



THE COPSE

HYDROGEOLOGICAL APPRAISAL

SEPTEMBER 2024

PROJECT NO. 24250588

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HYDROGEOLOGICAL APPRAISAL

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Report researched and produced by B. A. Hydro Solutions Limited (BAHS Ltd) on the instruction of Star Build Limited.

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TABLE OF CONTENTS

1	Introduction.....	1
2	Objectives	1
3	Geological Setting.....	3
3.1	Geology.....	3
3.2	Structure.....	4
4	Lithological Characterisation.....	5
4.1	Soil & Drift	5
4.1.1	Soil	5
4.1.2	Drift.....	5
4.2	Weald Clay Formation.....	5
4.3	Tunbridge Wells Sand Formation.....	6
5	Hydrology and Hydrogeology	8
5.1	Hydrology	8
5.2	Hydrogeology	9
6	Yield Testing & Analysis.....	11
7	Water Quality.....	12
8	Regulatory Considerations.....	14
8.1	Licensing.....	14
8.2	Permitting.....	15
8.3	Source Protection Zone(s).....	15
8.4	Coal Authority Reporting & Permitting	16
8.5	Bylaws.....	16
8.6	Private Water Supply Regulations	16
8.7	Borehole Registration	17
8.8	Site Specific Regulations	17
9	Appraisal Summary	19
	Guide to Drilling & Managing Your Borehole.....	23
	Bibliography	24
	Additional Information 1 – Licensing Restriction	25

Additional Information 2 – Hydrogeological Terms	26
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LIST OF FIGURES

Figure 1: Location Map	2
Figure 2: Geological Map	3
Figure 3: Pump test graph	11
Figure 4: Outline borehole design.....	21

LIST OF TABLES

Table 1: Site details.....	1
Table 2: Summary of Geological Sequence.....	4
Table 3: Flood Designation.....	8
Table 4: Hydrogeological Properties	10
Table 5: Indicative water quality	12
Table 6: Source Protection Zones	15
Table 7: Summary table	19

GLOSSARY OF TERMS

BAHS	B. A. Hydro Solutions Limited
µg/kg	Micrograms per kilogram
µg/l	Micrograms per litre
bgl	Below ground level
BGS	British Geological Survey
BH	Borehole
CA	Coal Authority
CAMS	Catchment Abstraction Management Strategy
DWI	Drinking Water Inspectorate
DWS	Drinking Water Standard
EA	Environment Agency
EHO	Environmental Health Officer
GP3	Groundwater Protection Policy
GSH/C	Ground Source Heating/Cooling
ha	Hectare
HSE	Health and Safety Executive
HGA	Hydrogeological Assessment
HTGA	Hydro-Thermogeological Assessment
LA	Local Authority
m	Metres
m ² /day	Square metres per day
m ³ /day	Cubic metres per day
maOD	metres above Ordnance datum
mg/kg	Milligrams per kilogram
mg/l	Milligrams per litre
NE	Natural England
NGR	National Grid Reference
NRW	Natural Resources Wales
PWL	Pumped Water Level
RWL	Rest Water Level
s	Drawdown in metres
SEPA	Scottish Environment Protection Agency
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SVC	Volumetric Heat Capacity
T	Transmissivity
TGA	Thermogeological Assessment
UKAS	United Kingdom Accreditation Service
UXO	Unexploded Ordnance
λ	Thermal Conductivity

1 Introduction

B. A. Hydro Solutions Ltd. (BAHS) has been commissioned to complete a Hydrogeological Appraisal documenting the conditions present at the following site, as confirmed by a borehole completed in July 2023. Information collected, interpreted and analysed within this Appraisal confirms the sustainability and wholesomeness of the water drawn from the 2023 borehole and how it is/shall be compliant with the Private Water Supply Regulations.

The site location is illustrated in the following figure; for the purpose of considering geological strata and depths to each stratum, a mean site elevation has been adopted throughout this report, as listed below:

Site Address:	The Copse	
	Worthing Road	
	Horsham	
Postcode:	RH13 9AT	
Drill position NGR:	TQ 16030 28194	
Elevation:	61	maOD

Table 1: Site details

2 Objectives

This Appraisal seeks to fulfil the following objectives:

- Document the geological sequence.
- Define the hydrogeological setting.
- Analyse and report pump testing.
- Confirm the sustainable abstraction rate.
- Document the quality of water present and proposed treatment.
- Demonstrate regulatory compliance.
- Document the borehole as completed.

