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Ref: 10-423-L6
Date: 6th May 2020

Russell Homes
13 Westpoint Enterprise Park
Clarence Avenue
Trafford Park
Manchester
M17 1QS

BY Email

Dear Sirs,

DECOMMISSIONING OF FORMER GROUNDWATER EXTRACTION BOREHOLE - LAND OFF NEW STREET, LITTLEBOROUGH, LANCASHIRE, OL15 8LX

BACKGROUND

E3P has been instructed by Russell Homes Manchester following a request from local residents and councillors to investigate and prepare an assessment of the geological and hydrogeological conditions and to examine the viability of decommissioning the former groundwater extraction borehole SD91N5 (known as the artesian well) which remains in-situ at a parcel of land off New Street in Littleborough, Lancashire, OL15 8LX.

E3P prepared an initial draft of this letter report in January 2020 (ref: 10-432-L6), subsequent to the issuing of this document Russells have received pertinent comments from the planning authority at Rochdale MBC. For clarity and ease of reference, E3P has updated the January 2020 letter to include further narrative to clarify a number of issues raised.

The work is required as part of the redevelopment of the site for low rise residential housing with associated highways, infrastructure and landscaped areas.

Currently the borehole is observed to be under variable sub-artesian to artesian state with a constant, albeit reasonable low maintained outflow. The former headworks, internal steel extraction pump and small dimeter casing (150mm) have been removed.

On-site observations confirmed near surface diameter of the steel casing with concrete grout at 600mm to remain reducing to 0.53m at a depth in excess of 30m. The borehole appears to be blocked at ~36m bgl which cannot be dipped any further.

The EA guidance note 'Good Practice for Decommissioning Redundant Boreholes & Wells' 2012 requires that boreholes be dealt with appropriately to ensure they are safe and secure.

The guidance note makes particular reference to 'artesian' boreholes where the confined aquifer at depth is at sufficient pressure to cause water to discharge either at the surface or over another shallower aquifer as being particularly problematic in terms of risk to the wider environs. The EA state that special attention to such boreholes is required to prevent uncontrolled discharge or cross contamination.

In this instance, borehole SD91N5 is under artesian conditions, therefore in accordance with the EA guidance note, special consideration is warranted to try and limit the egress of groundwater from this feature.

The EA categorically state that a landowner is responsible for ensuing that redundant boreholes and made both safe and structurally stable and are backfilled to prevent both pollution of groundwater and the flow of water between different aquifer units.

In this instance, the guidance is clear in its requirement that every effort should be made to seal borehole SD91N5 to remove the preferential contaminant migration pathway, limit the egress of groundwater and decommission this historical industrial feature.

This hydrogeological assessment will also consider the conditions of the confined aquifer in which the borehole is sealed to confirm that sealing of the feature will pose no increased groundwater flood risk within the catchment.

The location of the borehole in relation to the site and the proposed future development can be seen in Figure 1.1.

FIGURE 1.1 – LOCATION OF GROUNDWATER EXTRACTION BOREHOLE

GEOLOGICAL AND HYDROLOGICAL OVERVIEW

Records held by the British Geological Society (BGS) indicate that the extraction borehole (BSG ref: SD91NW5) was constructed by John Thom Ltd. between June and November 1936 on behalf of The Lancashire Tanning Company to extract groundwater.

Records confirm that the borehole was drilled using 600mm casing from ground level reducing to 530mm at 32m before competent bedrock in the form of SHALE onto SANDSTONE was encountered from approximately 46.3m bgl. Rock coring was advanced into the bedrock to the base of the borehole at 83.50m.

The extraction borehole construction records (attached to this report) confirm the permanent casing was installed to a maximum depth of 51.20m with the perforated section at 46.30m for groundwater in the sandstone bedrock aquifer. The borehole was sealed with 'sealing ring' at 46m and cemented steel casing to the surface headworks.

The borehole is currently a flowing artesian well which has created a stream which runs partially down the site. These conditions have been created due to the surrounding topography and underlying geology and hydrogeology at the site. The borehole was drilled as an artesian well specifically to target the confined aquifer in the sandstone bedrock, creating a conduit to the surface allowing groundwater outflow to the former tannery.

The borehole meets ground level at ~142-91m AOD with the River Roch at ~134.5m AOD. Groundwater from the artesian well is extracted from a confined aquifer in the sandstone at a depth in the region of 96.60m AOD, his aquifer is at least 37.90m beneath the River Roch and is confined by the clay aquitard and non aquifer within the mudstone siltstone and shales, therefore the aquifer is confined and is not forming base flow to the Roch. The grouting of the borehole will restore natural conditions within the aquifer, however there is no potential for any increased surface water flood risk during periods of peak flow.

