Document Information				
Title	Details			
Client	Lambert Smith Hampton (LSH), acting on behalf of Hertfordshire County Council (HCC)			
Project ID	Former Hazel Grove School Playing Fields, Hatfield			
	PF Project No. E70091/VBA			
Report Ref.	RE70091G001A			
Issue Date	1 September 2017			
Limitations and Uncertainties	Pell Frischmann have prepared this report in accordance with the Statement of Limitations and Uncertainties at the end of this report. It is a project evaluation stage document and does not constitute a detailed design or specification for actual construction works.			

Introduction				
Title	Details			
Overview and Evaluation Statement	HCC are considering the redevelopment of a parcel of land comprising the playing fields and associated grounds of the former Hazel Grove School at Hatfield. In connection with the redevelopment, Pell Frischmann (PF) have been appointed to fulfil the following brief:			
Objectives	"The site is in an area where the Welwyn Hatfield website suggests there is potential for the presence of chalk mines, advice is therefore required in relation to scoping that level of risk and recommending what, if any, additional work is likely to be required associated with ground conditions".			
	The objective of this Risk Evaluation Statement is to provide the necessary advice.			
Activity Schedule	PFs agreed workscope under the commission is to:			
	1. Research published geological and former land use information.			
	2. Review available information arising from the Welwyn Hatfield & HCC chalk mines study and investigation programme.			
	3. Obtain an 'Geoinsight' environmental database search to cross reference with the above and to establish whether there are any other records of natural cavities or surface workings which might influence our advice.			
	4. Provide advice on ground investigation (and on any potential masterplanning constraints, if evident) in the form of a letter report.			
Site Location	The land parcel is located on the southeast perimeter of the urban area of Hatfield, centred on National Grid Reference TL 217 066. The general location and the land parcel boundary are shown in the map and aerial photograph below. The area edged red is hereafter referred to as ' the Site '.			
	Gogle Earth Imagery - License Number JCPMB2ZBMMAWBHP			

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Risk Evaluation Statement

Introduction (cont'd)



Background Information on the Site					
Title	Details				
Site Description	The land surface profile at the Site falls gently to the south.The existing land condition is largely managed grassland, but with bushes and trees becoming the predominant ground cover in the southern area.A former playground area exists in the northern corner.These features are shown in the images below and on the aerial photograph on the previous page.				
	Improved grassland in the northern section of the Site Area of tarmac and concrete hardstanding in the north-western section of the Site				
	The Site is bordered by fences and hedgerows. Residential properties are present beyond to the north, east and west, including the recently developed Filbert Close area which was constructed on the area of the former school buildings.				
	The southern boundary of the Site is a tree line, beyond which is a park area of grassland with areas of broadleaf woodland. These woodland areas form a continuous tree belt along the A1 which passes around 120m to the southwest of the Site boundary.				

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Background Information on the Site (cont'd)						
Title	Details					
Geo Insight report	 A Geo Insight report from Emapsite has been obtained by Pell Frischmann for use within this evaluation. The report compiles the following publicly available data of relevance: > Published geology; > Surface workings; > Mining, extraction and natural cavities; > Natural ground subsidence; and > Archive borehole records. 					
	The available information within the Geo Insight report is reviewed in the following sections:					
Published Geology	The published geology at the Site comprises Chalk (Lewes Nodular Chalk Formation and Seaford Chalk Formation - Undifferentiated). The Chalk is shown in green on the Solid Geology map extract below. The same map shows that the Site is close to a boundary with the overlying Lambeth Group strata, shown in brown. The Superficial Deposits map indicates that no drift deposits are present.					
Surface Workings	The Geo Insight report ground workings map does not indicate any workings on the site itself. It does show four areas of 'Historic Surface Ground Workings' within 250m of the Site, as well as two further database entries. The features with purple legend on the map are recorded as 'Old Chalk Pits', as revealed by early Ordnance Survey maps. The blue triangles arise from a mining/cavity dataset; all six refer to chalk pits. The closest pit to the Site, 50m approx. to the NW is referred to as 'Vixendell Chalk Pit'.					