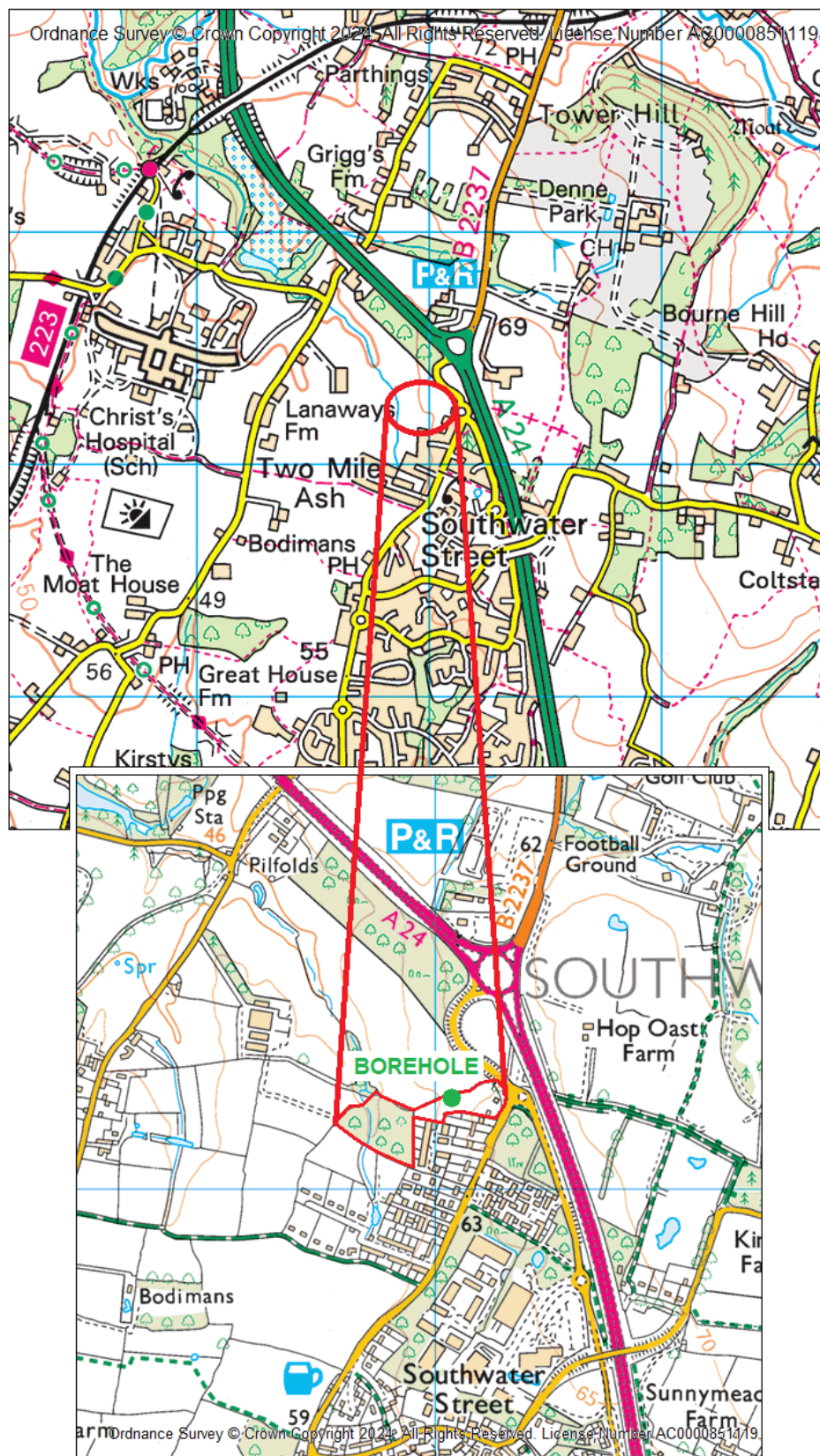


Figure 1: Location Map

3 Geological Setting

3.1 Geology

The following discussion of the geology beneath the site is based on a site-specific literature review and historical borehole records, including that from the recently drilled borehole on site. These records have been reviewed for the purpose of confirming the geological unit thickness, nature and depths. As geological units are not laterally continuous, vary in thickness and are not homogeneous, the thickness and depths will differ slightly away from the drill position so may be observed differently elsewhere.

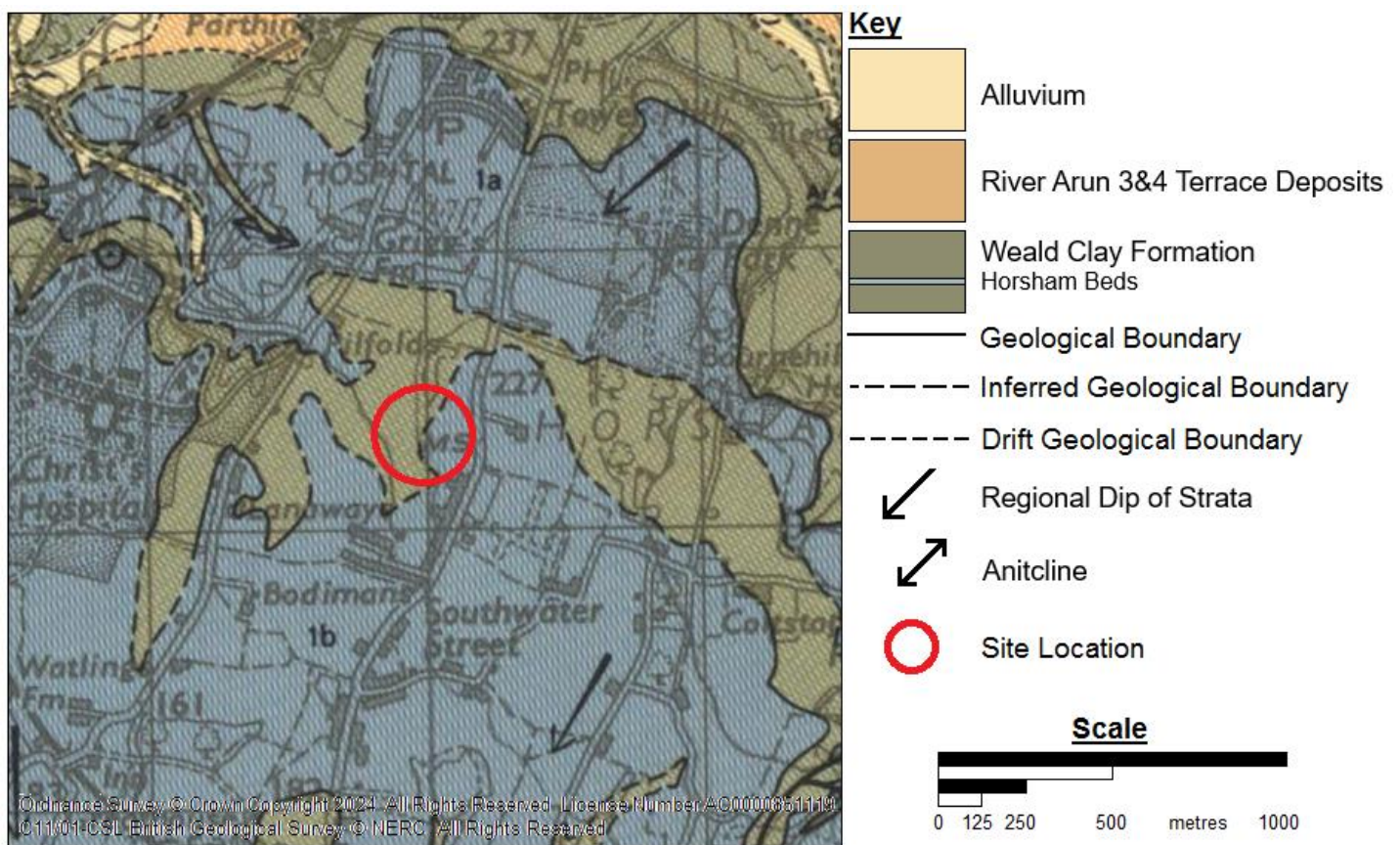


Figure 2: Geological Map

The geology mapped at ground level across the local area is illustrated in Figure 2; the location of the site is circled in red, the following table summarises the strata present, their names, lithological nature and the thicknesses of each unit.

