TFAG.PeterBoros

From: TFAG.PeterBoros <TFAG.PeterBoros@BTinternet.com>
Sent: 10 February 2021 16:58
To: 'Bowerman, Emma'
Cc: 'Clerk'
Subject: Objections to P20/S2808/DIS
Attachments: 2020s1712 - Thames Farm, Shiplake - Hydrogeological review FINAL.pdf

Importance: High

Emma,

The Parish Council with TFAG's assistance has commissioned a report from JBA on the Taylor Wimpey proposals and to comment upon any FRA that is produced.
In preparing for this exercise, they have been reviewing the available documents on the portal and in particular the hydrogeological data that is currently available
and has been underpinning some of the drainage strategy design work.

I attach herewith their interim report just issued, which simply focusses on the adequacy and implications of the available hydrogeological data/reports.
The report raises several material issues for consideration by both SODC and other statutory consultees such as EA, Thames Water and OCC as Lead Local Flood Authority.
The report highlights the most recent HIA produced by Taylor Wimpey fails to take account of the latest drainage proposals and therefore requires revision and re-submission.

- I would be obliged if this note and the attached report could be appended to the consultation data on the portal. Technically it was commissioned by the Parish Council, so I am not sure where you wish to display it but all of the drainage consultees should also please be provided with a copy.

- You will observe that the conclusions of the report are that more much more survey work needs to be undertaken in order to have a much better 3 dimensional understanding of the structure of the ground and the dissolution that has occurred before any firm plans can be made.

- That the Aquifer is potentially at risk of contamination because of the depth of grouting that is likely to be needed. This is an EA issue of course

- It is recommended that before any design work is finalised the site is monitored for at least a year to understand the way in which the current flows occur on and around the site and area.

If an acceptable basis can then be found for grouting the site then the report goes on to identify the need for Ground Water monitoring before during and after execution as well as CEMP being
prepared relative to the possible creation of pathways through the strata to the aquifer by contaminants as well as identifying the impact on those matters that cannot be mitigated against viz loss
of recharge to the aquifer, other wider scale restrictions on land use and the reduction in site storage characteristics for the aquifer as well as the high incidence of saturation of the ground
and consequences thereof.

Please confirm safe receipt/when the documents are on the portal.

Best regards,
Peter Boros

TECHNICAL NOTE

JBA Project Code	2020s1712
Contract	Review of Drainage Strategy for Thames Farm, Shiplake
Client	Shiplake Parish Council
Date	January 2021
Author	Brendon McFadden
Reviewer / Sign-off	Susan Wagstaff
Subject	Hydrogeological review of drainage proposal

1 Introduction

1.1 Background

JBA consulting have been commissioned by Shiplake Parish Council to complete a hydrogeological review of the proposed planning application Ref P20/S2808/DIS under consultation for a housing development at Thames Farm, Shiplake (see Figure 1-1), focusing on elements of the scheme that could affect groundwater and groundwater dependent receptors.

The Thames Farm site at Reading Road, Lower Shiplake, obtained planning permission (P16/SO970/O) in 2017 for up to 95 homes on a 5.6Ha site. The developer had originally proposed to drain the site to soakaways, however subsequent ground investigations have identified that the site has a large number of sub-surface voids formed by dissolution of the underlying Chalk bedrock. Consequently, the developer is now proposing to grout and vibro-compact the site in order to stabilise it for construction. Concerned that shallow soakaways will wash material from the voids and increase the risk of collapse and prevented from using deep borehole soakaways as the site is in Source Protection Zone 1 (SPZ 1), the surface water strategy has been amended to exclude any infiltration methods.

Approval was given on planning ref P16/SO970/O with various conditions, including condition 11 which states; No development shall commence until a drainage strategy, detailing all on and off-site surface and foul drainage works, has been submitted to and approved in writing by the local planning authority. No discharge of foul or surface water from the site shall occur before the drainage strategy has been completed and brought into use.

