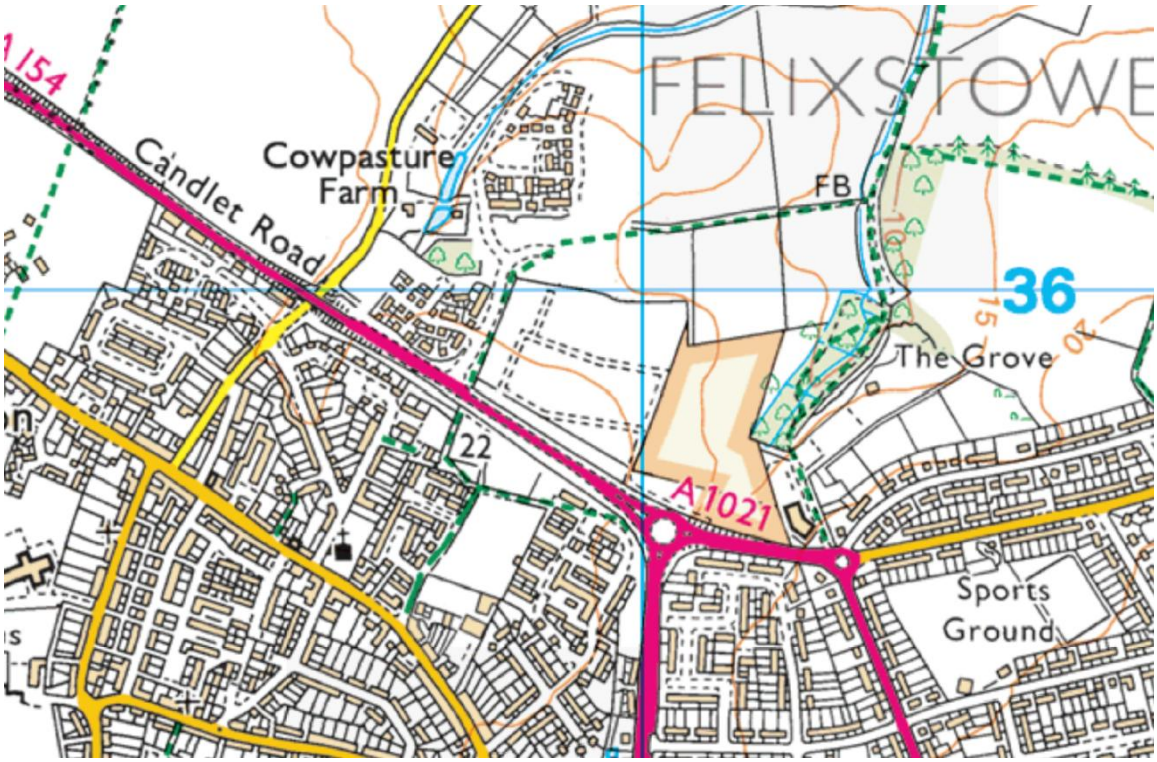


HYDROGEOLOGICAL ASSESSMENT: COWPASTURE ALLOTMENTS, FELIXSTOWE, SUFFOLK IP11 9RD

FELIXSTOWE TOWN COUNCIL, UNDERCLIFF ROAD WEST, FELIXSTOWE, IP11 2AG

Issued By
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Project Reference: 0410-Cowpasture Allotments-HGA-Felixstowe Town Council

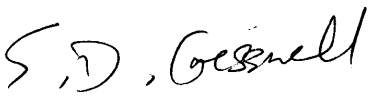
Title: Hydrogeological Assessment: Cowpasture Allotments, Felixstowe, Suffolk IP11 9RD

Date: 10/11/2026

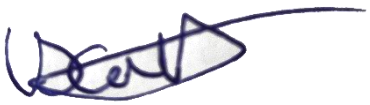
Client: Felixstowe Town Council, Undercliff Road West, Felixstowe, IP11 2AG

Produced By: Aquifer Energy Ltd, 29 Main Street, Long Whatton, LE12 5DF

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Reviewer: Lawrence Scott



Date	Revision Number	Changes	Author
10/11/2026	001.0	Document Issued	Steve Cresswell

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1. Introduction

1.1 Commissioning Background

Aquifer Energy has been commissioned by Felixstowe Town Council, Undercliff Road West, Felixstowe, IP11 2AG to undertake an assessment to determine the geology, hydrogeology, water quality and drilling risks for a water borehole at the following site:

Site Name	Cowpasture Allotments
Site Address	Cowpasture Allotments
	Cowpasture Drive
	Felixstowe
	Suffolk
	IP11 9RD
Grid Reference	TM 29843 35924
Borehole NGR	629843 , 235924
What Three Words	bath.still.thigh
Borehole Datum (maOD)	20
Target Volume of Water	<20 m^3/d
Water Use	Domestic Supply

1.2 Report Objectives

- Conduct a desktop geological and hydrogeological assessment of the underlying ground conditions at the site.
- Identify potential aquifers and give indication of yield
- Assess nearby boreholes for water quality information and provide a summary of potential water quality at the site.
- Provide an assessment of drilling risks & geological hazards
- Detail the regulatory requirements associated with drilling at the site.

1.3 Deliverables

1. Assessment of geology to a depth of up to 200m, including expected water level and target aquifer
2. Review of historic borehole logs surrounding the site
3. Assessment of hydrogeological conditions including assessment of likely borehole yield and viability of the project.
4. Assessment of drilling and geological risks

1.4 Report Constraints

This report has been prepared using the best available geological and hydrogeological knowledge and information and aims to give an assessment as to the viability or suitable of this site for a water borehole. However, the opinions expressed in this report and recommendations are all obtained from desktop information as no site survey or sampling work has been undertaken under this scope.

Some of the responses contained herein are based on data and information provided by the United Kingdom Research and Innovation (UKRI) or its component body the British Geological Survey (BGS). Your use of any information contained herein which is derived from or based upon such data and information is at your own risk. Neither UKRI nor BGS gives any warranty, condition or representation as to the quality, accuracy or completeness of such information and all liability (including liability for negligence) arising from its use is excluded to the fullest extent permitted by law.

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2 Site Location & Constraints

2.1 Location Plan

The site location is presented below in Figure 1.