Geological Group	Geological Formation	Lithological Nature	Anticipated Thickness (metres)
-	-	Soil and/or Worked Ground and/or Made Ground	<2
Lias Group	Weald Clay Formation	Mudstones with limestones, siltstones and ironstones	63 to 65
Lias Group	Tunbridge Wells Sand Formation	Mudstones with limestones, siltstones and ironstones	>50

Table 2: Summary of Geological Sequence

3.2 Structure

The main geological structures present and affecting the ground beneath the site are listed below. The tectonic events and the sequences leading to the resulting structures are not considered by this document as such detail does not affect the conclusions drawn by this study.

- There are few faults in the vicinity of the site, minor faults may be present but are not anticipated to affect the presence or abundance of groundwater beneath the site.
- The strata considered by this Appraisal have experienced moderate tectonic deformation since their deposition, they have been folded/tilted and faulted.
- The strata dip at 2 to 6 degrees to the south-west.

4 Lithological Characterisation

4.1 Soil & Drift

4.1.1 Soil

All sites are underlain by some form of soil, worked ground, made ground or a combination of the above. This document does not seek to characterise the nature of this layer as it is normally relatively thin and does not have any hydrogeological bearing on the presence, abundance or nature of the groundwater present. Where sites are underlain by known or possible contamination, appropriate professional advice should be sought. In most cases it would not be appropriate to construct a borehole for groundwater abstraction where it would/may pass through such ground.

As a precautionary approach, it should be assumed when designing a new abstraction borehole, that the soil could be liable to collapse, and that temporary casing would be needed through the soil and drift deposits present beneath. Soils and the first 1 to 3 metres below ground level [depending on ground conditions and the target horizon for abstraction] should be cased and sealed out of new boreholes on completion in order to form a reliable sanitary seal. At this site casing sealed out the top 60 metres of ground.

4.1.2 Drift

There are no mapped or reported Drift deposits present beneath the proposed drill position.

4.2 Weald Clay Formation

The rock head beneath this site has been confirmed when the borehole was drilled to be formed by the Weald Clay Formation, it appears to have been weathered to a depth of only 2 metres below rock head. Weathering, erosion and exposure will have reduced the strength of the ground resulting in it becoming weaker, less able to stand without temporary support and liable to collapse when drilled.

The Weald Clay Formation is the top most unit of the Wealden Group and is typically formed of mudstones and shales with subordinate layers of siltstone, occasional layers of fine to medium grained sandstones, some of which are calcareous in nature. The mudstones, shales and siltstones form a series of thinly bedded sediments which tend to be a dark grey colour. A number of

thicker sandstone and limestone horizons have been found to extend over some distance, whilst most are lensoidal with only limited lateral extents.

The Horsham Stone Member and the Paludina Limestones are examples of more traceable horizons within the Weald, which have more of a regional presence. Most of the more arenaceous deposits and limestones have such limited thicknesses and lateral extents that they have no hydraulic connection to ground level and thus contain finite pockets of water.

The Weald Clay sequence has a maximum thickness of up to 457 metres in this area although erosion has thinned the sequence present. The boundary between the mudstone and shale sequence of the Weald Clay and the Tunbridge Wells Sand Formation beneath is often poorly defined.

The Weald Clay Formation, with a thickness ranging from a minimum of 63 metres to up to 65 metres, was encountered during the drilling of a new borehole on site. At a shallow depth, the borehole intersected a sandstone layer identified as the Horsham Stone. Beneath this, the subsurface was predominantly composed of dark grey mudstones and siltstones, interspersed with occasional sandstone layers, particularly near the contact with the underlying formation.

The drilling log indicates that the ground conditions were stable enough to allow the installation of steel casing to a depth of 60 metres without the need for temporary casing. This stability facilitated the grouting process before advancing the borehole to its final depth of 104 metres.

4.3 *Tunbridge Wells Sand Formation*

The Tunbridge Wells Sand Formation is divided into three, the Upper and Lower Tunbridge Wells Sand Formations, and the intervening Grinstead Clay Formation. The Upper Tunbridge Wells Sand is generally described as a fine to medium grained argillaceous sandstone with regular siltstone and silty sandstone bands found throughout. Where confined, the uppermost boundary of the unit may be marked by the presence of a pebble bed. Where present at its maximum extent the Upper Tunbridge Wells Sand is up to 70 metres.

This Grinstead Clay unit is expected to be between 7 to 22 metres thick. The Lower Tunbridge Wells Sand includes the Ardingly Sandstone which is formed by massive blocky sandstones. The rest of the Formation consists of alternating sandstones, siltstones and mudstones which typically become increasingly clay rich towards the contact with the underlying Wadhurst Clay Formation. The Lower Tunbridge Wells Sand has a thickness of between 20 and 30 metres.

The Tunbridge Wells Sand Formation, with a minimum thickness exceeding 50 metres, presented a firm geological unit during the drilling of the new borehole on site. Upon penetrating this formation, the borehole encountered predominantly firm sandstone characterised by a grey to blue hue. The ground conditions were robust enough to obviate the need for temporary casing, allowing for the installation of a screen down to a final depth of 104 metres below ground level.

The drilling records lack the granularity to distinguish between the various geological Members within the Formation. While the borehole certainly penetrated the Upper Tunbridge Wells Sand, it remains uncertain whether it extended into the Grinstead Clay Member.

5 Hydrology and Hydrogeology

5.1 Hydrology

When the 2023 borehole was drilled, there were no observer or reported occurrences of temporary or permanent hydraulic linkages appearing between groundwater and surface water. RSK have separately reported and determined there is no risk posed to the Sussex Water Neutrality Zone posed by this new abstraction.

The Environment Agency's flood designation for the site is summarised below, this Appraisal is not, and cannot be used as part of, a flood risk Appraisal.

Flood risk from River or Sea:	Low Risk
Description of Risk:	Very low risk means that this area has a chance of flooding of less than 0.1% each year. This takes into account the effect of any flood defences in the area. These defences reduce, but do not completely stop, the chance of flooding as they can be overtopped, or fail.
Flood risk from Surface Water:	Very Low Risk
Description of Risk:	Very low risk means that this area has a chance of flooding of less than 0.1% each year. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
Flood risk from Reservoirs:	Unlikely (Low)
Description of Risk:	Flooding from reservoirs is unlikely in this area. An area is considered at risk if peoples' lives could be threatened in the event of a dam or reservoir failure.
Flood risk from Groundwater:	Unlikely (Low)
Description of Risk:	Flooding from groundwater is unlikely in this area as the hydrogeological setting means under normal conditions groundwater is not shallow enough to cause problems. Water levels could only rise to problematic levels following prolonged, and extreme wet conditions.