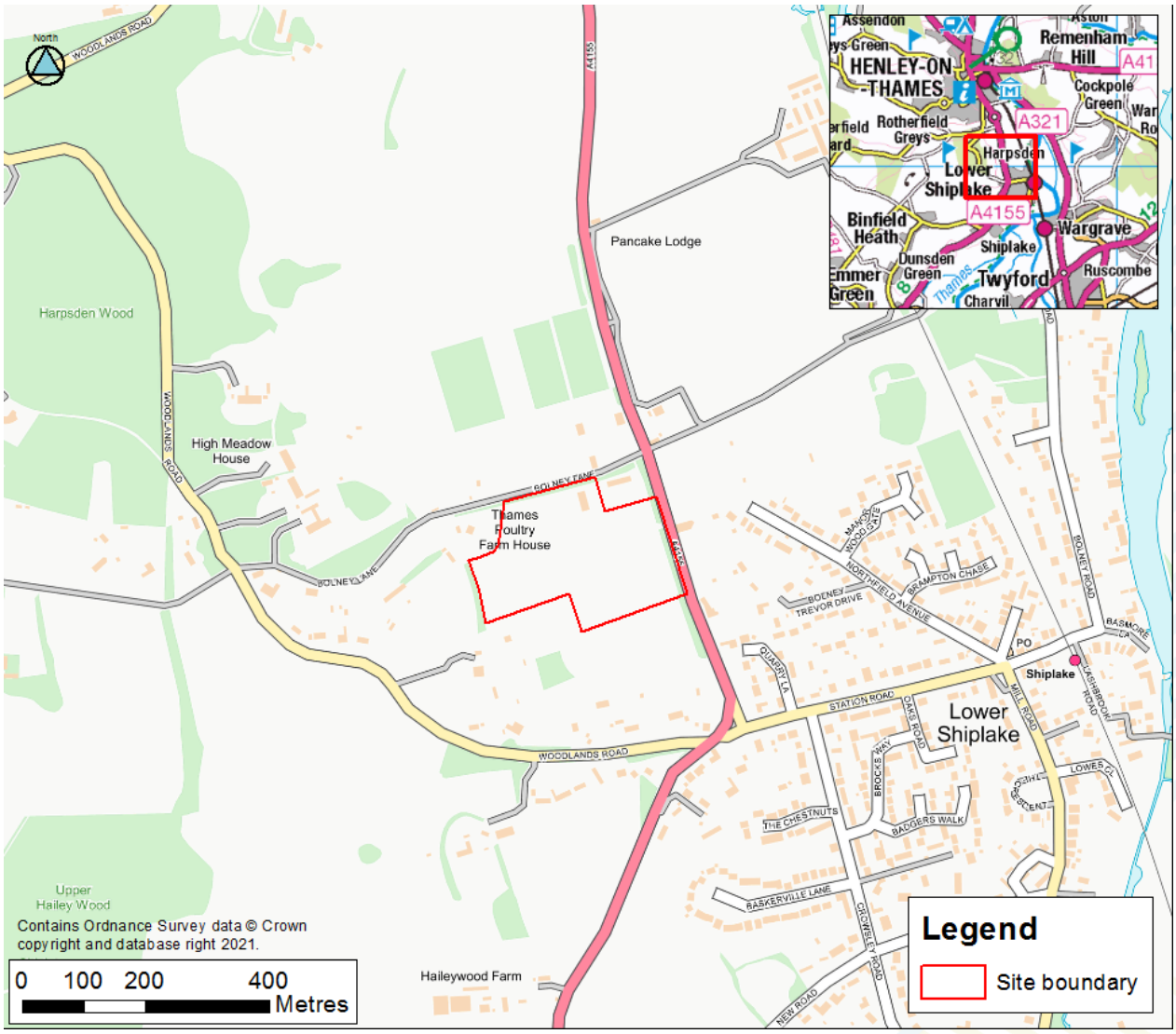
As part of the discharge condition 11 (P20/S0715/DIS) which required a drainage strategy to be submitted, a Hydrogeological Impact Assessment was completed by H Fraser Consulting (April, 2020). This assessment refers to the use of deep soakaway boreholes from a previous drainage plan (ALP, April 2020), and no update to this HIA has been made available for the new drainage plan (ALP, Oct 2020). This report therefore considers the original HIA, and whether it is sufficient, detailing the site constraints, findings of the HIA and potential hydrogeological impacts to consider. The original discharge of condition 11 (P20/S0715/DIS) was withdrawn, due to objections from Thames Water and the Environment Agency regarding the use of deep soakaways within an SPZ 1 an unacceptable risk. This review therefore considers the current information on the site, including the existing HIA (HFC, 2020), in regard to the updated drainage scheme proposal, and any further considerations that should be made.