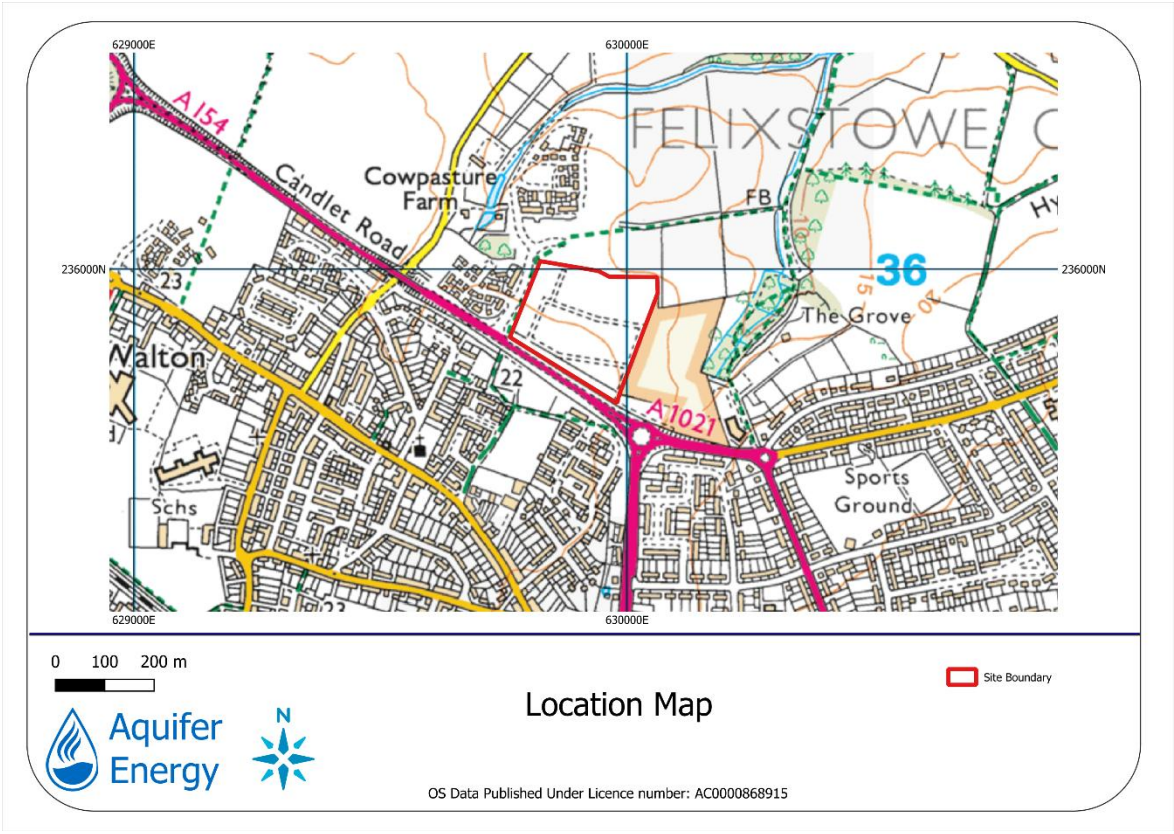


Figure 1: Location Map

The site is located in the north of Felixstowe on the east coast of England. The site is an allotment and is located to the north of the A154.
The site is essentially flat at an elevation of 20maOD, the topography to the north drops down to close to sea level at King's Fleet.
The site has a housing estate to the east and north, a road with playing fields beyond to the south and a woodland to the east.
Figure 2 shows the preferred borehole location.

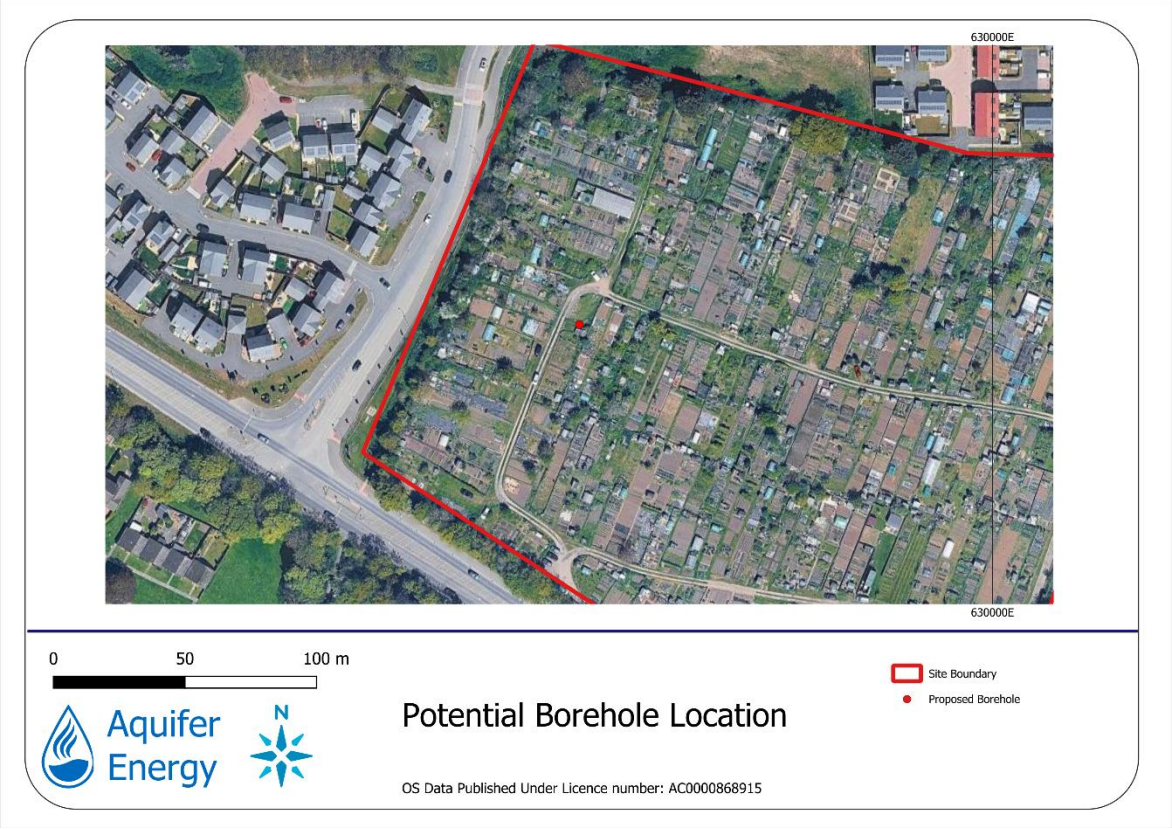


Figure 2: Preferred Borehole Location

3 Geological Setting

The geology and hydrogeology at surface and beneath the site is critical to understanding the viability of and long-term performance of a water borehole.

The geology & hydrogeology at this site has been characterised by BGS Maps, Onshore Geoindex, Historic Borehole records and Aquifer Energy's Inhouse Databases.

3.1 Geological Sequence

Table 3.1 below shows the anticipated geological sequence down to a depth of up to 200m. It gives a short description of the formation, anticipated thickness and depth encountered. Figure 3 and Figure 4 show the regional geological maps of both the bedrock and the superficial deposits.

Table 3.1 – Geological Sequence Beneath Site

Geological Strata	Formation Description	Estimated Thickness (m)	Depth to top of Formation (mbgl)
Soil	Acid loamy soil.	1	0
Red Crag Formation (Crag Group) - [Neogene]	Poorly sorted coarse grained shelly sandstone.	7	1
London Clay Formation (Thames Group) - [Eocene]	Blue clay, soft and sticky, with sand and shell inclusions	23	8
Thanet Formation (Montrose Group) - [Palaeocene]	Yellow-brown, glauconitic silty fine grained sand.	15	31
Chalk Group (Cretaceous)	White to pale cream chalks with flint with thin layers of grey clay towards the base.	>154	46

3.1.1 Quaternary

The Quaternary is the most recent geological timescale from 2.5 Million years before present to today. Most of the sediments of the Quaternary are classified

as Superficial Deposits in that they are not consolidated and have little to no structure. Historically these were known as 'Drift' deposits.

3.1.1.1 Soil

Soil is classified throughout England and Wales by the soil association and has been simplified by the LandIS to 27 soil map units (www.landis.org.uk/soilsguide/soilscapes_list.cfm).

The soil at the site location has been classified as Soilscape 6: Freely draining acid loamy soil. The soil will likely allow drainage to the underlying strata.

There are no other Drift Deposits at the site location.

3.1.2 Neogene

The Neogene Period represents a period of time from 23 million years ago to 2.5 million years ago. Comprised of two epochs, the Miocene and Pliocene (oldest to youngest) which are subdivided into 8 stages. The nine stages consist of six stages in the Miocene (Aquitanian, Burdiglian, Langhian, Serravallian, Tortonian and Messinian) and two stages in the Pliocene (Zanclean and Piancenzian (or Waltonian)).