Table 3: Flood Designation

Based on the flood risk status above, the site this Appraisal provides the following guidance:

The overall flood risk for this site is assessed as being LOW; The borehole will be completed above ground level once fully completed. Any dip points, cable entry points, breather pipes, etc shall be sealed into the head plate and shall isolate these in the event of a flood.

5.2 Hydrogeology

In this section the ground beneath the site is divided into hydrogeological units which are in turn considered in terms of the presence, abundance, movement and potential to sustain a new groundwater abstraction. Each unit is considered as it is reached with depth below the site. The borehole as constructed is documented in Table 5.

The study has considered the different strata present beneath the site in terms of their hydrogeological conditions in order to set the hydrogeological context to the now established groundwater abstraction. The drilling log, with historical records have been used to confirm the hydrogeological setting, where there are no boreholes or abstractions locally which can be used directly to judge the potential of the ground, BAHS Ltd use information derived from representative abstractions completed into comparable hydrogeological settings.

Hydrogeological Unit(s): Soil & shallow horizons - dry & weathered

Hydrogeological Description: N/A

RWL: c.60 maOD

T range: N/A

Comments:

The hydrogeological characteristics of the soil and shallow horizons in the study area indicate that these layers are predominantly dry and weathered. The water level is approximately 60 metres above ordnance datum. The shallow ground typically remains dry or only moist, containing minimal amounts of water that accumulate following periods of rainfall. This water naturally migrates downward to the permanent water table. Due to the predominantly dry conditions of the shallow ground, it is not feasible to sustain any measurable scale of groundwater abstraction using a modern conventional borehole.

Hydrogeological Unit(s): Weald Clay Formation

Hydrogeological Description: Aquitard

RWL: Dry

T range: N/A

Comments:

The Weal Clay Formation is characterised as an aquitard, indicating its low permeability and limited capacity to transmit water. This formation is typically dry, suggesting minimal groundwater presence or movement within its structure. The hydrogeological properties of the Weald Clay Formation make it an effective barrier to fluid flow, thereby influencing the regional groundwater dynamics and potentially impacting the hydrological balance in areas where it is present.

Hydrogeological Unit(s): Tunbridge Wells Sand Formation
Hydrogeological Description: Secondary A Aquifer
RWL: 35 to 40 maOD
T range: 3 to 12 m²/day
Comments:

The Tunbridge Wells Sand Formation, classified as a Secondary A Aquifer, exhibits water levels ranging from 35 to 40 metres above ordnance datum. Groundwater within this formation is present in both pore spaces and the joints and fractures that permeate the rock. Notably, the porosity, as well as the extent of jointing and fracturing, diminishes with increasing depth. Despite this, the unit remains fully saturated under natural conditions, ensuring a consistent water supply. There is no associated risk with drilling the borehole deeper than initially designed, as no water loss would occur. This hydrogeological unit demonstrates significant potential for sustaining new, reliable groundwater abstraction. Testing of the newly drilled borehole has confirmed its capacity to comfortably support an abstraction rate of 20 cubic metres per day (see Section 6).

This Appraisal confirms the new borehole targets the Tunbridge Wells Sand Formation for the purpose of groundwater abstraction. Based on water level and abstraction records from the borehole and other local boreholes passing through comparable ground; this Appraisal estimates a Transmissivity (T) range in the local area of 3 to 12 m²/day.

Using a conservative T value, a 10 metre drawdown in water levels below a rest water level of 35 to 40 maOD; a yield of 0.8 cubic metres per hour has been demonstrated to be sustainable. The following table summarises the above values and the borehole as drilled:

Rest Water Level	21 to 26 mbgl	Or	35 to 40 maOD
Drawdown in water levels (m)	10		
Transmissivity Range (m ² /day)	3	To	12
Potential yield range (m ³ /hour)	0.8		
Drill depth range (m):	104		

Table 4: Hydrogeological Properties

6 Yield Testing & Analysis

Pump testing of boreholes is completed to measure the sustainable yield a borehole can maintain under the conditions at the time of testing. This provides the owner with confidence in the reliability of their supply, and the regulator with the information they need to understand the risk associated with a private water supply drawn from the borehole.

At the time of testing an extended constant rate test was completed on the borehole over a period of just over three days with the average abstraction rate being $0.842 \text{ m}^3/\text{hour}$. This test confirmed the borehole could maintain a daily abstraction of $20 \text{ m}^3/\text{day}$, however the test was not completed in line with the British Standard Iso 14686:2003. During the test water levels were lowered by 2 metres from a rest water level of 22 metres below ground level.

Testing was repeated on the 17th September 2024 in line with the British Standard. Pre-test measurements found water levels did not change over the preceding 48 hours, at 23.00 metres below ground level. The test was maintained for nearly 8 hours at a near constant abstraction rate with measurements made initially every minute, reducing to every 2 minutes, then 5 minutely, 10 minutely, 20 minutely and finally every 50 minutes. The following graph illustrates the drawdown in water levels due to pumping at an average rate of $1.6 \text{ m}^3/\text{hour}$.

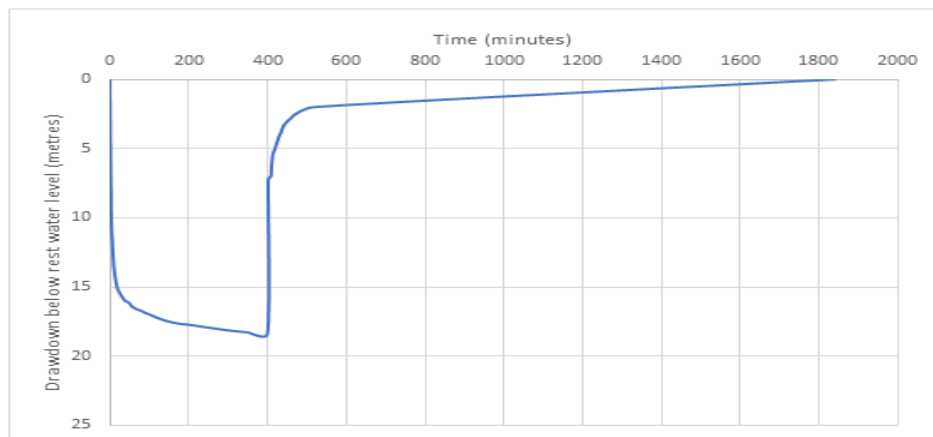


Figure 3: Pump test graph

The test was completed in line with the British Standard confirming the hole performs very similarly to measurements made in 2023 showing the conditions remain constant. The drawdown levelled off at the equivalent of $38 \text{ m}^3/\text{day}$, thus able to sustain substantially more than 20 cubic metres a day. This appraisal thus concludes this is a reliable and sustainable source of water.

