

Project No: 30422
Project: Maple Cross
Document Ref: 30422TN2.4 Groundwater Framework Agreement
Version: 4.0
Date: 24/03/2020
Status: FINAL

1 INTRODUCTION

Affinity Water has objected to planning application 19/1179/FUL on the grounds that piling in the area poses a risk with regards to the following:

- Creating potential pathways between shallow gravel groundwater and deep chalk groundwater potentially allowing naturally occurring manganese present in the gravel aquifer to migrate to the chalk.
- As above, but this also applies to other hypothetical contaminants potentially present
- Turbidity during piling causing Public Water Supply groundwater sources to reach above 1 NTU¹ and shut down.
- Piling potentially blocking significant fissures hence creating a “curtain” effect. This could hypothetically cause the flow paths to change around groundwater sources, potentially causing greater drawdown for the same output.

Third parties have also objected on the grounds that dewatering during construction may affect local water features.

This document presents a summary of potential risks for each of the concerns above, along with mitigation measures that would reduce any perceived risk to acceptable levels (Section 2). These are summarised as a Framework Agreement (Section 3), and draft planning conditions are proposed to ensure that the measures will be implemented (Section 4).

It should be noted that the current land use is not licensed tip or former landfill, as suggested by Affinity Water.

2 RISKS AND MITIGATION MEASURES

2.1 Creation of pathways and manganese in groundwater

Manganese is a naturally occurring metal found in rocks and minerals. It is not considered a pollutant, but is regulated in drinking water as it can form black sediment which affects the appearance of water and can cause staining. The UK drinking water standard is 50 ug/l.

The shallow aquifer at the site is thought likely to have high naturally occurring manganese concentrations, based on observations by Affinity Water and others in the local area. There is therefore a potential for piling activities² to create pathways for transport of manganese between the shallow aquifer and the underlying Chalk aquifer.

In order to reduce the risk to water quality at Affinity Water’s public water supply (PWS), the following works are proposed:

- Characterisation of manganese concentrations in shallow groundwater at the site.

¹ Turbidity is the cloudiness, or opacity, of a fluid due to fine suspended particles. It is measured in nephelometric turbidity units (NTU).

² It is noted that the piling method and in particular depth will depend on the eventual use / structural floor loading requirements.



- DQRA³ to quantify risks to groundwater quality at the PWS⁴ from transport of manganese at the site to the Chalk Aquifer.
- Development of a Piling Method Statement to identify appropriate piling methods to address risks of manganese transport. CFA⁵ piling would deliver a safe piling solution with respect to contaminant transport to the Chalk aquifer, but displacement piling is preferable in terms of minimising impacts to the permeability of the Chalk aquifer. The DQRA will show whether transport of manganese is likely to be significant if displacement piles are used. If so, it may be that the use of displacement piles with aquifer protection measures at each pile site is an appropriate solution.
- Monitoring of manganese concentrations in groundwater in the superficial and Chalk aquifers throughout the piling programme.

2.2 Creation of pathways and contamination of the Chalk aquifer

Draft Planning Condition C8 requires that site investigation, risk assessment, remediation and verification are undertaken to protect environmental receptors. It is proposed to strengthen this planning condition to explicitly require PWS boreholes to be considered as potential receptors, and for Affinity Water to be consulted by the Local Authority in its approval of the required documents.

2.3 Turbidity in the Chalk aquifer

Turbidity is the cloudiness, or opacity, of a fluid due to fine suspended particles. It can be naturally occurring but is regulated in drinking water as turbidity can interfere with water treatment processes, and is sometimes linked with bacterial contamination. Turbidity is not regulated as a pollutant by the Environment Agency, but water suppliers must ensure that turbidity is below 1 NTU at the point of treatment.

Piling has the potential to create turbidity in groundwater. Other factors also create turbidity such as storm water run-off, mining and quarrying, and the growth of phytoplankton. The following factors reduce the risk of piling causing turbidity and affecting water quality at the PWS:

- The piles are predominantly pushed through superficial materials, putty chalk and unstructured chalk which will not have the well-developed open fractures of the structured chalk; turbidity created is less likely therefore to be entrained in the active fast flow fracture network connected to the PWS.
- The PWS boreholes are partially lined with a casing from ground surface, and the piled zone will be entirely above the base of the casing.
- The effects of turbidity creation are likely to be temporary and short lived.
- Only a fraction of the piling zone will be actively piled at any one time, and the quantity of flow through the piling zone that might be affected by turbidity is relatively small.
- The travel time from the site to the PWS boreholes may up to a year, particularly in the unstructured chalk and overlying material.
- Preliminary calculations indicate that dilution at the borehole is likely to be significant.