3.1.2.1 Red Crag Formation

The Red Crag Formation was deposited during the Pleistocene to Pliocene and is part of the Crag Group. The Red Crag Formation is typically a coarse grained, poorly sorted shelly sand. The Red Crag Formation is yellow to brown in colour where weathered and dark green and glauconitic when fresh. The base of the formation is a bed of rounded flint pebbles and phosphatic nodules.
The Red Crag Formation was deposited in a shallow marine sea that covered the North Sea Basin.
The base of the Red Crag Formation rests on the London Clay Formation in the Felixstowe area.

3.1.3 Palaeogene

The Palaeogene Period represents a period of time from 66 million years ago to 23 million years ago. Comprised of three epochs, the Palaeocene, Eocene and Oligocene (oldest to youngest) which are subdivided into 9 stages. The nine stages consist of three stages in the Palaeocene (Danian, Selandian and Thanetian), four stages in the Eocene (Ypresian, Lutetian, Bartonian and Priabonian) and two stages in the Oligocene (Rupelian and Chattian).

The early Paleogene saw the majority of the UK land mass above sea level and large scale erosion of the chalk. The earliest rocks of the Paleogene in the London Basin is the Thanet Formation which was deposited in marine conditions and is comprised of green sands. Overlying this are the terrestrial and shallow marine sediments of the Lambeth Group consisting of sands and red clays, deposited prior to the marine conditions of the Thames Group (Harwich and London Clay Formations). After the Thames Group, a series of sands, clays and limestones were deposited that represent both marine and non marine conditions known as the Bracklesham Group.

3.1.3.1 London Clay Formation

The London Clay Formation was deposited during the Ypresian age and is part of the Thames Group. The London Clay Formation is typically a blue grey to grey-brown clay, varyingly silty with some layers of sandy clay. Commonly there are thin carbonate concretions, referred to as 'cementstone nodules' in many borehole logs, along with disseminated pyrite. There are thin beds of fine sand and shells, increasingly towards the base of the formation. The sand beds frequently have glauconite resulting in a green tinge. Towards the base may be thin beds of black rounded flint gravel.

3.1.3.2 Thanet Formation

The Thanet Formation was deposited during the Thanetian age and is part of the Montrose Group. The Thanet Formation is typically a coarsening upwards sequence of silty clay at the base to a glauconitic fine-grained sand at the top. The formation is typically pale yellow-brown in colour. Rarely there are coarse gravels within the formation but typically there is a thin gravel and cobble bed known as the Bullhead Bed at the base, which has green coated flints in a green clayey sand matrix. The base of the Thanet Formation rests on the underlying Chalk Group which is commonly irregular with karstic features.

3.1.4 Cretaceous

The Cretaceous Period represents a period of time from 145 million years ago to 66 million years ago. Comprised of 2 epochs, Early and Late (or Lower and Upper) and subdivided into 12 stages which are (from oldest to youngest) Berriasian, Valanginian, Hauterivian, Barremian, Aptian, Albian, Cenomanian, Turonian, Coniacian, Santonian, Campanian and Maastrichtian. The boundary between Early and Late Cretaceous is the boundary between Albian and Cenomanian.

At the end of the Cretaceous there is a worldwide iridium-rich layer that has been postulated to be the result of a meteor impact and coincides with the extinction of three quarters of the plants and animals on the planet. The Late Cretaceous saw continued sea level rise covering most of the land masses across England, resulting in limited land based material (sand and clay) to be deposited in the sea and skeletal plates of coccoliths (phytoplankton) and shell fragments dominated the depositional environment, resulting in the formation initially of chalk and clay marls, becoming decreasingly clay rich with time. These chalks were deposited across vast areas with thicknesses up to 550m. Extensive marls that are continuous for hundreds of kilometres may be the result of volcanic ash.

3.1.4.1 White Chalk Subgroup

The White Chalk Subgroup consists of chalk with flints that has discrete marl seams, discrete flint seams, and nodular chalk units and hardgrounds. The White Chalk Subgroup was previously known as the Upper and Middle Chalk Formations and these terms are still on many geological maps and reports. The Plenus Marls Member marks the base of the Subgroup (previously this was the top of the Lower Chalk Formation). The chalk is split into provinces, the northern province, the southern province and a transitional zone between. The site is located in the Transitional Province and the uppermost formations were either not deposited or have been eroded.

3.1.4.2 Grey Chalk Subgroup

The Grey Chalk Subgroup was previously known as the Lower Chalk Formation and this term is still on many geological maps and reports. The base of the Plenus Marls Member marks the top of the Subgroup (previously this was the top of the Lower Chalk Formation). The chalk is split into provinces, the northern province, the southern province and a transitional zone between. The site is located in the Transitional Province and has two formations, the Zig Zag Chalk Formation and the West Melbury Marly Chalk Formation, separated by the Totternhoe Stone Member. The base of the Grey Chalk Subgroup is typically a glauconite rich marl (The Cambridge Greensand Member in the Transitional Province).

3.2 Geological Structure

Towards the end of the Cretaceous period and into the Palaeogene the collision of the African plate with the Eurasian plate (forming the Alps and known as the Alpine orogeny) was felt in Southern England. The sediments have been regionally folded into two synclinal basins, the London Basin and the

Hampshire Basin, with the Weald Anticline in between. Some of the original extensional faults were reactivated as thrust faults.
The folding has resulted in the local beds at the site dipping to the east. There are no faults marked on the geological maps in the vicinity of the site.

3.3 Historic Borehole Records

Boreholes in the vicinity are listed below in Table 3.2

BGS Reference	Site Name	Easting	Northing	BH Surface Elevation (maOD)	Drilled Depth (mbgl)	Rest Water Level (mbgl)	Flow Rate (m^3/d)	Specific Capacity (m^2/d)	Geology
TM23NE23	Felixstowe Maidstone Road 1	629300	235600	21.9	6	Dry			Made ground to 1.1m, Clayey silty sand to 1.7m, Red Crag Formation to TD
TM33NW39	Gulpher Farm, Felixstowe	630460	236870	7.6	79.2	4.0	110		Soil / made ground to 1.2m, London Clay Formation to 14.9m, Thanet Formation and Lambeth Group to 32.6m, Chalk Group to TD
TM23NE29	Sprites Hall Pumping Station, Trimley St Mary	628940	236620	18	77.7	16.8	870	120	Red Crag Formation to 2.4m, London Clay Formation to 27.1m, Thanet Formation and Lambeth Group to 38.1m, Chalk Group to TD
TM23NE30	Laundry, Walton	628700	236200	21.3	82.3	21.3	650	210	Concrete and soil to 0.8m, Kesgrave Catchment Subgroup to 4.6m, Red Crag Formation to 6.1m, London Clay Formation to 31.9m, Thanet Formation and Lambeth Group to 42.8m, Chalk Group to TD
TM23NE31	Laundry, Walton	628700	236200	21.3	91.9	21.9	870		Concrete, made ground and loamy soil to 1.4m, Kesgrave Catchment Subgroup to 4m, Red Crag Formation to 6.1m, London Clay Formation to 31.4m, Thanet Formation and Lambeth Group to 43.9m, Chalk Group to TD
TM33SW6	Old Waterworks, Felixstowe Road	630580	234880	21.3	152.4	18.7			Soil to 0.6m, Red Crag Formation to 5.8m, London Clay Formation to 30.8m, Harwich Formation to 31.3m, Thanet Formation and Lambeth Group to 47.4m, Chalk Group to TD
TM33SW3	Hamilton Road, Felixstowe	630300	234700	19.8	76.2	21.9	60		Soil to 0.6m, Red Crag Formation to 9.1m, London Clay Formation to 31.5m, Harwich Formation to 34.6m, Thanet Formation and Lambeth Group to 48.8m, Chalk Group to TD
TM33SW4	Felix Works, Felix Road, Felixstowe	630560	234820	18.3	76.2	19.8	410	240	Soil to 0.9m, Red Crag Formation to 7m, London Clay Formation to 31.4m, Harwich Formation to 33.5m, Thanet Formation and Lambeth Group to 47.9m, Chalk Group to TD
TM33SW5	Felixstowe Spa, Hamilton Cliff	630470	234440	3.1	152.4		220		London Clay Formation to 17.2m, Harwich Formation to 19.6m, Thanet Formation and Lambeth Group to 32.9m, Chalk Group to TD
TM33SW7	Harvest House, Felixstowe	630760	234580	4.5	45.7	7.0	370	380	Red Crag Formation to 7.3m, London Clay Formation to 19.5m, Harwich Formation to 21m, Thanet Formation and Lambeth Group to 35.8m, Chalk Group to TD