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Background Information on the Site (cont'd)

Title	Details			
Mining, Extraction and Natural Cavities	The Mining, Extraction and Natural Cavities map in the Geo Insight report does not indicate any database records within the Site area. There is also only one data entry within 250m of the Site; a location 50m approx. to the NE has the following associated note: "Small scale underground mining may have occurred, mine adits shafts and tunnels may be present". The note does not appear to relate to any identified feature on the surface workings map.			
Natural Ground Subsidence	The Natural Ground Subsidence section of the Geo Insight report indicates that the Site is at least partially underlain by 'soluble rocks which could be prone to dissolution', but that the hazard rating is reported as 'low'.			
Archive Borehole Records	No archive exploratory hole records are identified for the Site area or in the immediate vicinity. The closest boreholes are a pair of holes on Roehyde Way around 130m to the west. Both boreholes show the presence of chalk bedrock, but the depth of the superficial deposits is very different in both; one has 7.2m thickness of overlying drift materials and the other has 2.0m thickness. The borehole record with the deeper drift falls within the pink area on the Superficial Deposits geology map (see prev. page); that area is indicated to be underlain by Glacial Sand and Gravel.			
Geo Insight Report Summary of Findings	In relation to the HCC brief for the commission, the Geo Insight report verifies that the Site is very likely to be underlain by Chalk bedrock and that there is associated development risk associated with historic chalk mining.			
	However, the important aspect that the report does reveal is that there are no publicly available records (within the datasets available to Emapsite) of actual workings, mines or cavities either within the confines of the Site itself or immediately on/or adjacent to the site boundary.			
	The main identified risk to the Site arising from the above information and which requires further consideration is the historic 'Vixendell Chalk Pit', 50m approx. to the NW.			

Specific Information on Chalk Mining					
Title	Details				
The Hatfield Chalk Mine Review	The following information is available on the Welwyn Hatfield Borough Council (WHBC) website: "Following the discovery of chalk mines in Briars Lane, Hatfield, it was agreed by WHBC and Hertfordshire County Council to undertake a study to review the possibility of chalk mining elsewhere in Hatfield.				
	the study looked at historical information and geotechnical data such as the composition of the ground and the natural landscape.				
	The study systematically pulled together data, often some of it indirect, to indicate the relative likelihood of chalk mining activity.				
	The result was a map that showed areas of evidence and a risk assessment model for council services to use. This was published in 2007.				
	The result of the study allowed us to proactively investigate areas, either to rule out the risk of any subsidence or to put in place measures to minimise any risk.				
	Following further investigation, completed in 2009, it was concluded that the initial areas identified were significantly smaller than originally thought. Some of the areas that do remain are also smaller in size.				
	We then commissioned the next phase of our investigation to gain further information. This was completed in August 2011.				
	We then commissioned the next phase of our investigation to gain further information.				
	Of the 14 areas, six were identified as 'no significant risk' and were removed from the list. Four were reduced in size but not eliminated and two were inconclusive".				
	The above work resulted in the issue of three successive versions of the risk-based Chalk Mining hazard map in 2007, 2009 and 2010. The latter is still the 'current' version. Extracts of the maps are shown overleaf:				

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Risk Evaluation Statement

Specific Information on Chalk Mining (cont'd)



The Site can be seen to have initially been within an identified risk zone.

The red areas on the plan are potential shallow mining areas with 'bell-pit' type workings (locally called 'chalkwells' or 'deneholes').

The blue areas are 'buffer zones'; these were originally delineated as archive records of chalk mining suggested that tunnels could typically lead away from bell-pit type workings for up to a max. distance of around 100m.

Following the 2009 investigation phase, the map was updated and several buffer zones were significantly reduced in size or deleted altogether.

The reduction in buffer zones arose from a conclusion that there was only limited evidence in Hatfield of chalk mining being undertalken in tunnels leading away from bell-pits. Risk areas were typically reduced to 25m radius from a recorded feature

On this 2009 map edition, the Site is shown as having no significant risk. However, the extraction risk zone remains to the NW. This accords with the historic 'Vixendell Chalk Pit' identified in the Geo Insight report.

Following the 2010 investigation phase, the map was updated again.

The closest area of extraction risk to the NW ('Vixendell Chalk Pit') was reduced in size but was still present. It is labelled on the map as *Area 19 – Hazel Grove Hotel.*

The reduction in size relates to the identification of the chalk being at shallow depth on the NE side of the former pit (where chalk was shallow, it was extracted in open pits, not in mines/tunnels).