The following further mitigation measures are proposed:

- The timing of the piling operation can be arranged in discussion with Affinity Water to take place during a period when the PWS is not actively pumping to minimise capture of groundwater from the site. Consultation with Affinity Water can be undertaken to establish the times of high and low demand; the current expectation is that piling would only occur between 1st September to 30th April.
- The rate of piling can be regulated, to reduce the likely turbidity created at any one time by specifying the number of piles to be constructed on any one day and in different areas of the site. This can be managed through a Contractor's Method Statement.

³ Detailed Quantitative Risk Assessment

⁴ Public Water Supply

⁵ Continuous Flight Auger

- A DQRA will be undertaken to expand on the preliminary calculations already undertaken, to assess potential impacts of turbidity.
- A piling method statement will be presented, which will set out how the design will minimise turbidity, and how the operation will be carefully controlled and monitored.
- Monitoring of turbidity in groundwater in the Chalk will be undertaken throughout the piling operation to provide an early warning of turbidity.

2.4 Piling and groundwater flow

There is the potential for piles to reduce the permeability of the ground and this has been assessed below along with consideration of different piling techniques.

With displacement piling (as is envisaged), the ground is displaced to accommodate a low permeability concrete pile. With CFA piling, wet concrete is injected into the ground, with the potential for escape of concrete into fractures. This has the potential to create a barrier to groundwater flow, with concern expressed by Affinity Water that groundwater levels at the PWS might be adversely affected.

Preliminary calculations indicate that displacement piling, which is the preferred method, might result in between 0.18% and 0.45% of the PWS abstraction volume slowed down or diverted through the piled zone. This is likely to have a negligible impact on groundwater levels and flows at the PWS. CFA piling may have a greater impact depending on the methods used, but is not likely to be significant.

The following mitigation measures will be undertaken to reduce the impacts of piling on groundwater flow:

- A Piling Method Statement will be developed. This will include calculations of the likely impacts on groundwater flow of the different piling options, and an assessment of whether this is likely to be significant with respect to the PWS boreholes. It will also describe how piling will be carefully controlled and monitored to control potential effects on ground permeability.
- Monitoring of groundwater levels in the Chalk aquifer during the piling operation.

2.5 Dewatering

Dewatering has the potential to affect groundwater levels and groundwater flows in the shallow aquifer, however the effects are not likely to be significant because:

- The area to be dewatered is small (the dewatered excavation is for a SuDS drainage tank).
- The depth of dewatering is relatively shallow (c. 3.5 m bgl).
- The groundwater abstracted by dewatering can be re-injected into the aquifer to replenish groundwater levels/flows. This water would be collected and re introduced back into the ground subsequent to being processed through a proprietary 'silt buster'. Full details would be provided in a Dewatering Method Statement to be issued to Affinity Water.

In addition, the following further mitigation measures will be undertaken:

- A Dewatering Method Statement will be produced, to include an assessment of the impact of the proposed dewatering method on groundwater levels and flows.
- The preferred dewatering option is for well-point dewatering, however the use of sheet piling to reduce the lateral effects of dewatering could be considered if well-point dewatering were not acceptable.

3 FRAMEWORK AGREEMENT

The following is proposed as the basis for an undertaking by the Applicant to reduce as far as possible the effects of construction on Affinity Water's assets.

Prior to commencement, the applicant shall liaise with Affinity Water and seek their technical review and advice with regard to steps 1 to 7 below. Prior to commencement the applicant shall undertake the following, taking into consideration as far as practicable, Affinity Water's technical advice and opinion:

1. Site investigation to:
 - a. Characterise shallow groundwater quality, particularly with respect to manganese.
 - b. Characterise the distribution of other contaminants in soil and groundwater deriving from historic land use.
 - c. Characterise groundwater flow pathways.

This undertaking is to be secured by planning condition C8.