It is understood that the borehole was drilled into inclined bedrock at the valley floor with the land rising upwards inducing a significant hydrological pressure. The 'response zone' of the extraction well, where water can enter the borehole, is located within the confined aquifer where the hydrological pressure is sufficient enough to force water out at ground level without the need for pumping, thus the flowing artesian well is formed.

A detailed cross-section showing the geological and hydrogeological conditions in relation to the extraction well and the surrounding area can be seen in drawing Ref: 10-423-008.

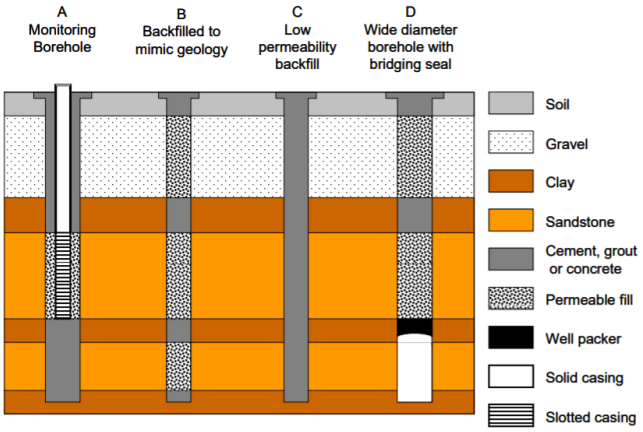
DECOMMISSIONING OF GROUNDWATER EXTRACTION BOREHOLE

The groundwater extraction borehole is an anthropogenic industrial feature that poses a risk to the aquifer in terms of a conduit from pollution arising from future site activities such as motor vehicle fuel leakage, pollutant entering the near surface superficial aquifer. In this instance the artesian outflow also contravenes the EA guidance in terms of allowing outflow of waters and overland flow of a water body originating from an confined aquifer.

It is recommended that the borehole be decommissioned to remove the risk of pollution to controlled waters in accordance with the EA recommendations. In addition, the decommissioning of the well has been asked to be looked at by local residents and councillors in order to try and reduce or better the current flood risk situation.

In accordance with the Environment Agency (EA) guidelines for the 'Good practice for decommissioning redundant boreholes and wells', redundant boreholes and wells must be dealt with appropriately to make them safe and secure, and also to ensure they don't cause groundwater pollution or loss of water supplies.

FIGURE 1.2 – SCHEMATIC OPTIONS (B–D) FOR DECOMMISSIONG OF WELLS AND BOREHOLES



E3P propose to decommission the borehole in accordance with option C in Figure 1.2, along with the installation of an inflatable plug to be inserted to prevent the flow of water up the borehole. This has been assessed as providing the most comprehensive solution to stop the artesian flow and therefore reducing the risk of surface water flooding. It has also been judged the best solution to ensure geotechnical stability and to prevent potential future contamination of the groundwater, by removing the preferential pathway for surface contaminants to reach the underlying aquifer.

The borehole is installed with 600mm (reducing to 530mm dimeter) steel casing to a depth in excess of 40m, this casing is sealed with a concrete surround. If is not considered feasible to remove this casing due to the age (over 90 years old), it is therefore proposed to deal the borehole at the deepest possible depth using a pressurised inflatable packer to stop the initial outflow. Once the outflow is stemmed, the borehole will be grouted to ground level.

EA guidance on the decommissioning of redundant boreholes and wells outlines a 5 Step process to ensure that the process is undertaken in a safe and compliant manner. These steps are addressed below in regards to the decommissioning of the former groundwater extraction borehole a New Street, Littleborough.

Step 1 – Defining the Objectives

- The borehole currently presents a hazard in the form of an open hole that could create safety issues in regards to future site users of the proposed future development, the decommissioning of the borehole will remove this hazard.
- In its present state the borehole can act as a conduit for contamination to the groundwater, grouting of the borehole will remove this preferential pathway.
- Prevent the flow of groundwater within different aquifers and geological horizons.
- Prevent the wastage of groundwater caused by the flowing artesian borehole.

Step 2 – Removing Headworks and Casing

A steel casing pipe of 150mm in diameter which was formally used to pump groundwater is understood to be present within the borehole and will require removal along with any other infrastructure that is identified.

To confirm the depth of the borehole and the absence of any other obstructions prior to backfilling, the drill string of the rotary rig to be used for the decommissioning will be lowered into the borehole.

The concrete casing which lines the borehole is to remain in situ during its decommissioning. It is considered that the removal of the casing would result in potential collapse of the borehole walls given

the presence of granular materials in the underlying strata, this would cause a risk of subsidence at ground level and would inhibit the ability to properly decommission the borehole.

Step 3 – Backfilling

Following the dipping of the borehole with the rotary string to confirm the borehole depth, a 2.5 bar blank inflatable pipe stopper will be lowered to the base of the borehole and inflated at 2m intervals to determine the depth at which the artesian flow is coming from. Once this has been indicated by the termination of flow at ground level, the depth will be recorded and the inflatable stopper will be removed.