BGS Reference	Site Name	Easting	Northing	BH Surface Elevation (maOD)	Drilled Depth (mbgl)	Rest Water Level (mbgl)	Flow Rate (m^3/d)	Specific Capacity (m^2/d)	Geology
TM33NW33	Laurel Farm, Felixstowe	631470	236780	18.3	75.5	18.6	170		Sand & gravel to 6.7m, London Clay Formation to 30.5m, Thanet Formation and Lambeth Group to 46.5m, Chalk Group to TD
TM33NW29	Fleet House Farm, Old Felixstowe	631550	236640	17.3	67	14.3	44		London Clay Formation to 29.3m, Thanet Formation and Lambeth Group to 43m, Chalk Group to TD

Table 3.2 – BGS Borehole Records Near Site

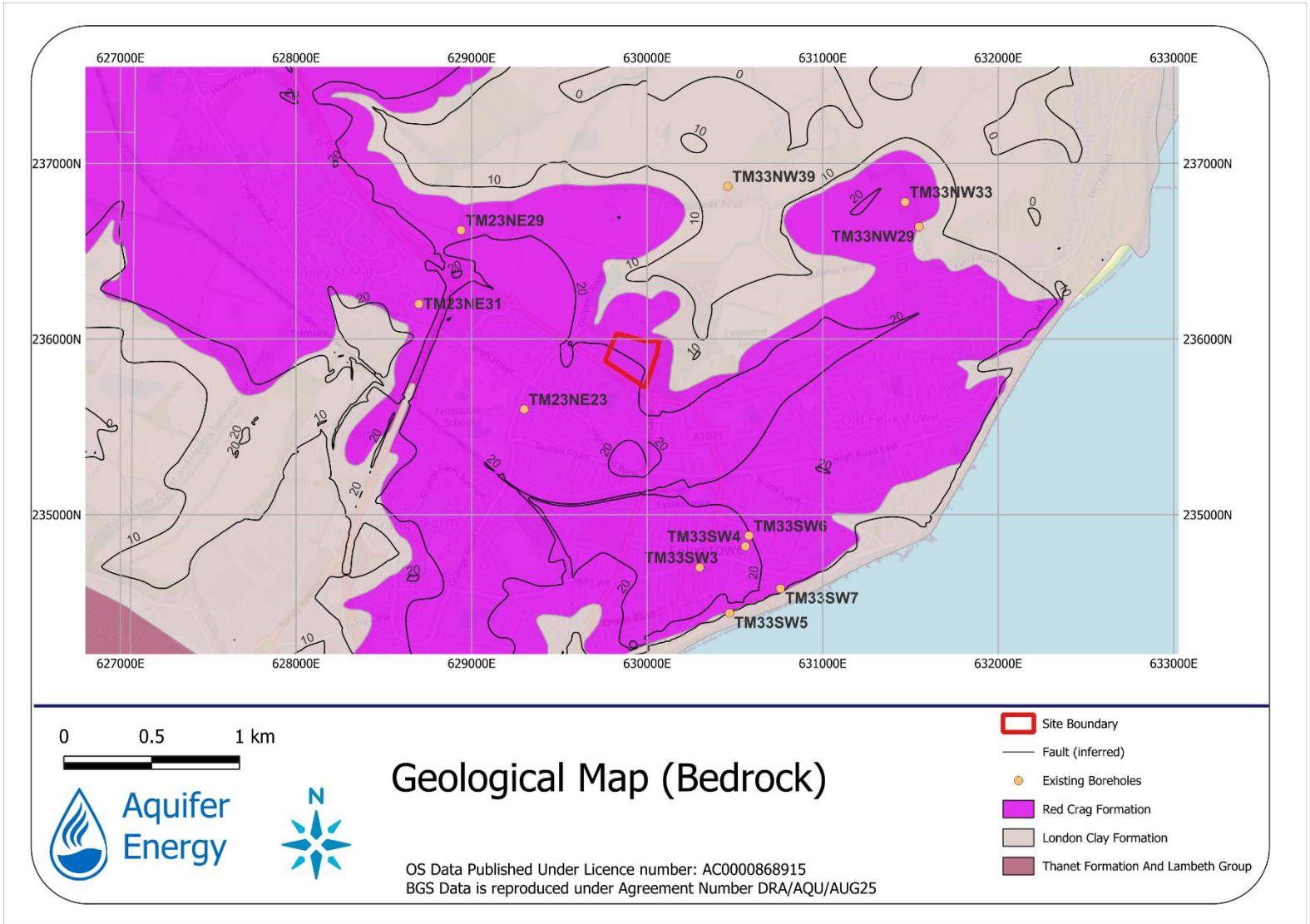


Figure 3: Bedrock Geological Map

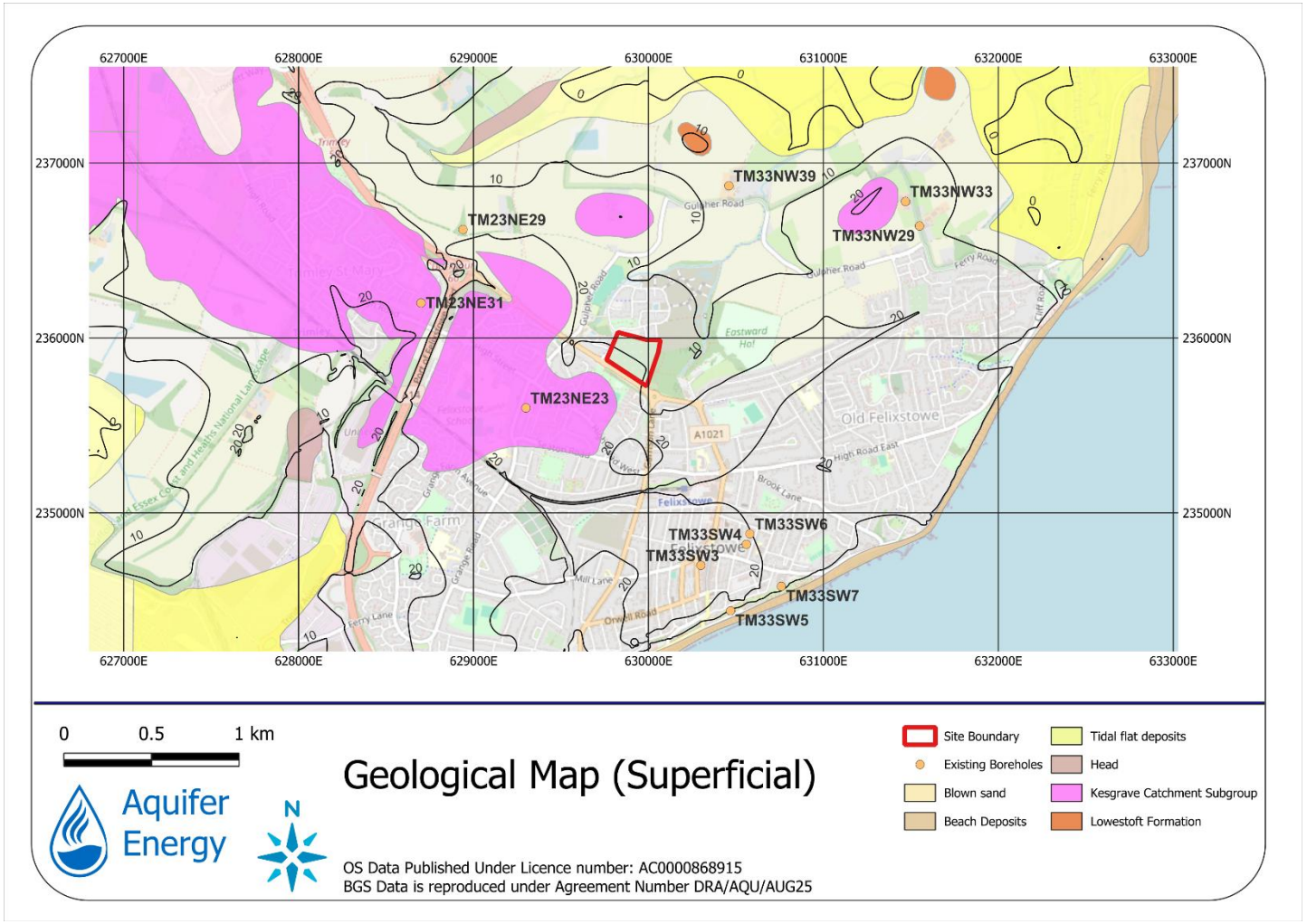


Figure 4: Superficial Geological Map

3.4 Hydrology

3.4.1 Surface Water

Surface water features in the vicinity of the site are listed below:

A pond is marked at the northern edge of the site at Cowpasture Farm which drains to the northeast and presumably drains to the northeast to King's Fleet. King's Fleet flows from west to east at an elevation of around sea level and discharges to the River Deben approx. 3.6km northeast of the site and then out to the North Sea.
The River Orwell flows southeast from Ipswich and merges with the River Stour 4.3km southwest of the site in Harwich Harbour.

3.4.2 Flood Risk

The flood risk based on the Environment Agency flood risk assessment is presented in the table below. The potential for flooding should be a consideration in the final borehole design. The risk is based on the proposed location of the borehole, not the entirety of the site.

Type of Flooding	Chance of Flooding	Comments
Surface Water	Very Low	Less than 0.1% chance of a flood each year.
Rivers / Sea	Very Low	Less than 0.1% chance of a flood each year.
Groundwater	Unlikely	
Reservoirs	Unlikely	

3.5 Hydrogeology

The potential hydrogeological units available beneath the site have been identified and characterised below:

3.5.1 Soil

The soil is not considered a viable target for a groundwater abstraction. Whilst it may be seasonally wet, a sustained flow is unlikely to be achievable.

3.5.2 Red Crag Formation

he Red Crag Formation is classified as a Principal Aquifer in that it can support water supplies at a strategic scale.

The Red Crag Formation contains coarse sandstone and as such is expected to have good permeability and porosity. The sand grains are poorly consolidated and care will be needed to screen and gravel pack the borehole adequately to prevent sand ingress into the borehole. At the site location any water present is expected to be perched and the Red Crag Formation is likely to be dry for parts of the year, therefore the Red Crag Formation is not a target for an abstraction borehole at the site location.

Expected Rest Water Level: n/a