1.1.1 Current drainage scheme proposal

The current drainage scheme proposal is detailed in Thames Farm, Shiplake Drainage Statement (ALP, Oct 2020) under consultation (P20/S2808/DIS). Due to the identified constraints relating to ground conditions and location within an SPZ 1 (discussed further in Section 1.2), shallow and deep soakaway drainage strategies are excluded, with no infiltration features proposed.

In summary it is proposed that surface water will be collected in on-site attenuation features, and directed through to an off-site main/sewer connection that will travel along approximately 2km of pipework to Lash Brook (a tributary of the River Thames) 1km south-east of the site. Further details and drawings are given in the Drainage Statement.

Figure 1-1 - Site location



1.2 The Scheme and Constraints

The sections below outline the main elements of the scheme and constraints that are the subject of this review.

1.2.1 Ground condition constraints

A ground investigation and Ground Stability Assessment was carried out by Peter Brett Associates (Nov, 2019). They identified deep seated disturbed ground across the site associated with karstic solution voids within the underlying Chalk, and shallow weak/disturbed ground.

It was therefore recommended that ground stabilisation works are carried out across the site prior to the construction of foundations, using a technique such as compaction grouting to stabilise deep seated disturbance (Chalk voids) and a potential secondary phase of dynamic grouting or replacement of shallow disturbed ground. The grouting treatment process compacts the ground by injecting a viscous sand, cement, PFA and bentonite grout mixture under high pressure to locally consolidate the ground surrounding the point of injection.

1.2.2 Groundwater abstraction and Source Protection Zones (SPZs)

The proposed development site is located over a Chalk aquifer, within SPZ 1 of a Thames Water public water supply (Harpsden PWS). The abstraction is licenced for around 13 Ml/d average and 18 Ml/d peak, with peak daily output of 14.8Ml/d in 2018/19.

The Environment Agency defines Source Protection Zones (SPZs) around groundwater sources - such as wells, boreholes and springs - that are used for public drinking water supply. Within these zones, potentially polluting activities are strictly controlled. Three zones are defined around each source (Environment Agency 2013; Environment Agency website):

- Zone 1: Inner protection zone: The area from which pollution could reach the source within 50 days (minimum 50 m radius).
- Zone 2: Outer protection zone: The area from which pollution could reach the source within 400 days. This zone now has a minimum radius of 250m or 500m around the source, depending upon the size of the abstraction.
- Zone 3: Total catchment: The total area from which groundwater flows to the well, borehole or spring.

Moving from Zone 3 (outermost) to Zone 1 (innermost), the degree of restriction placed on potentially polluting activities increases. The development site is located within SPZ1.

The policies associated with SPZs are set out in 'The Environment Agency's approach to groundwater protection' (EA, 2018). Within the context of the proposed development the following EA Position Statements are considered relevant:

- G4 - Inside SPZ1 we will object to any new trade effluent, storm overflow from sewer system or other significantly contaminated discharges to ground where the

risk is high and cannot be adequately mitigated. If necessary, we will use a prohibition notice to stop any such existing discharge.

- G12 - The discharge of clean roof water to ground is acceptable both within and outside SPZ1 provided that all roof water down-pipes are sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. The method of discharge must not create new pathways for pollutants to groundwater or mobilise contaminants already in the ground.
- G13 - Where infiltration SuDS are proposed for anything other than clean roof drainage (see G12) in a SPZ1, a hydrogeological impact assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply.
- N8 - Within SPZ1, the Environment Agency will normally object in principle to any planning application for a development that may physically disturb an aquifer.