7 Water Quality

On completion of the borehole in July 2023, the hole was purged and a sample analysed to establish the quality of groundwater present, testing was repeated in September 2024. BAHS sample, and test, water quality from boreholes and wells across the United Kingdom and have built up an extensive database of results. Test results from the closest comparable boreholes, wells and springs to the site assessed have been used to compared with measurements made in the new borehole. UK values are the Drinking Water Standards defined by relevant regulations and standards.

Parameters	2023	2024	Concentrations Measured Locally					UK Limit	Unit	Over Limit
			Min	-	Max	Average	Median			
Alkalinity	458	458	59	to	458	255	216	-	mg/l	
Aluminium	<20	<20		<20		<20	<20	200	µg/l	
Calcium	2.0	1.6	1.6	to	36.5	11	4	-	mg/l	
Chloride	59.7	61.1	31.1	to	61.1	47	42	250	mg/l	
Chromium	<30	<30		<30		<30	<30	50	µg/l	
Copper	<100	<100		<100		<100	<100	2000	µg/l	
Cyanide	<10	<10		<10		<10	<10	50	µg/l	
Fluoride	3660	3480	3480	to	3660	3570	3570	1500	ug/l	*
Total Iron (FeII+FeIII)	923	604	91	to	3610	1090	604	200	µg/l	*
Lead	<1	<1		<1		<1	<1	10	µg/l	
Magnesium	0.49	0.24	0.24	to	12	5	4	-	mg/l	
Manganese	6	<5	5	to	706	152	6	50	µg/l	*
Nitrate	<22	<22		<22		<22	<22	50	mg/l	
Nitrite	<50	<50		<50		<50	<50	500	µg/l	
Phosphate	1.34	1.43	0.05	to	1.43	1	0	-	mg/l	
Potassium	9.25	<8.00	8	to	10.7	10	9	-	mg/l	
Sodium	250	240	27	to	250	133	110	200	mg/l	*
Sulphate	70.1	<40.0	40	to	150	112	150	250	mg/l	
Sulphide	<0.1	<0.1		<0.1		<0.1	<0.1	-	mg/l	
Zinc	<0.02	<0.02		<0.2		<0.2	<0.2	-	mg/l	
Electrical Conductivity	1038	987	234	to	1038	642	576	2500	µS/cm	
Hardness, Total, as CaCO3	7	5	5	to	140.7	46	24	-	mg/l	
pH	8.84	8.9	7.27	to	8.9	8	8	6.5-9.5	pH units	
Total Dissolved Solids	511	515	157.6	to	515	328	280	-	mg/l	

Table 5: Indicative water quality

Based on the concentrations measured in samples collected from the borehole and other local boreholes, wells, and springs originating from the same geological horizon, water treatment is necessary to reduce the levels of fluoride, iron, manganese, and sodium, which have been found to be close to or exceeding the UK drinking water limits.

Specifically, fluoride concentrations range from 3480 to 3660 µg/l (limit: 1500 µg/l), iron from 91 to 3610 µg/l (limit: 200 µg/l), manganese from 5 to 706 µg/l (limit: 50 µg/l), and sodium from 27 to 250 mg/l (limit: 200 mg/l). Treatment has been designed for this borehole consisting of reverse osmosis which involves passing the water through a very fine membrane. The membrane captures most substances within/dissolved in water making it a very soft, pure water. Along with pH balancing and remineralisation, this process will make the water wholesome and suitable for any potable purpose.

The confined nature of the Tunbridge Wells Sand Formation means the water being abstracted is not new or recently entered the ground as either rainfall recharge or from another source. Rather, the water present is old and not influenced by activities over the recharge area to the north-east. Concentrations of nitrite and nitrate below detection levels, combined with high levels of fluoride, sodium and other raised parameters are all indicative of 'old' water.

For this reason, it is the professional opinion of BAHS that this water would be free from modern contamination such as pesticides, fertilizers, herbicides, PFOS, etc. On a risk-based approach and due to the proposed use of membrane treatment, BAHS recommend against testing for such parameters and only considering testing them at the time of commissioning when a full UKAS analysis will be completed in compliance with the Private Water Supply Regulations.

8 Regulatory Considerations

8.1 Licensing

In England the Environment Agency (EA), and Natural Resources Wales (NRW) in Wales, have assessed the available surface water and groundwater resources within each river and groundwater management unit (catchments). The status of each unit or catchment is documented in a corresponding Catchment Abstraction Management Strategy (CAMS). Some of the units have been assessed as having water available, which means that the EA or NRW will consider an application for a licence to abstract surface or groundwater, on a case-by-case basis, dependent on the effects of the new abstraction on other existing abstractors and the environment, in the vicinity.

Other units may be deemed as either over abstracted or over licensed, and there is an over-arching stance in these areas that applications for consumptive groundwater abstraction licences would be refused under these CAMS policies. There are, however, some circumstances where licences may be granted for abstraction at certain times of the year, dependent on hydrological conditions, and possible restrictions imposed on the licences. Applications for licences for open loop ground source heating systems may be considered in all surface water and groundwater units providing the water will be returned to the source and there would be no detrimental effects arising from the proposal.

There is a different system in Scotland operated by the Scottish Environment Protection Agency (SEPA). The following forms a guide taken directly from SEPA publications, with interpretation by B. A. Hydro Solutions Ltd. Boreholes and wells come under the Controlled Activity Regulations (CAR) and their further amendments. It is up to the client or their approved representatives to seek authorisation from SEPA and must prove that any abstraction is sustainable and is not detrimental to the local environment.

Boreholes abstracting less than 10 cubic metres per day will fall under the General Binding Rules and are considered low risk to the environment and do not require registration.

A borehole drawing between 10 and 50 cubic metres per day requires registration, which will require an application to SEPA and incur a fee. A borehole abstracting between 50 and 2000 metres cubed per day would require a simple licence and an abstraction of over 2000 metres cubed per day would require a complex licence. A licence depends on the identification of a responsible person, who must ensure compliance with the conditions of the licence. An application charge will apply, and the activity may also be subject to an annual subsistence charge.

As this Appraisal is for an abstraction not exceeding 20 cubic metres a day, the relevant CAMS and resource status for this site has not been determined (10 cubic metres a day in Scotland). An abstraction of up to 20 m³/day in England and Wales does not require a licence, the limit being 10 m³/day in Scotland; this allows a cumulative abstraction up to the relevant volume per day from any combination of springs, surface water, boreholes, well, etc., per relevant property deed.