Expected Transmissivity: n/a.

3.5.3 London Clay Formation

The London Clay Formation is classified as unproductive and will act as a barrier to prevent water from moving up or down through the unit, which will act to confine the aquifers below.

Expected Rest Water Level: n/a
Expected Transmissivity: n/a

3.5.4 Lambeth Group and Thanet Formation

The Lambeth Group and Thanet Formations are classified as Secondary A aquifers. Secondary A aquifers have permeable layers that are capable of supporting water supplies at a local rather than a strategic scale, historically known as minor aquifers. The permeable layers are likely to be suitable for a water abstraction borehole, however are not as prolific as the underlying chalk, although in hydraulic continuity.

Expected Rest Water Level: n/a
Expected Transmissivity: 10 to 50 m^2/day.

3.5.5 Chalk Group

The Chalk Group is classified as a Principal aquifer, in that it may support water supply and/or river base flow on a strategic scale (previously known as Major Aquifers). The Chalk provides over 50% of all groundwater supply in the UK. The Chalk is considered a dual porosity aquifer. There is a very high porosity to the chalk, but the pore spaces are incredibly small and therefore groundwater cannot readily move into and out of the pore spaces. The majority of groundwater flow in the Chalk is via fractures and fissures. The fractures near to the surface may have been enhanced by dissolution. The frequency and size of fractures decreases with depth due to the weight of the overlying sediments,

and therefore the majority of the fractures will be in the top 50m, although hardgrounds less than 100m deep can provide good fracture development too. This can result in yields decreasing as pumped water levels drop. Additionally, transmissivity is higher in the chalk in valleys than on interfluves. Rest water levels can be highly variable due to the fast recharge times of fractured aquifers, with 5m of fluctuation possible in confined aquifers.

Expected Rest Water Level:	17 to 22 mbgl
Expected Transmissivity:	50 to 400 m^2/day.

3.5.6 Potential for Water Volume (Chalk)

The table below provides an indication of the water that may be available at the site based on the rest water levels and expected transmissivities identified in the hydrogeological units above.

	P(90)	P(50)	P(10)
Rest Water Level (mbgl)	22	19	17
Rest Water Level (maOD)	-2	1	3
Transmissivity (m^2/day)	50	140	400
Drawdown (m)	0.2	0.2	0.2
Yield (m^3/day)	8	23	66

P(90) = 90% chance of achieving; P(50) = 50% change of achieving (most likely); P(10) = 10% chance of achieving.

A probability/yield plot is provided below to show the range of yields with the probability of realising that yield with the chosen drawdowns.