Due to the site location within a Thames Water abstraction borehole SPZ1 area the use of deep bore soakaways was rejected by Thames Water and the Environment Agency, who stated that the close proximity to the nearby groundwater abstraction station and underlying aquifer introduced an unacceptable risk which could not be overcome within the constraints of the approved Site Layout or within the overall scheme viability.

1.2.3 Proposed drainage scheme

The latest proposed drainage scheme is detailed in Thames Farm, Shiplake Drainage Statement (ALP, Oct 2020). Due to the identified constraints relating to ground conditions and location within an SPZ1, shallow and deep soakaway drainage strategies have now been excluded, with no infiltration features proposed.

The current proposal is that surface water will be collected in on-site attenuation features and directed through to off-site main/sewer connection to Lash Brook (a tributary of the River Thames) 1km south-east of the site. Further details and drawings are given in the Drainage Statement.

2 Site ground conditions

A summary of the ground conditions at the site is described below, based on the following investigation reports;

- Geotechnical Investigation - Terramech (2018-2019)
- Phase 1 Ground Stability Assessment - Peter Brett Associates LLP (2019)

2.1 Geology

With reference to online resources (www.bgs.ac.uk), and the British Geological Survey (2000) Reading, Solid and Drift, 1:50,000 (Sheet 268), the published geology suggests that much of the eastern section of the site comprises Quaternary age Taplow Gravel Member (sand and gravel), overlying Cretaceous Chalk Group strata of the Seaford and Newhaven Chalk Formations (undifferentiated). Towards the west of the site, the Taplow Gravels appear to feather out; exposing the chalk. Within the south western corner of the site, a wedge of Head Deposits (gravel, sand, silt and clay) are identified.

With reference to the previous ground investigations undertaken by Terramech, boreholes have confirmed a ground model comprising a thin mantle of topsoil across the site ranging from 0.2 to 0.35 m in thickness, above the Taplow Gravel Member and Head Deposits, all overlying the Chalk Group. The chalk surface was encountered at about 6.2 mbgl (metres below ground level) on the western side of the site, and 4.2 mbgl at the eastern side of the site. Made Ground was not encountered at any of the exploratory hole locations across the site.

2.1.1 Cavity assessment (PBA, 2019)

Approximately 550 dynamic probe locations were completed across the site, with 87 locations recording slightly disturbed/disturbed ground profiles. These profiles tend to display reduced levels of strength in the ground from surface level, with significant depths of weak ground and possible voiding to varying depths up to 16mbgl.

Where disturbed ground has been identified, many of the locations are peripherally surrounded by profiles that exhibit relaxed or slightly relaxed ground that has been affected by the karstic processes.

2.2 Hydrogeology

The Chalk bedrock underlying the site is a Principal Aquifer, in an area with medium to high groundwater vulnerability. The gravels underlying the site have a Secondary A or minor aquifer status. Groundwater flow in the Chalk aquifer is primarily by secondary permeability, such as fractures or fissures, rather than through primary matrix porosity.

Groundwater levels within the underlying Chalk aquifer were 12-22mbgl in two Terramech boreholes drilled on site (March, 2019). The groundwater level has implications for the hazards posed by natural and mining cavities (PBA, 2019).

3 Review of Available Information

3.1 Hydrogeological impact assessment for proposed development works near Harpsden Water Treatment Works (H Fraser Consulting, April 2020)

A hydrogeological impact assessment was completed for the site in April 2020 under an application to discharge condition 11 (P20/S0715/DIS). This HIA is written for a previous drainage proposal (ALP, April 2020), which included deep soakaway boreholes.

In this HIA (HFC, 2020), the effects of the grouting operation on the PWS are thought to be low as:

- The grouting will be above the water table.
- The grout is a stiff grout that does not flow horizontally under its own weight.
- The depth of grouting is largely above the base of the solid casing of the PWS boreholes.
- There will be operational controls to monitor grout takes and pressure, hence unexpected loss of grout will result in cessation of operations and assessment.