8.2 Permitting

The EA are moving most regulated activities to a permit-based system which will include abstraction licenses. At present permits are needed for certain activities in close proximity to watercourses and/or where there is a release to the environment. This can include soakaways, direct and indirect discharges to groundwater, open loop ground source heating/cooling systems and drainage activities. It may be possible to avoid a formal permit by ensuring compliance with general binding rules, please refer to the EA, NRW or SEPA websites.

Ground source heating and cooling systems shall be covered by a permitting system with exemptions where compliance with general binding rules can be achieved. At the time of reporting the general binding rules had not been confirmed, BAHS recommends seeking clarification prior to commencing projects that may be affected.

8.3 Source Protection Zone(s)

Source Protection Zones (SPZs) indicate the presence of sensitive licensed groundwater abstractions from the underlying aquifer(s), often those used for public/private potable supply. The EA and NRW use these zones in conjunction with their Groundwater Protection Policy (GP3) to set up pollution prevention measures in areas which are at high risk, and to monitor the activities of potential polluters nearby that may result in contamination of these sources.

Is site within a SPZ:	No
SPZ number:	N/A

Table 6: Source Protection Zones

Based on the SPZ status beneath the site, this Appraisal provides the following guidance:

Although this site is not within a Source Protection Zone, a new borehole should be correctly grouted, headworks sealed and any activities that could pose a risk of contamination must be excluded from around the borehole. For example no soakaways, chemical stores, heating oil storage, septic tanks, etc., within 50 metres of the borehole, and no livestock kept within 20 metres of the borehole.

8.4 Coal Authority Reporting & Permitting

Where a site is underlain by coal bearing strata and strata termed Coal Measures, a Coal Authority Report is recommended to determine whether there are any known mine workings or shafts on or beneath the property. This report will also inform whether a permit to drill is needed to complete the planned drilling work.

This site is not within a Coal Mining Reporting Area. There is therefore no reason to contact the Coal Authority (CA) and a permit to drill from the CA is not needed.

8.5 Bylaws

There are some local bylaws which prohibit or limit drilling within certain areas. This Appraisal cannot provide a definitive list of bylaws, if any may exist that could affect activities on the site, the LA should be consulted in advance of drilling works.

BAHS are not aware of any bylaws that apply to groundwater abstractions/drilling in this area. When consulting with local drilling contractors BAHS recommend raising this with them and/or checking with your Local Authority or planning department.

8.6 Private Water Supply Regulations

A private water supply feeding a commercial activity where the water is also used for potable purposes must be registered with the Local Authority's Environmental Health Department. The Environmental Health will consider the supply when they are consulted/involved with other activities, planning applications, development, pollution incidents, etc., in the vicinity.

The Local Authority are responsible for administering and enforcing the Private Water Supplies (England) Regulations 2016, Private Water Supplies

(England)(Amendment) Regulations 2018 and The Private Water Supplies (Wales) Regulations 2017. It is normally the Environmental Health Department and their officers who undertake the inspections and enforcement works.

The Local Authority are responsible for completing a risk Appraisal on the private water supply once every 5 years to identify any defects, issues in the immediate vicinity or risks posed from further away that may compromise the quality of water being supplied. Based on the risk Appraisal the Local Authority will define a list of water quality parameters and the frequency they must be tested to confirm parameters are present at concentrations below the UK Drinking Water Limits.

If there are defects or improvement works the Local Authority deem to be necessary they will work with the water undertaker to agree a plan to resolve/upgrade/make corrections within an appropriate timeframe. If the works are not completed the Local Authority can issue enforcement notices and/or prevent the water supply being used.

8.7 Borehole Registration

There is a requirement under the Water Resources Act 1991 (as amended by the Water Act 2003) that boreholes are registered with the British Geological Survey and the Environment Agency.

The borehole at the site has been registered and a copy of the form (BGS ID: 21494334 : BGS Reference: TQ12NE165) can be found within the Water Supply Feasibility Study completed by RSK.

8.8 Site Specific Regulations

There are documented concerns that a number of conservation areas are at risk of deteriorating as a result of changes to the hydrogeological and hydrological environment. There is reason to believe the abstraction of water by water undertaker is having an adverse effect on the conservation areas. At present it cannot be demonstrated beyond doubt that the existing abstractions are having an affect, consequently Natural England advise that developments within this affected zone must not add to this impact.

For a new development to not have an adverse effect it must be water neutral [quality and quantity]. The definition of water neutrality is the use of water in the supply area before the development is the same or lower after the

development is in place (Natural England's Position Statement for Applications within the Sussex North Water Supply Zone, September 2021 – Interim Approach).

This document does not constitute a Water Neutrality Report and cannot be used to demonstrate neutrality. The implications of the new borehole and work to document the water neutrality has been undertaken by RSK, please refer to their undertakings which state this abstraction would be water neutral.

9 Appraisal Summary

B. A. Hydro Solutions Ltd. has been commissioned to complete a Hydrogeological Appraisal to document the hydrogeological setting of the newly drilled abstraction borehole for a private water supply. This study has collected and assessed all available information at the time of production.

Please refer to:

- Section 3 for geological & structural summary,
- Section 4 for discussion on the lithology beneath the site,
- Section 5 for discussion on the hydrological and hydrogeological setting,
- Section 6 for discussion on yield testing and sustainability,
- Section 7 for discussion on the anticipated water quality,
- Section 8 for relevant regulatory information, and

The findings from this study are listed below:

Strata	Thickness (m)	Max Depth (m)
Weald Clay Formation	63 to 65	65
Tunbridge Wells Sand Formation	>50	>115
Target horizon for borehole:	Tunbridge Wells Sand Formation	
Shallowest anticipated drill depth:	104	metres
Maximum anticipated drill depth:	104	metres
Recommended primary casing depth:	60	metres
Recommended screen depth:	To Base	metres
Gravel or Formation pack:	Filter Pack	
Anticipated rest water level:	35 to 40	maOD
Anticipated transmissivity range:	3 to 12	m ² /day
Anticipated yield range:	0.8 to 3.1	m ³ per hour
Water Quality Summary:	Fair	
Problematic water quality parameters:	Fluoride, Iron, Manganese and Sodium	
Direction of Groundwater Flow:	South	

Table 7: Summary table

Between the 11th July and the 18th July 2023 a borehole was drilled at this site to provide a potable water supply of up to 20 cubic metres a day. The borehole was test pumped at the time, although limited water level measurements were collected, nonetheless the hole was found to be able to sustain a daily total of 20 cubic metres of water.