Clean pea gravel will then be backfilled into the hole to the depth of the identified artesian flow before the inflatable stopper is then reinserted and inflated on top of the gravel to stop the artesian flow and confine the groundwater within the contained aquifer from which it originated.

Bentonite pellets will be placed in the metre overlying the inflatable pipe stopper to provide an extra seal as a precautionary measure, while the remainder of the borehole will be backfilled by pumping grout with some gravels down the rotary drill string so that the grout enters from the base to lift the remaining water in the borehole as the grout will be of higher density than the water. Following this the remainder of the borehole will be filled with impermeable grout and all groundwater will be contained beneath the pipe stopper.

Step 4 – Sealing the Top of the Borehole

Following the backfilling of the borehole a concrete cap with a diameter of at least 1m greater than that of the borehole will be constructed by excavating to a depth of approximately 1.5m below proposed development formation level. A shuttered steel mesh and angled bars will then be fixed to the top of the borehole and 2 cubes of tremied concrete will be poured to create the cap.

It will be ensured that the cap for the borehole is at least 1m below proposed development formation levels in accordance with EA requirements.

Step 5 – Recording Details and Informing Others

Detailed records will be kept during the decommissioning process including the depth and position of each layer of backfilling and seal materials, as well as recording the type and quality of the materials themselves.

This letter report details the reasons for the need to decommission the former groundwater extraction borehole, as well as the location of the borehole. Should any further pertinent information become available these records will be updated accordingly.

During the construction of the cap for the borehole, the word “WELL” will be inscribed in the concrete so that the feature can be easily identified if it is ever uncovered in the future.

SUMMARY

The primary and overarching requirement for decommissioning of the artesian well is to ensure full compliance with the DEFRA / EA Good practice for decommissioning redundant boreholes and wells’. This document makes specific reference to artesian wells that should be sealed and grouted where possible.

It is noted that within earlier submissions a proposal was included for the retention of this feature and maintaining an overland flow through the development. At the time of the original planning application, access to the feature was not possible due to historical industrial infrastructure in the immediate area completely restricting access. It was presumed at this time that the feature could also be a spring or near surface outflow that could not be sealed and controlled in an effective manner. It was only when

full and unrestricted access could be made that the well was observed to be in tack with the only outflow originating from the artesian conditions manufactured by the installation of the well.

The artesian well is an industrial feature and a relict of prior site use, every effort should be made to restore natural conditions by sealing the well to negate environmental risk from past industrial operations and ensure betterment to the wider environs as required by the DEFRA / EA.

It is noted and fully accepted that the FRA for the site confirmed that the outflow from this feature would pose a low risk of flooding in terms of the calculated persistent outflow. However, the estimated calculated outflow from the feature could be in the region of 10,000 cubic meters per day, therefore while the risk of increased flooding was deemed to be low, there is still a volume of water entering the river catchment. The opportunity to remove this water from the surface water system not only ensures compliance with DEFRA / EA guidance, but it seeks to take the flood risk from low to none. This is clearly a betterment and therefore something we would anticipate would be welcomed by both the LLFA and the EA.

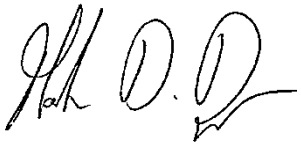
With respect to potential pollution emanating from the well, it is possible that a change in the hydrology or former mine workings known to be present at depth beneath the site is altered by one of many plausible factors, this could theoretically induce polluted mine waters into the aquifer currently discharging through the artesian well. While this is not currently a material consideration, the potential to mitigate future pollution is something that should be accepted as a material consideration and the environmental improvement accepted as required by the DEFRA and EA guidance.

The well also provides a direct conduit to the deeper aquifers, not necessarily by a pollutant entering the well directly, but more likely by a slow seepage through the surrounding annulus providing a preferential pathway to a sensitive receptor. This is one of the primary reasons for DEFRA and the EA stipulating that such industrial features should be decommissioned in the correct manner. It is noted that upon completion of the development there will be no contaminated material on-site, however the SUDS manual clearly defines the risk of pollution emanating from the built environment post development which is a material consideration.

Upon the completion of the decommissioning of the former groundwater extraction borehole, the confined aquifer that is the source of the flowing artesian borehole will be once again confined with no conduit to the surface. This will therefore reduce the risk of surface water flooding in the area as well as removing a pollutant pathway for surface contaminants to pollute the underlying aquifer.

I trust that the content of this letter is suitable for your requirements; however, should you require any additional information, please do not hesitate to contact me.

Yours sincerely,
For and on behalf of E3P Ltd



Martin Dyer
Director