The effects on the PWS due to changing recharge across the developed site are thought to be negligible because:

- Recharge across the site is less than 0.5% of the abstraction at the PWS.
- If recharge were to be removed from the site, the maximum impact on drawdown is thought to be 0.03 m. This is not considered to be a significant impact.
- Recharge is in fact thought likely to increase due to reduction in volumes lost to run-off, evapotranspiration and soil moisture deficit.
- Recharge under the developed scenario may be quicker, although it will be attenuated through the storm water collection and attenuation system, however the recharge volumes are not sufficiently large for a change in timing to have a deleterious effect on the PWS abstraction.
- Given the relatively low volumes of recharge, the effect of changing the spatial distribution of recharge over the site is not thought to be significant.
- The quality of the surface water collected is anticipated to be good. It is understood that there are proposals to further govern the quality of the injection water via reedbeds/attenuation infrastructure, and that water quality is not a concern. This aspect has not been further assessed.

It is noted that the report does not used the most up to date SPZ mapping (see latest SPZ outlines in Figure 4-1).

The hydrogeological considerations for an updated HIA are discussed in Section 4.

3.2 Risk Assessment for Drilling & Grouting Works near Thames Water Main Supply (Vertase, March 2020)

Vertase produced a risk assessment for Drilling & Grouting Works near Thames Water Main Supply (submitted in March 2020 for P20/SO715/DIS) which state that "where groundwater conditions allow the ground treatment will be undertaken to a typical maximum depth of 15m below ground level. Where the water table is confirmed at a shallower depth, then treatment will be restricted to finish in the ground immediately above the water table".

4 Hydrogeological impact considerations

The current application is not supported by a hydrogeological impact assessment that takes into consideration the updated drainage strategy. The section below provides an outline assessment of the potential impacts of proposed grouting and surface drainage schemes that should be considered, and any potential gaps in the current HIA. This is not a comprehensive assessment but outlines areas of concern that should be addressed in an updated HIA.

4.1 General considerations for the HIA

The HIA needs to include a good spatial and 3D understanding of the hydrogeological setting of the site and surrounding area, which would be improved with the following inclusions.

- Mapping:
  - Geology: BGS mapped geology (including any faults or structural features, fracture directions/bedding plane orientation) and also the geology encountered on site with the probing (and any differences).
  - Hydrogeology: including aquifers, depth to water, SPZs, surface water. Actual distance of the boreholes to the site (unless actual location of boreholes is confidential). It would be useful to know how close the grouting is to the actual borehole - is it clearly within fissure / fracture location. Could use observation borehole locations. Consideration of the typical fracture length in the Chalk and proximity to the PWS.
- A conceptual model of the site including:
  - PWS boreholes and key depths - base of casing, screen depths. Depths of known flow.
  - Depth of Chalk rock head, superficial horizons and any bedding plan horizons (may be level of preferential flow).
  - Depth of groundwater levels and degree of seasonality and uncertainty in this.
  - Level of nearby surface waters, e.g., pond, streams, river etc.
  - Depth of unstable/ground improvement ground - i.e., maximum depth of proposed grouting or areas where the grout may migrate to through voids.

This should pull together all the information spatially and demonstrate how this works to protect the PWS and to clearly demonstrate any level of risk to the PWS.

The original HIA (HFC, 2020) report includes location of observation boreholes - if long term data is available from the EA for any of these this should be included in any new HIA update if available (e.g., Shiplake OBH, Engbers OBH, Kilnpits OBH).

4.2 Loss of aquifer storage

The grouting of voids within the Chalk aquifer underlying the site will lead to a potential decrease in the overall potential storage of the aquifer. This is against EA Policy N8, where the EA will normally object in principle to any planning application for a development that may physically disturb an aquifer.