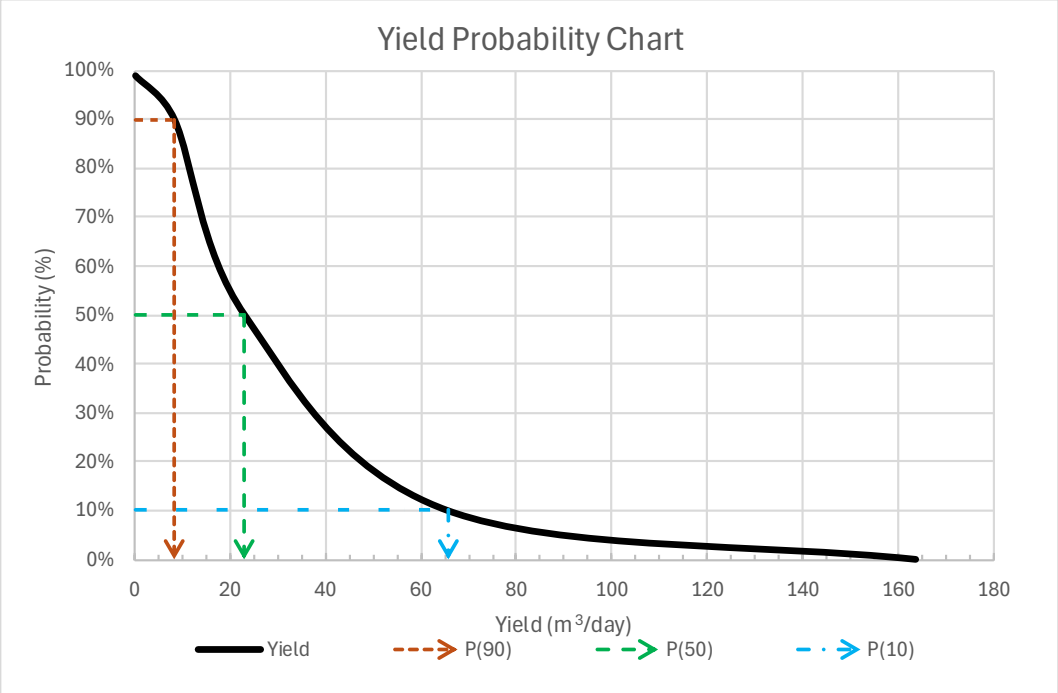


Figure 5: Yield - Probability Plot

The table above and Figure 5 shows that the borehole is likely to be able to provide 20m^3/day, potentially more based on the transmissivities observed in offset boreholes. However, assessment of larger volumes is outside the scope of this report.

Risks of low yield associated with an unconfined fractured Chalk aquifer are as follows:

- Lack of fractures at the site, especially if there is a thick overburden prior to entering the water bearing strata.
- Rapidly changing groundwater levels related to recent recharge, and risk of low water levels due to drought.

3.6 Water Quality

The mineralisation levels will ideally be low due to low residence time, however if residence time is high then mineralisation levels will be elevated.

The table below presents the anticipated range of major, minor and trace elements that may be dictated in a water sample at the site location. This should be considered a guide as the chemistry of the subsurface can change over short distances.

Major Elements	**Units**	**Min**	**Expected**	**Max**	**Private Water Supply Limits**
Ca	mg/l	17	100	200	
Mg	mg/l	4	24	113	
Na	mg/l	8	83	590	200 mg/l
K	mg/l	2	10	30	
Cl	mg/l	14	40	1250	250 mg/l
HCO_3	mg/l	256	323	450	
SO_4	mg/l	5	100	560	250 mg/l
Minor Elements					
NO_3	mg/l	0	0.1	2	50 mg/l
NO_2	µg/l	0	2	21	500 µg/l
NH_4	µg/l	4	24	1660	500 µg/l
P	µg/l	10	20	100	
F	µg/l	250	1000	1875	1500 µg/l
Br	µg/l	100	130	430	
I	µg/l	1	10	40	
Si	mg/l	6	9	11	
Trace Elements					
Al	µg/l	1	4	20	200 µg/l
As	µg/l	0	1	4	10 µg/l
B	µg/l	10	130	600	1000 µg/l
Ba	µg/l	30	50	90	

Cd	µg/l	0	0.05	0.35	5 µg/l
Cr	µg/l	0	0.5	1.8	50 µg/l
Cu	µg/l	0.4	2	37	2000 µg/l
Cy	µg/l	0	2	5	50 µg/l
Pb	µg/l	0.4	0.6	1	10 µg/l
Hg	µg/l	0	0.1	0.7	
Ni	µg/l	0	2.5	80	20 µg/l
Fe	µg/l	9	140	1280	200 µg/l
Mn	µg/l	3	6	40	50 µg/l
Zn	µg/l	2	14	245	
pH		7.0	7.4	8.3	6.5 – 9.5
Conductivity	µS/cm	40	750	4410	2500

Once drilled a full suite of determinants to determine what (if any) treatment is required should be undertaken.

As can be seen from the above table, most analytes are expected to be within the drinking water limits, however confined chalk waters have been known to have high sodium, chloride, sulphate, ammonium, fluoride, nickel and iron. Any analytes that are above private water supply limits can be reduced via dilution. Saline intrusion is a risk at the site location.

The list of analytes tested above is not exhaustive and there are other analytes to test for, including microbiological tests.

4 Outline Borehole Design

A borehole at this location should target groundwater in the White Chalk Subgroup principal aquifer. There has been saline intrusion in the near vicinity of the site, typically fresh water sits on top of saline water, and therefore a borehole should be drilled only a short distance into the chalk to limit the exposure of the borehole to any increasing conductivity. Therefore a borehole should be drilled between 55 and 60mbgl.

All boreholes should be constructed to achieve a permanent sanitary seal and support of formations between the surface and the possible productive zones within the borehole. Temporary casing will likely be required to support any The Red Crag Formation whilst drilling the upper section of the borehole. Permanent casing should be installed and grouted 5m into the confirmed competent Chalk. A sulphate resistant cement may be required.

Water levels will be above the top of the chalk; therefore the pump can be installed in the cased hole. A liner and gravel pack may be required to support the borehole wall and ensure the borehole remains open.

An outline borehole design is provided in Figure 6.

WATER SUPPLY BOREHOLE SCHEMATIC

Project: Cowpasture Allotments
Client: Felixstowe Town Council
Site Postcode: IP11 9RD
Elevation: 20maOD
x = 629843
y = 235924
OSGB36 / National Grid