The borehole was retested for 8 hours on the 17th September 2024 in line with BS ISO 14686:2003 in order to measure more accurately the sustainable yield and to allow more comprehensive analysis of the test data. Result confirmed the hole able to sustain an abstraction rate of at least 1.6 cubic metres an hour with a drawdown in water levels of around 18 metres.

Water quality analysis of samples taken in 2023 and 2024 from the borehole show the source to have raised concentrations of fluoride, iron and sodium for which treatment has been specified. The proposed use of a membrane treatment system (reverse osmosis) will remove the problematic water quality and reduce the concentrations of all other parameters, the treatment will re-mineralise the water, balancing the pH and making it a good source of wholesome water.

The borehole, as installed, is illustrated in Figure 3; this shows the drill depth and diameters, depth of casing and screen installed, the geological sequence and water levels in the borehole.

Flooding from groundwater is unlikely in this area as the hydrogeological setting means under normal conditions groundwater is not shallow enough to cause problems. Water levels could only rise to problematic levels following prolonged, and extreme wet conditions.

The overall flood risk for this site is assessed as being LOW; the borehole shall be completed above ground level. Dip points, cable entry points, breather pipes, etc shall be sealed into the head plate and it shall be sealed/isolated in case of flooding.

Although this site is not within a Source Protection Zone, the borehole was correctly grouted, headworks sealed and any activities that could pose a risk of contamination are excluded from around the borehole.

A private water supply feeding a commercial activity where the water is also used for potable purposes must be registered with the Local Authority's Environmental Health Department. The Environmental Health will consider the supply when they are consulted/involved with other activities, planning applications, development, pollution incidents, etc., in the vicinity.

While this Appraisal does not constitute a formal risk assessment, the document establishes that the borehole has been appropriately drilled to safeguard the quality of groundwater within the Tunbridge Wells Sand Formation. The yield is sustainable and the quality can be made wholesome with the proposed treatment.

This document is not a Water Neutrality Report and cannot be used to demonstrate neutrality. Works have been undertaken by RSK to assess the water neutrality of the proposed scheme, utilising the borehole as a source of

water. They conclude the groundwater abstraction would make the scheme water neutral with no impact on the conservation sites being protected by the water neutrality zone.