2. A monitoring programme to include:
 - a. Installation of monitoring boreholes at the site boundary in the shallow aquifer and the chalk aquifer.
 - b. Baseline characterisation of manganese, turbidity and any other contaminants of concern.
 - c. Baseline monitoring of groundwater levels.
 - d. Development of trigger levels and contingency actions to be undertaken in the event that trigger levels are exceeded.
 - e. Monitoring of the agreed parameters throughout the piling and dewatering programmes

This undertaking is to be secured by planning conditions C8 and C9

3. Detailed Qualitative Risk Assessment to build on preliminary quantitative assessment work, to include:
 - a. The risks of manganese impacting public water supply quality
 - b. The risks of turbidity impacting the public water supply
 - c. The risks arising from other potential contaminants associated with former site use
 - d. The piled scenario as a site conceptual model

This undertaking is to be secured by planning condition C8.

4. Remediation strategy and verification plan, if required:
 - a. Any remediation strategy will have due regard to the sensitivity of the local setting and the proximity of public water supply boreholes and other local water features.

This undertaking is to be secured by planning condition C8.

5. A Piling Method Statement will be developed to include:
 - a. An assessment of likely impacts arising from different piling options.
 - b. The preferred piling method and rationale including impacts on contaminant pathways, turbidity and ground permeability.
 - c. The layout of piles including depths.
 - d. The timing of piling operations, which will be agreed with Affinity Water to be at a time of low water demand; the current expectation is that piling would only occur between 1st September to 30th April.
 - e. The schedule of piling operations, including the number of piling rigs, the number of piles installed per day and the likely length of the operations.
 - f. The procedures used to control piling operations including any monitoring, measurement, record-keeping and quality assurance procedures applied by the contractor and/or piling contractor.
 - g. Mitigation measures identified to reduce the impact of piling, including but not limited to sentinel monitoring of turbidity, and describing aquifer protection measures as appropriate.
 - h. Trigger levels for contaminants of concern (including manganese and turbidity) and contingency actions to be undertaken in the event that trigger levels are exceeded.

This undertaking is to be secured by planning condition C14.

6. A Dewatering Method Statement shall be produced to include:
 - a. The dewatering method
 - b. The timescales and programme for dewatering
 - c. The area to be dewatered and location of dewatering infrastructure
 - d. Arrangements for discharge or re-injection of dewatering effluent including location and volumes

- e. An assessment of the likely impact of dewatering on groundwater levels and flows, including the lateral extent of impact and effects on local surface water features

This undertaking is to be secured by planning condition C14a

7. Remediation, verification, piling and dewatering operations shall be undertaken in accordance with the approved methodology. Monitoring data and reports shall be made available to Affinity Water as set out in the approved methodologies.

Reports submitted to the Local Authority as required by planning conditions shall be submitted independently by the Applicant to Affinity Water. The Applicant shall make best endeavours to keep Affinity Water informed of the progress of the undertakings outlined above and to give due regard to concerns that Affinity Water may raise regarding the above undertakings and throughout the construction programme.

4 PROPOSED PLANNING CONDITIONS

Three Rivers District Council has requested a number of planning conditions, should the planning permission be granted at appeal. If acceptable to all parties, amendments are proposed to conditions C8, C9 and C14 and an additional condition, C14a is proposed, with the purpose of strengthening the protection given to the PWS boreholes and ensuring that Affinity Water remains actively engaged in the approval of documents and discharge of planning conditions.

C8 Contamination

Prior to the commencement of development approved by this planning permission, the following components of a scheme to deal with the risks associated with contamination of the site shall each be submitted to and approved, in writing, by the Local Planning Authority, **in consultation with Affinity Water:**

1. A preliminary risk assessment which has identified:
 - all previous uses and proposed uses
 - potential contaminants associated with those uses;
 - a conceptual model of the site indicating sources, pathways and receptors; and
 - potentially unacceptable risks arising from contamination at the site **including consideration of naturally occurring manganese in shallow groundwater, pathways created by piling, and turbidity in the Chalk aquifer.**
2. A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including **local groundwater abstractions for Public Water Supply, and other relevant** these off site **receptors.**
3. The results of the site investigation and the detailed risk assessment referred to in (2) and, based on these and the Supplementary Site Investigation prepared by Tier Environmental Ltd (Report ref. TL117755511.1), an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.
4. A verification report that demonstrates the effectiveness of the remediation carried out in (3) must be produced together with any necessary monitoring and maintenance programme and copies of any waste transfer notes relating to exported and imported soils shall be submitted to the Local Planning Authority for approval, to demonstrate that the works set out in the remediation strategy in (3) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met.

