GeoReports

British Geological Survey

Example Report
BGS Wallingford

Ground Source Heat Pump - vertical closed loop:

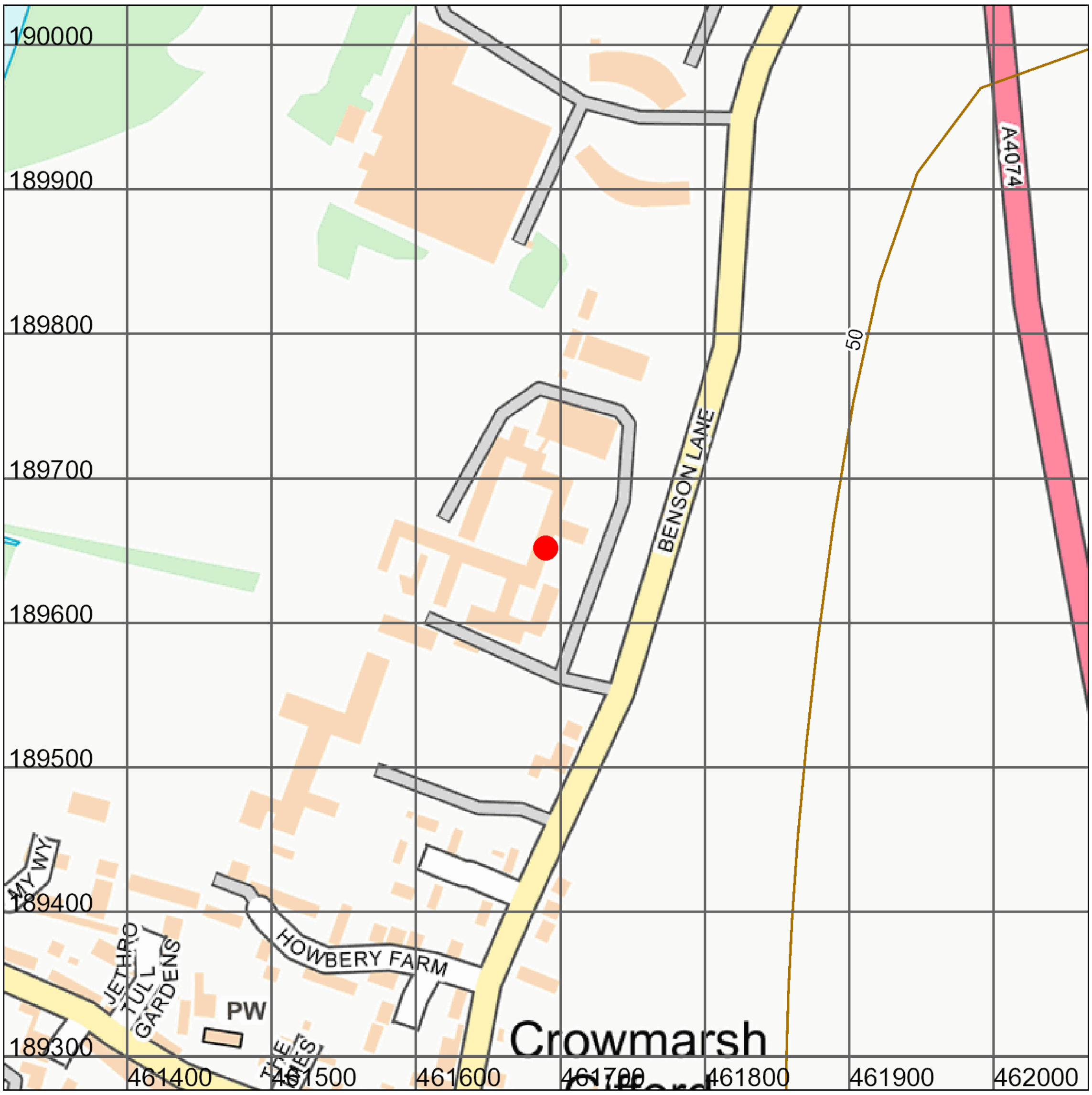
This report is designed for users proposing to install ground source heating using a closed vertical loop. This report contains an evaluation of the geological formations beneath the site including information on the temperature and interpreted thermal properties data for the geological units at depth. It also contains recommendations on the design of the proposed borehole and information on the legal requirements.