The two other closest areas, Nos 18 and 22, are far enough away from the Site to be able to disregard them in terms of development risk.

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Specific Information on Chalk Mining (cont'd) Title Details Desk Study The following report has been referenced for information on the investigation of Area 19: Information on Investigation within Mine Areas 6, 10, 14, 16, 17, 18, 19, 22, 23, 24 and 25 across Hatfield, Area 19 Hertfordshire, Interpretative Ground Investigation Report, Hyder Consulting Report No. 0003-UA000917-GDR-01, October 2010 Area 19 was referred to by Hyder as 'Hatfield Oak Hotel (formerly Hazel Grove Hotel)'. Their desk study work determined that the area of extraction risk was centred on the car park of the hotel. Their desk study information review includes the following information of relevance to this risk evaluation: "Geological maps indicate that chalk is present at shallow depth beneath the site (ie. Area 19). There are no relevant BGS boreholes for the site but ground investigations carried out at the former Hazel Grove Primary School situated to the south-east (Ken Rush Associates, 2004) indicated 1.2m to 2.5m of stiff clay (presumed to be glacial till) over weak chalk. Probe drilling carried out around the school confirmed that no mines or other features extended beneath it from this potential mine area". Further relevant desk study information from the report follows: "Historical maps reviewed indicate that the site has been in residential use since the 1960s but was agricultural land before this time. The maps from 1880 show a depressed area in the centre of the site described as 'Vixendell' and marked as an old chalk pit. A desk study completed for the Department of Transport identifies the site as the location of a 'worked chalk pit/dene hole". Based on the desk study and walkover survey findings, the chalk mining risk associated with Area 19 was considered to be 'Moderately Low', for the following reasons: "From the geological map chalk is at very shallow depth at this location and, given that the pit appears to have been constructed on open agricultural land, there would appear no need for mining to have taken place. Furthermore no evidence of ground movements were identified". Ground Hyder recommended to WHBC that ground investigation should be carried out at Area 19. Eight probe holes were formed during summer 2010, the closest pair to the Site being WS30A and WS40. Investigation Information on Depth to the chalk was found to be very variable, as summarised in the following text extract: Area 19 1175 19 11 V/// "The top of the Upper Chalk Formation Hyder 2010 Approximate was recorded in six of the eight probe exploratory probe hole extent of risk area holes at depths of between 0.50m on the HCC map locations (in green) (WS29A) and 6.75m (WS31) and was proven to the maximum depth probed of 8.00m. The chalk was found to be 1 HATFIELD OAK H shallowest beneath the northern part of **WS40** the site where the top of the chalk was recorded at a depth of only 0.50m in WS29A and 3.62m in WS32 while below the southern and western parts of the site the chalk was noted at depths of The Site 6.30m in WS30A, 6.75m in WS31 and 5.93m in WS39. At the eastern end of the site the chalk was recorded at a **WS30A** depth of 3.20m in WS40". The Chalk was found to be overlain by clayey drift materials of glacial origin. Given that the area was indicated to be a historic chalk pit, near-surface fill materials were found to be of very limited extent. Also, no deeper area of made ground was detected within the exploratory hole coverage shown above. In relation to chalk mining risk, Hyder concluded: "Based on the ground investigation findings indicating a variable depth to the top of the chalk it is unlikely that mining would have occurred off the northern and eastern sides of the former chalk pit but mining could possibly have taken place from the southern and western walls of the pit". As a result, the mining risk area was modified to the semi-circle shape above. Hyder concluded: "It would be necessary to undertake a geophysical (microgravity) survey around the southern and western margins of the former pit to determine whether any mines extend beneath the thicker glacial deposits in these areas". (No work of this nature has been progressed, to our current knowledge). Pell Frischmann P:\Data\PROJINFO\E70091 Former Hazel Grove School Playing Fields\18 Engineering\05 Geotechnical\RE70091G001A.docx