Groundwater levels were taken at two boreholes drilled at the site, approximately 12 and 22 mbgl. As disturbed ground was found up to 16mbgl there is potential that grouting could be required below the water table, removing this potential storage. It was noted that groundwater levels could vary significantly from those observed during the ground investigation and the range of potential variation has not been defined by ongoing monitoring via installed observation wells (Terramech, 2019).

The current HIA states that the effect of grouting is low risk in part due to grouting being above the water table. However, the ground investigation data suggests that disturbed ground/voids may be located beneath the water table. If this is the case it would suggest that any grouting operation would result in grouting within the aquifer. More detailed monitoring of seasonal groundwater levels relative to the known disturbed ground depths should be established to demonstrate that grouting would not be required to go below the maximum water table depth. If grouting occurs below the water table, there may be additional impacts on water quality (for instance fly ash has a very high pH) and potential for additional migration of the grout.

4.3 Potential contamination of groundwater

The grouting mixture may contain a proportion of fly ash (power station ash) as a cheap filler to reduce the cost of the concrete. This may have a detrimental impact on the water environment due to very high pH. Some confirmation may be required by the Environment Agency to demonstrate that there will be no risk to groundwater (ALP Drainage Statement, Oct 2020).

The SODC emerging Local Plan[1] includes the following policies regarding new developments;

- Policy ENV11: Pollution - Impact from Existing and/ or Previous Land Uses on New Development (Potential Receptors of Pollution)
    - *Development proposals should be appropriate to their location and should be designed to ensure that the occupiers of a new development will not be subject to individual and/or cumulative adverse effect(s) of pollution. Proposals will need to avoid or provide details of proposed mitigation methods to protect occupiers of a new development from the adverse impact(s) of pollution*.
- Policy ENV12: Pollution - Impact of Development on Human Health, the Natural Environment and/or Local Amenity (Potential Sources of Pollution)
    - *Development proposals should be located in sustainable locations and should be designed to ensure that they will not result in significant adverse impacts on human health, the natural environment and/or the amenity of neighbouring uses.*

Due to the removal of any soakaway element within the new drainage strategy it is likely that there will be a reduced risk of groundwater pollution from surface run-off. The current HIA assumes that grouting is low risk due to only effecting the unsaturated zone above the aquifer, however, as discussed above it is not clear from ground investigation data that disturbed ground does not extend below the watertable.

1 https://www.southoxon.gov.uk/wp-content/uploads/sites/2/2020/12/SODC-LP2035-Non-Track-Change-Version-November-2020.pdf

Therefore, an updated HIA should demonstrate that the grouting works will not pose a pollution risk to the Chalk aquifer, including additional monitoring and analysis of groundwater levels to demonstrate that grouting is not required below the water table.

The composition of any leachate from the grout material should be specified within the HIA and whether this could impact upon the aquifer water quality arriving at the PWS. The findings of this assessment should then be adopted into the Construction and Environmental Management Plan for the development.

4.4 Loss of aquifer recharge

The proposed drainage scheme is such that water that would have previously infiltrated to ground is diverted to surface water attenuation storage and then a surface water course (Lash Brook) a significant distance from the area of the site (1km south-east of the site). The site is currently estimated to be 98% permeable (ALP, Oct 2020), with the Chalk aquifer overlain by highly permeable sand and gravel. This permeability would be largely negated across the proposed site, with surface water infiltration reduced significantly with proposed impermeable surfacing, sub-surface grouting and surface water capture and export via mains/sewer.