Aquifer Energy

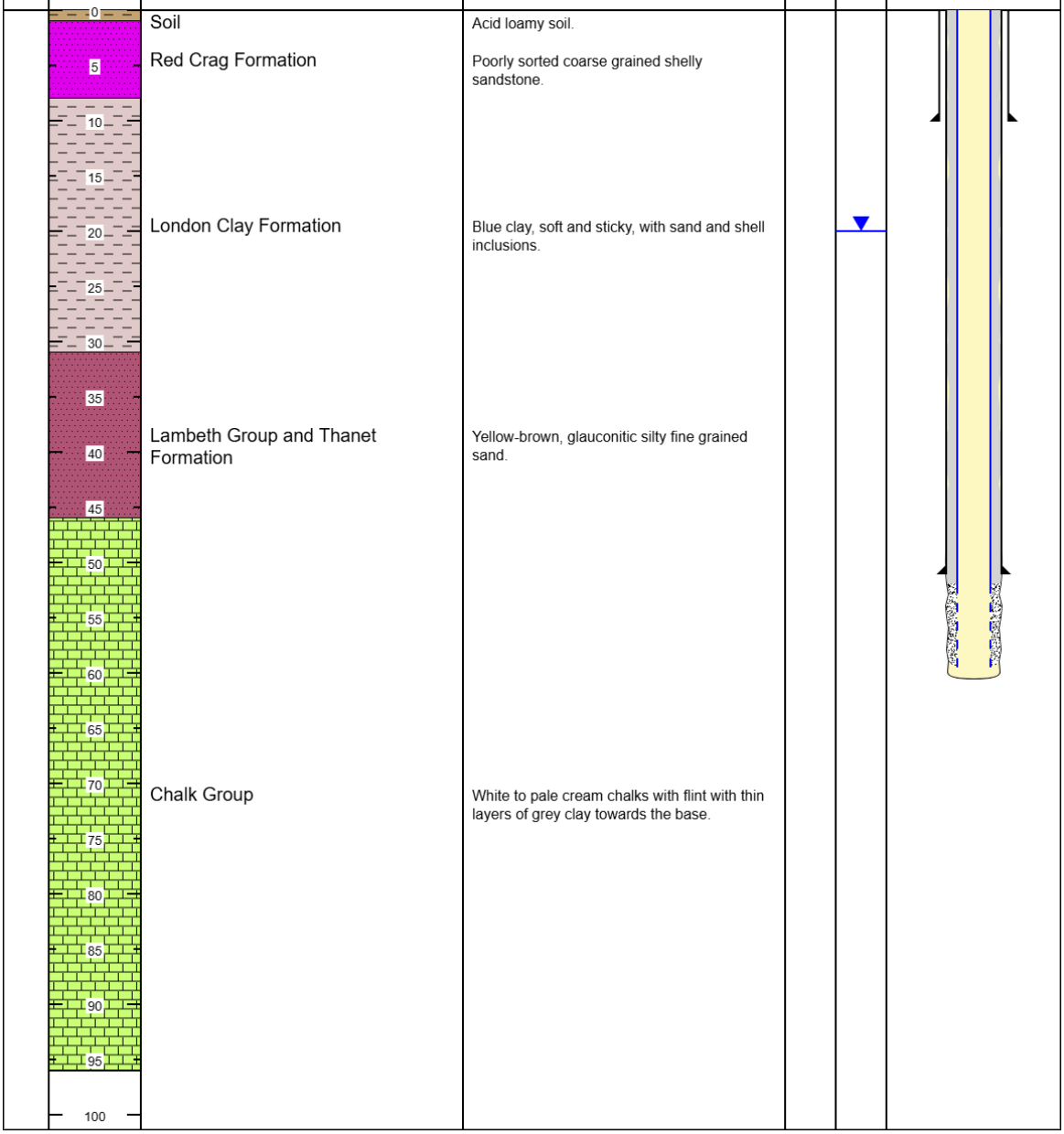


Figure 6: Outline Borehole Design

5 Regulatory

5.1 Licensing

A borehole abstracting less than 20m^3/day is exempt from the Environment Agency (EA) regulations and therefore no abstraction license is required.

Any borehole or water source that intends to abstract more than 20m^3/day in England is regulated and enforced by The Environment Agency and needs to apply for and be licensed by The Environment Agency. The process for this is outlined below:

Online Pre-Application form to the EA, this will detail expected volumes, initial borehole depth, diameter and details about the type and use of abstraction. This will kick off an initial conversation with the EA.

Water Features Survey – After initial discussion the EA will issues a water features survey, the radius of this will depend on the water abstraction volumes requested, see approximate radius in table below

Volume Abstracted	Search radius
20 to 100m^3/day	250m search radius
100 to 500m^3/day	500m search radius
500 to 1,000m^3/day	1km search radius
1,000 to 3,000m^3/day	1.5km search radius
3,000 to 5,000m^3/day	2km search radius
Over 5,000m^3/day	2km to 4km search radius

Ground Investigation Consent (GIC) – Once the Water Features Survey (WFS) has been completed and approved by the EA they will issue a GIC which will give permission to drill, and test pump the borehole

Test Pumping – After the water borehole has been drilled in line with the EA specifications test pumping must take place, the specification for volumes, time and types of tests will be specified in the GIC, data must be carefully collected during the test to allow for the abstraction license application.

Interpretation & License Submission – Once the test pumping is completed the collected data must undergo hydrogeological interpretation to demonstrate the borehole has a sustainable yield and does not detrimentally impact any other

nearby users. This is formatted into a report and submitted to the EA along with the full license application forms and the EA fee.

License Issued – The EA will return with any questions from the test pumping and drilling process, once answered satisfactorily the EA will approve and issue the abstraction license allowing the borehole to operate.

This process will normally take between 6 to 9 months to complete from start to finish.

5.2 Borehole Siting

A new borehole should be drilled at least 50m apart from any other water source (spring or borehole used for domestic water supply) or any form of foul water soak away.

At the site location there are no registered licensed abstractions. A 50m radius (in green) about the proposed borehole location has been indicated on Figure 7and can be used to ensure that there are no undocumented boreholes or foul water soak aways identified within the 50m radius.

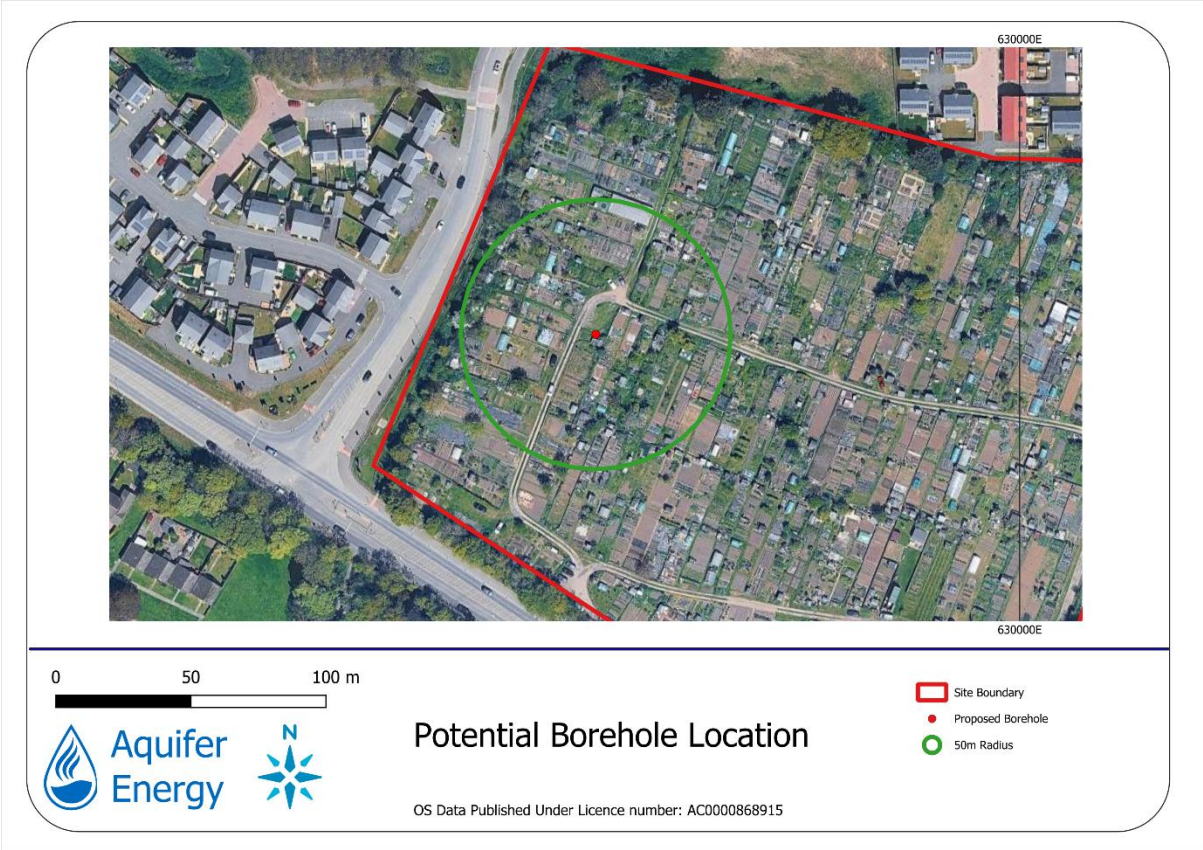


Figure 7: 50m radius about the proposed borehole

5.3 Catchment Abstraction Management Strategy (CAMS)

Water Licensing in England is managed by the EA that have licensing strategies known as Catchment Abstraction Management Strategies (CAMS) for all areas of England. The CAMS advise on the water bodies resource availability, water bodies being sub-catchment surface water units or groundwater units. For surface water units, the CAMS monitor water levels in rivers at specific Assessment Points (Aps). When groundwater abstractions directly impact surface water flows, the impact is measured at the surface water AP.

