the same result.		
B13	2.2 x 10-5	8.9 x10-6	4.2 x 10-5	Unable to induce a head of water above 29.10m due to rapid infiltration rate (1000 litres used). Test repeated with the same result.
B14	3.0 x10-5	2.7 x10-4	1.1 x10-4	4.2 x10-5
B15	6.14 x 10-5	1.5 x10-2 (Unable to induce ahead of water above 8.50m)	1.2 x10-2 (Unable to induce ahead of water above 13.85m)	

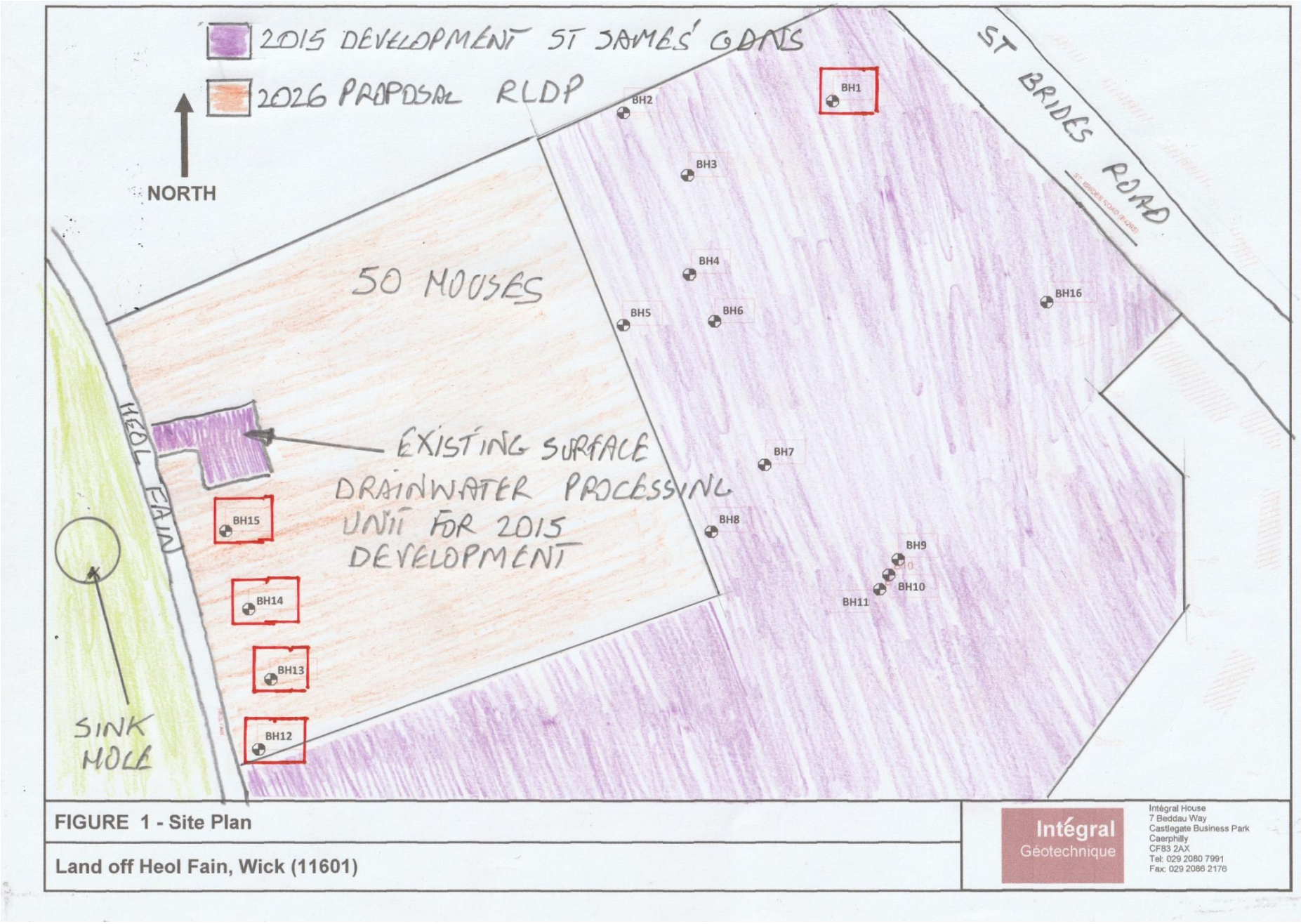

FIGURE 1 - Site Plan

Land off Heol Fain, Wick (11601)

Intégral Géotechnique

Intégral House
7 Beddau Way
Castlegate Business Park
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