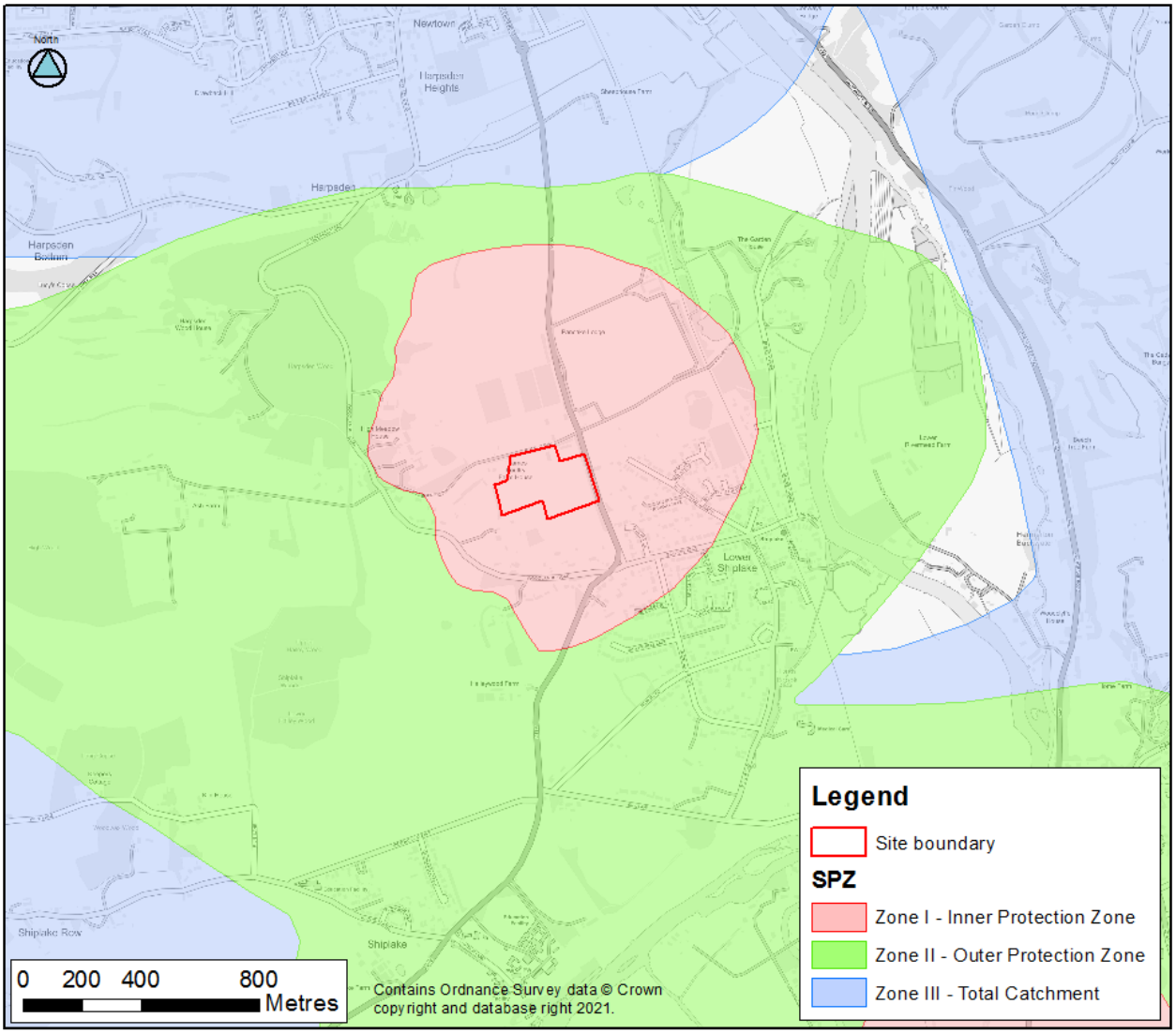
The grouting of voids within the Chalk, and shallow disturbed ground underlying the site will lead to a decrease in the overall permeability of the ground above and including the aquifer. This will result in a significant decrease in infiltration of water directly from the ground surface (i.e. due to rainfall infiltration) to the underlying groundwater table.

The catchment required to support the borehole will increase due to this loss of infiltration across the site, which is sited in the SPZ 1 for the Thames Water PWS. This will mean a larger area would be within the 50-day travel time covered by the SPZ 1. The SPZ 1 would need to be redrawn, bringing new areas into SPZ 1. This would have two potential impacts:

- Increase the likelihood of the borehole being affected by pollution incidents,
- Put new SPZ 1 restrictions on the uses of parcels of land formally not subject to them, reducing their potential utility. This also relates to Policy ENV12 detailed above, which states that there should not be significant adverse impacts on the amenity of neighbouring uses. The SPZ 1 area is approximately 1,280,000 m² while the site footprint is 57,300 m² (see Figure 4-1), which is approximately 4.5% of the SPZ 1 area.