Where Principal Aquifers are present, the areas are divided into groundwater management units (GWMU) which are subdivisions of the groundwater bodies. The groundwater may be assessed on different criteria than the assessment points for surface water.

Restrictions on water abstraction may be made via Hands Off Level (HoL) when AP levels have dropped. EA may also adopt a case by case basis when determining a request for an abstraction license.

The following table lists the CAMS information applicable to the site.

CAMS	East Suffolk ALS
Date Issued	March 2019
Resource Availability at	
Q95	Restricted Water Available
Q70	Water Available
Q50	Water Available
Q30	Water Available
Groundwater	No Water Available

5.4 Groundwater Vulnerability

Groundwater vulnerability is an indication of the potential for groundwater to be contaminated from human activities. The area surrounding the site is designated as 'High' for groundwater vulnerability.

5.5 Source Protection Zones

A source protection zone is used to delineate the level of risk to a well, borehole or spring used to supply drinking water from pollution. There are three main zones:

Zone	Comments
Inner - SPZ1	The largest of: 50m from a groundwater abstraction Or

	A 50 day travel time of groundwater to a groundwater abstraction
Outer – SPZ2	The largest of: 250m from a <2000m^3 per day abstraction Or 500m from a >2000m^3 per day abstraction Or A 400 day travel time of groundwater to a groundwater abstraction
Total Catchment – SPZ3	The area around a supply source within which all the groundwater ends up at the abstraction point.
1c, 2c and 3c	Where an aquifer is confined, the zones may be extended.
Zone of Special Interest - SPZ4	Where local conditions require additional protection

The site is not located in a Source Protection Zone.

5.6 Private Water Supply Regulations

The Private Water Supply Regulations apply to all private supplies of water intended for human consumption (which includes drinking water, food production, cooking or other domestic purposes).

The local authority must carry out a risk assessment for every private water supply in the area and review and update that risk assessment every 5 years if the supply is part of a commercial or public activity.

Following the risk assessment, the local authority will conduct monitoring of parameters identified in the risk assessment to ensure that the water quality is wholesome.

5.7 Mining Remediation Authority (Coal Authority)

Parts of the country have been designated as areas where the coal authority requires notification of borehole drilling in the area and potentially a permit to disturb the coal measures.

The site is not located within a Mining Remediation Authority Reporting Area.

6 Drilling Risks

6.1 Summary of Drilling Risks

Drilling Area	Associated Risks
Borehole Stability	The Red Crag Formation may have unconsolidated sands which may need to be behind temporary casing whilst drilling the borehole. The London Clay can be sticky. The Lambeth Group and Thanet Fomation likely have poorly consolidated sands that can run and collapse into the borehole.
Gypsum / Anhydrite Deposits	Gypsum and Anhydrite are not expected in the subsurface at this site.
Risk of Lost Flush	The risk of loss of flush is high due to fractures and fissures in the Chalk.
Artesian Conditions	Artesian conditions are considered low risk at the site, the expected rest water level is 17-22mbgl.
Site Contamination	No contamination has been identified by any desktop source during data collection for this report. However, contamination does not form part of the scope of this report and a separate contamination survey should be conducted prior to works.
Historic landfills	Low Risk - The historic landfill dataset does not identify historic landfills within 1km of the site.
Coal Mining	Low Risk - The site is not within a Mining Remediation Reporting Area.
Non Coal Mining	Low Risk – The BGS 1km Mining Hazard Grid reports the site area as N/A for non-Coal Mining activities.
Ground Gas (except Radon)	Low Risk - The Red Crag Formation, London Clay Formation, Thanet Formation and Lambeth Group, Chalk Group are not considered a medium or high risk for ground gas. It is always advisable to monitor for ground gas whilst drilling and whilst pumping water to surface.

Radon	The BGS Radon Indicative Atlas (1km grid) suggests that the property has up to a 1% chance of being above the Action Level for Radon (4.0 pCi/L). It is always advisable to monitor for Radon gas whilst drilling and whilst pumping water to surface.
Oil and Gas	Low Risk – The site is not located within an England Onshore Licence. Exploration drilling boreholes have not been conducted in the area.
Buried Structures	No buried structures have been identified by any desktop source during data collection for this report.
UXO density (zeticauxo.com)	Moderate Density according to the Zetica Unexploded Bomb Risk Map. [Low: < 15 bombs per 1000 acres. Moderate: 15 – 49 bombs per 1000 acres. High: >50 bombs per 1000 acres This does not represent the UXO risk.

7 References

British Geological Survey (1997) The physical properties of major aquifers in England and Wales Technical Report WD/97/34.

British Geological Survey (2000) The physical properties of minor aquifers in England and Wales Technical Report WD/00/4.

British Geological Survey England and Wales geological map Solid & drift, 208 & 225

Website: http://magic.defra.gov.uk/MagicMap.aspx

8 Appendix A:

Terms and Conditions for Hydrogeological Reporting Services

Purpose and Scope

This Hydrogeological Report has been prepared by Aquifer Energy Ltd ("the Company") at the request of the Client, for the purpose of assessing the hydrogeological conditions relevant to the potential drilling of a water borehole. The Services provided are limited to a desktop study based on publicly available data, historic site records, and information provided by the Client.

Professional Standard

The Company has undertaken the Services with reasonable skill, care, and diligence customarily exercised by professionals in the geology industry at the time of performance. The scope and depth of the Services were determined by the purpose described in the report, the resources agreed, and the timeframe stipulated in the contract with the Client.

Data Sources and Limitations

The findings and conclusions are based upon:

- Information provided by the Client and third parties.
- Desktop analysis of published geological, hydrological, environmental data and Aquifer Energies inhouse databases.
- Professional interpretation and judgment of the Company’s staff.

No guarantee can be given as to the presence, quality, or quantity of groundwater at the site. Subsurface and hydrogeological conditions may vary considerably over short distances and can change over time due to natural or human-induced factors.

No Warranty or Guarantee

Except as set out in Section 2, the Company makes no other representation or warranty, whether express or implied, regarding the Services. In particular, no guarantees are provided as to:

- The success of drilling operations.
- The availability of groundwater at any depth.
- The chemical or biological quality of groundwater.
- Ground or geological conditions beneath the site.

Use and Reliance

This report is for the sole use of the Client and for the specific purpose outlined in the introduction. It should not be used for other purposes, including licensing, permitting, or construction design, without further written advice from the Company. Any reliance by third parties is entirely at their own risk. The Company accepts no liability to any third party who may become aware of or rely upon this report without the Company's prior written consent.

Changes Over Time

Hydrogeological conditions, regulatory requirements, and data availability may change over time. The conclusions of this report are valid only at the time of issuance. Any future use of the report without review and written confirmation by the Company is at the Client's sole risk.

Third-Party Data and Accuracy

The Company is not responsible for inaccuracies in third-party data, laboratory testing (where applicable), or information provided by the Client. The Company has not independently verified such data unless stated otherwise. Errors or omissions in third-party data that affect the report are not the responsibility of the Company.

Exclusions

Unless specifically stated, this report does not include assessments of:

- Contaminated land, including asbestos, hydrocarbons, or heavy metals.
- Geotechnical properties for construction.
- Ecology, environmental impact, or planning constraints.
- Structural design suitability.

Drawings and Illustrations

Any drawings or figures included in the report are for illustrative purposes only. They are not to scale, may not represent exact locations or dimensions, and should not be used for setting out or engineering purposes.

Variation in Ground Conditions

Groundwater levels, flow rates, and geochemical properties can vary seasonally or due to human activity. Additionally, soil and rock conditions may differ from those interpreted through desktop data. Without site-specific intrusive investigations, such variations cannot be ruled out.