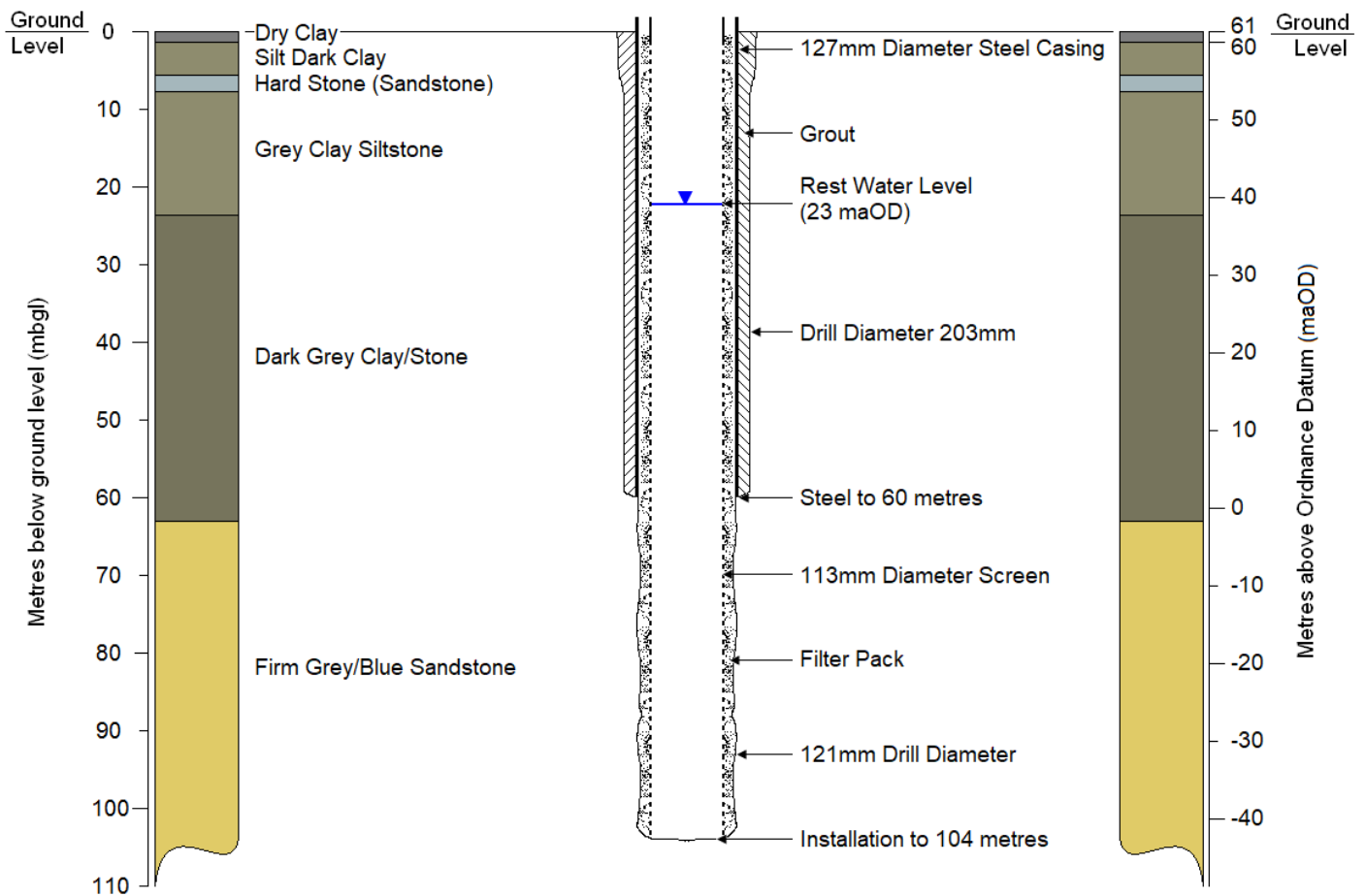


Figure 4: Outline borehole design

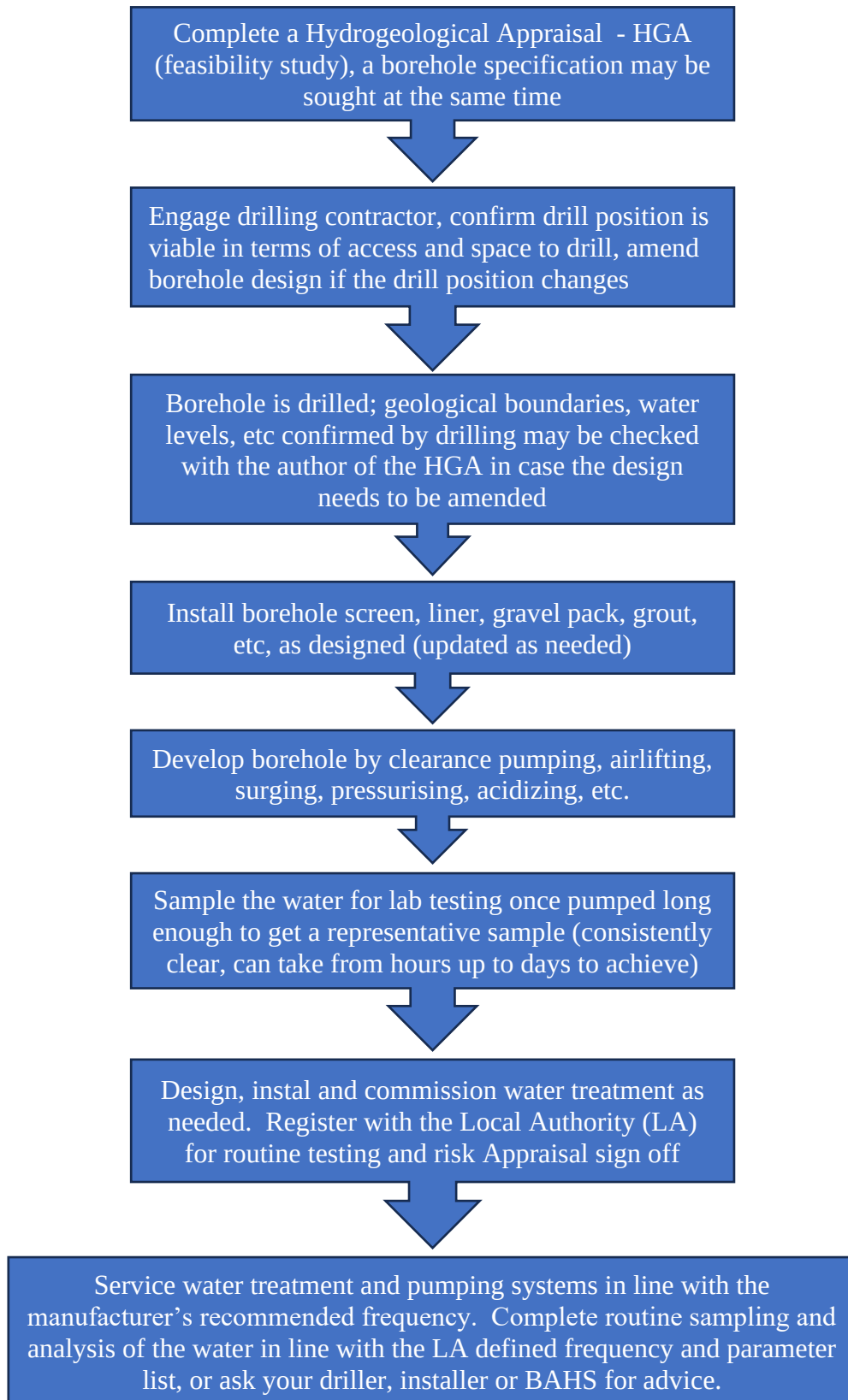
Disclaimer – The Copse, Worthing Road, Horsham, RH13 9AT

Information within this Hydrogeological Report has been gathered from all sources available to B. A. Hydro Solutions Ltd. Discussion and interpretation is the professional opinion of B. A. Hydro Solutions Ltd. based on information and data provided by the client plus the best available information collected specifically for this study.

If the client wishes to drill a borehole based on the information contained within this report B. A. Hydro Solutions Ltd. must stress no guarantee can ever be given that groundwater will be present, or that the quantity or quality of groundwater required will be available for abstraction. B. A. Hydro Solutions Ltd. cannot guarantee the ground conditions discussed/used (as drawn from research undertaken) are directly comparable to the ground beneath the site. Groundwater quantities/qualities, ground properties including thermal potentials can vary seasonally and as a result of external factors beyond our control and not foreseen by this study.

SEPTEMBER 2024

Guide to Drilling & Managing Your Borehole



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Additional Information 1 – Licensing Restriction

BAHS Ltd. have been instructed to complete a Hydrogeological Appraisal for use in the development of a proposed new groundwater borehole. A borehole for abstraction purposes requires an abstraction licence if quantities exceed 20 m³/day.

Licences are awarded by the Environment Agency (EA) following a detailed review of the availability of the resource in the specific area. The country is divided into river catchments that are individually assessed to determine the total surface and groundwater resource that can be theoretically abstracted while maintaining sufficient levels or flows to protect or enhance the environment. Resources are then licensed up to the limit deemed sustainable by the Environment Agency.

Additional Information 2 – Hydrogeological Terms

The hydrogeological properties of strata and the ground as a whole is a function of its permeability and the ease at which water is able to move through the various strata. The ground can broadly be divided into three hydrogeological rock types, the aquifers which contain water, aquitards which can contain water but restrict the movement of water and aquicludes which do not contain water and act as a barrier to groundwater movement.

Groundwater moves through the ground via either pore spaces in the rocks, fractures and joints which dissect the strata or sometimes through solution features such as caves. The interconnectivity of the pores, joints, fractures and solutions features determines the amount of water which can accumulate and the ability of the ground to transmit.

The storage potential of the ground is described by its *storativity* [S] which is a dimensionless value ranging from zero up to one. The larger the number the greater the proportion of the saturated ground, in terms of total volume, which can be drained by lowering the water table. If the storativity was one it would be space entirely filled with water and no rock.

When the storativity is very low or zero there is no space in which water can accumulate or none of the water in the ground can be abstracted by lowering the water table. Due to the number of observations needed to quantify the storativity of the ground it is uncommon to be able to derive such values from historical data.

The ground's ability to transmit water is measured by its *transmissivity* [T], the larger the number the easier the water is able to move through the rocks. Theoretically there is no maximum T value, practically it is limited by the aquifer thickness, the volume of water in the aquifer and the capacity of the borehole and pump used to test the ground conditions.

The productivity of boreholes is simplistically measured by its *specific yield* [Sy] which is a measure of the sustainable yield a borehole can deliver per day per metre the water table is lowered. This can easily be derived from measurements recorded during pump tests or reported steady state yield and drawdown values.