Title	Details
Risk Evaluation Conclusions	In relation to the proposed development at the Site, the key conclusions of this Chalk Mining Risk Evaluation are summarised as follows.
	Available geological information suggests that the full Site area is underlain by Chalk, so the risk evaluation process is justified and required.
	We advise that risk evaluation should also cover the risk associated with natural cavities.
	In this particular case, the following factors act to reduce or lower the development risk:
	There are no available records of chalk extraction pits or mines within the actual Site area and no part of the Site is within a chalk mining risk zone on the current (2010) WHBC plan.
	Probe holes formed in advance of the adjacent Filbert Close development to the NE reportedly did not detect any 'mines or other features'.
	There are no available records of natural cavities or dissolution features within the Site area. The frequency of natural cavity records within the general area is also low.
	Available data to date suggests that much of the site is likely to have a depth to top of chalk of <3.0m, which in itself significantly decreases the risk of chalk mining.
	On the basis of the above, based on current information, the risk of the proposed development of the Site being constrained by the presence of chalk mining or natural cavities is considered to be ' Low '.
	As such, we confirm that there are no location-specific chalk mining-related constraints in relation to site planning which need to be accounted for within the development of preliminary layouts etc.
	The development risk associated with chalk mining and/or natural cavities cannot be completely excluded at this stage as the conclusions above are only based on currently <u>known</u> information; there could still be unknowns in relation to the ground conditions in the site, as follows:
	i. There remains slight risk that early, unrecorded pits or workings could be present, for which full surface reinstatement occurred in advance of the first mapping.
	ii. There remains slight risk that workings from the Vixendell Chalk Pit extended a short distance below the western part of the Site.
	iii. There is risk that one or more unrecorded, natural dissolution features (eg. infilled pipes) exist at the Site, as there is a boundary with the overlying Tertiary strata in relatively close proximity (to the east).
Recommended Ground Investigation	A housing development of the type proposed for the Site requires a ground investigation process to be followed inform engineering design.
	In this instance, as a result of the identification of the 'Low' risk ranking for chalk mining and natural cavities, we recommend that some supplementary work should be incorporated into the ground investigation.
	The objective of the supplementary work would be to reduce the risk ranking to 'Very Low', such that the development could proceed with conventional foundation types (presuming at this stage that there is no specific Local Authority Building Control policy in that respect).
	It will be apparent from reading the previous sections that, in addition to the risk from mining and natural cavities, in this chalk terrain there is also a foundation design risk from backfilled surface workings and shallow pits. This risk will also need to be addressed by the ground investigation.
	To address the chalk-specific risks, our recommendation in this respect is that the exploratory hole coverage for the Site should be approximately x2 to x3 the scope of that which might normally be employed on a non-chalk site and that it should include a combination of both 3.5m deep trial pits and 6.0m deep dynamic sample probe holes. A higher density of exploratory holes should also be implemented in the western area of the Site.
	It should be borne in mind that further, more specialist, ground investigation work could be required if any chalk mining or dissolution features are revealed by the ground investigation work.

Conclusions and Recommendations with Respect to Chalk Mining Risk at the Site

Conclusions and Recommendations with Respect to Chalk Mining Risk at the Site (cont'd)

Title	Details
Potential for Infiltration Drainage in this Geological Terrain	In view of the general chalk-related risks set out above, the use of infiltration drainage within the confines of the Site area is not recommended.
	Within this geological terrain, we advise that infiltration drainage should only be considered as being potentially feasible within open space or landscape areas which are well away from any dwellings, gardens, roadways or services. Any such installation would also need to be in accordance with any specific Local Authority Building Control policy.

Pell Frischmann Revision Record

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Rev	Description	Date	Originator	Checked	Approved
А	Initial Issue	01/09/17	SW	AC	SW

Statement of Limitations & Uncertainties:

This report/datasheet has been prepared by Pell Frischmann with reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client in accordance to the agreed scope of services.

The report is based on a review of the available 'Information' which is scheduled herein. The 'Information' comprises publically available information from third parties, information provided by the client and any data collected through our fieldwork activities. The Information reviewed has been accepted in good faith as providing true and representative data with respect to site conditions. Should additional Information become available that may influence the opinions expressed in this report, Pell Frischmann reserves the right to review such Information and, if warranted, to alter the opinions expressed in the report accordingly.

This report has been prepared solely for the use of Hertfordshire County Council and their direct agents and may not be relied upon by other parties without written consent from Pell Frischmann. Pell Frischmann disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.