The current HIA (including deep borehole soakaways) assumes that recharge to the PWS would likely increase and be quicker with the proposed development. However, as the newly proposed drainage plan excludes all infiltration mechanisms it would be necessary to reassess the potential effect of removing nearly all recharge across the site, and alteration of the SPZ 1, in an updated HIA.

Figure 4-1 - Site footprint in relation to groundwater abstraction borehole SPZ



5 Conclusion

Based on this review of the current drainage proposal, existing site data and Hydrogeological Impact Assessment the following points are made;

- An updated Hydrogeological Impact Assessment would be needed for the proposed grouting and updated drainage scheme, with approval from EA and Thames Water. The impact assessment should show that there is no significant impact on the underlying aquifer and nearby abstraction borehole, both in terms of water levels, flows and water quality. The HIA should include a hydrogeological conceptual model of the site, which needs to confirm that the PWS borehole doesn't take its water from a part of the aquifer which may be grouted up (such as enhanced permeability of the near surface Chalk).
- It is recommended that borehole groundwater monitoring is carried out across the site for at least 12-months prior to development to assess the groundwater table variability across the area. Additionally, any long-term local observation borehole data available (e.g. from the Environment Agency) should also be included in the assessment and any surface water levels (such as the nearby pond). Current risk assessments assume that grouting will be entirely above the water table of the aquifer, however, it is unclear from current ground investigation data whether this is the case across the site. Detailed groundwater levels should then be compared to the existing extensive ground stability depth mapping across the site to establish relative depths to groundwater ranges. The data should be presented in a comprehensive hydrogeological conceptual model including maps and cross sections to demonstrate the spatial location and potential interaction (or reasons for no interaction) of the proposed grouting and the PWS boreholes.
- Groundwater monitoring should be carried out before, during and after construction to assess any on-going impacts to local groundwater following grouting works. Monitoring would include measurement of long-term groundwater levels and chemical quality. Chemical analysis suite would be appropriate to demonstrate that the grouting mixture has not had a detrimental impact on aquifer quality (water quality records may be available for the PWS).
- A Construction Environmental Management Plan (CEMP) should be developed detailing measures to avoid creation of potential migration pathways into the underlying aquifer or increasing pollution risk. This should include measures to prevent creation of new contamination pathways by piling or excavating through the full thickness of superficial deposits to the Chalk; a detailed grouting scheme that ensures grouting does not extended below the water table, and measures to prevent accidental fuel spillages during construction; and measures to control generation of silt laden run-off during site works. Proposals for wet working or not working during periods of high rainfall (and hence high infiltration to the ground) should be considered and the risk of associated contamination assessed.

Regardless of mitigations measure put in place, the scheme cannot mitigate against the increase in the catchment of the borehole due to loss of recharge to the aquifer across the site. This will increase the vulnerability to pollution of the aquifer/PWS and could put additional restrictions on nearby land that is then captured in the extended SPZ 1.

The changes to the top of the Chalk and superficial aquifers in terms of reduction in voids and associated reduction in storage and permeability are also inherent in the grouting scheme. These cannot be mitigated. Although if the grouting scheme is never below the water table these impacts may be minimal. However, if the water table ever rises to the elevation of the grouted aquifer then the aquifer will respond in a very different manner to as at present. Once the water table is within the lower permeability, lower storage, grouted material then this ground may become saturated fairly rapidly and not allow rapid flow of groundwater as at present.

6 References

H Fraser Consulting (HFC, 2020) Hydrogeological impact assessment for proposed development works near Harpsden Water Treatment Works.

Abley Letchford Partnership (ALP, April 2020) Thames Farm, Shiplake - Drainage Statement.

Abley Letchford Partnership (ALP, Oct 2020) Thames Farm, Shiplake - Drainage Statement.