The approved monitoring and maintenance programme shall be implemented.

Reason: This is a pre commencement condition to ensure that risks from land contamination to the future users of the land and neighbouring land are minimised, together with those to controlled waters, **public water supply boreholes (including from manganese and turbidity)**, property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other offsite receptors in accordance with Policies CP1 and CP8 of the Core Strategy (adopted October 2011) and Policies DM8 and DM9 of the Development Management Policies LDD (adopted July 2013)

C9 Long-term monitoring

The development hereby permitted may not commence until a monitoring and maintenance plan in respect of contamination, **manganese, turbidity and groundwater levels**, including a timetable of monitoring and submission of reports to the Local Planning Authority **and Affinity Water**, has been submitted to, and approved in writing by, the Local Planning Authority, **in consultation with Affinity Water**. Reports as specified in the approved plan, including details of any necessary contingency action arising from the monitoring, shall be submitted to, and approved in writing by, the Local Planning Authority, **in consultation with Affinity Water**.

Reason: This is a pre commencement condition to ensure that risks from land contamination (**including turbidity and manganese**) to the future users of the land and neighbouring land are minimised, together with those to controlled waters, **public water supply boreholes**. property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other offsite receptors (**including public water supply boreholes**) in accordance with Policies CP1 and CP8 of the Core Strategy (adopted October 2011) and Policies DM8 and DM9 of the Development Management Policies LDD (adopted July 2013).

Condition C14 Piling Method Statement

No piling or other deep foundation designs, investigation boreholes and ground source heating and cooling systems using penetrative methods shall take place until a Piling Method Statement (detailing the depth and type of piling to be undertaken and the methodology by which such piling will be carried out, including measures to prevent and minimise the potential for: damage to subsurface sewerage infrastructure **together with contaminant transport (including manganese) to the Chalk aquifer; creation and transport of turbidity in the Chalk aquifer and at local groundwater abstractions; the reduction of ground permeability and impacts on groundwater flow and levels;** and the programme for the works, **including timing, duration and schedule**) has been submitted to and approved in writing by the Local Planning Authority, **in consultation with Affinity Water**. Any piling or other deep foundation designs, investigation boreholes and ground source heating and cooling systems using penetrative methods must be undertaken in accordance with the terms of the approved piling method statement.

Reason: The proposed works will be **both** in close proximity to underground sewerage utility infrastructure **and the source protection zone of one or more of Affinity Water's groundwater abstractions for Public Water Supply (PWS)**. Piling has the potential to impact on local underground sewerage utility infrastructure **in addition to contaminant transport to the Chalk aquifer (including manganese), turbidity in the Chalk aquifer and potentially at the PWS abstractions, and on ground permeability, which may affect groundwater levels and flows**. This condition is necessary to protect underground infrastructure **and water supply** in accordance with Policies CP1 and CP8 of the Core Strategy (adopted October 2011) and Policy DM8 of the Development Management Policies LDD (adopted July 2013).

C14a Dewatering method statement

No dewatering shall take place until a Dewatering Method Statement (detailing the dewatering method and predicted impact on groundwater flow) has been submitted to and approved in writing with the Local Authority, in consultation with Affinity Water. Any dewatering must be undertaken in accordance with the terms of the approved dewatering method statement.

Reason: The proposed work will be within the source protection zone of one or more of Affinity Water's groundwater abstractions for Public Water Supply (PWS) and within 500 m of the Marsh Lake within Maple Lodge Nature Reserve. This condition is necessary to protect water supply and the environment in accordance with Policies CP1 and CP8 of the Core Strategy (adopted October 2011) and Policy DM6 and DM8 of the Development Management Policies LDD (adopted July 2013).

C23 Decommission of investigative boreholes

{This condition to remain as drafted}

A scheme for managing any borehole installed for the investigation of soils, groundwater or geotechnical purposes shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall provide details of how redundant boreholes are to be decommissioned and how any boreholes that need to be retained, post-development, for monitoring purposes will be secured, protected and inspected. The scheme as approved shall be implemented prior to the occupation of any part of the permitted development.

Reason: To ensure that redundant boreholes are safe and secure, and do not cause groundwater pollution or loss of water supplies in accordance with Policies CP1 and CP8 of the Core Strategy (adopted October 2011) and Policy DM8 of the Development Management Policies LDD (adopted July 2013).