Modules:
Geological Map Extracts
Borehole prognosis (point)
Temperature and Thermal properties detailed
Geoscience Data list

Report Id: ***GR_999999/1***

Client reference:

Search location



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Search location indicated in red

Site Address:

British Geological Survey

Wallingford

Point centred at: 461690,189652

Geological Map Extracts 1:10,000 Scale

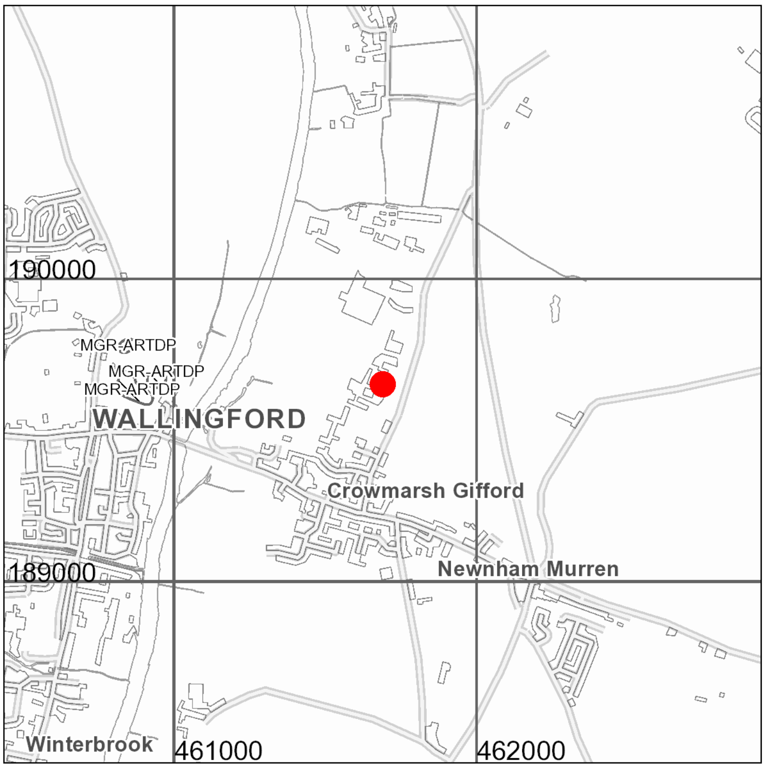
This part of the report contains extracts of geological maps taken from the 1:10 000 scale BGS Digital Geological Map of Great Britain (BGS Geology 10k). The geological information in BGS Geology is divided into four themes: artificial ground, landslide deposits, superficial deposits and bedrock, shown here in separate maps. The fifth 'combined geology' map superimposes all four of these themes, to show the uppermost geological formations.

More information about BGS Geology 10k is available here http://www.bgs.ac.uk/products/digitalmaps/DiGMapGB_10.html and information on the BGS geological classification schemes here http://www.bgs.ac.uk/bgsrcs/. The maps are labelled with two-part computer codes that indicate the name of the geological unit and its composition. Descriptions of the units listed in the map keys may be available in the BGS Lexicon of Named Rock Units (http://www.bgs.ac.uk/lexicon/). If available, these descriptions can be found by searching against the first part of the computer code used on the maps. Please consult the legend and the codes on the map in areas of complex geology. If in doubt, please contact BGS Enquiries for clarification.

In the map legends the geological units are listed in order of their age, as defined in the BGS Lexicon, with the youngest first. However, where units are of the same defined age they are listed alphabetically and this may differ from the actual geological sequence.

Artificial ground

This is ground at or near the surface that has been modified by man. It includes ground that has been deposited (Made Ground) or excavated (Worked Ground), or some combination of these: Landscaped Ground or Disturbed Ground.



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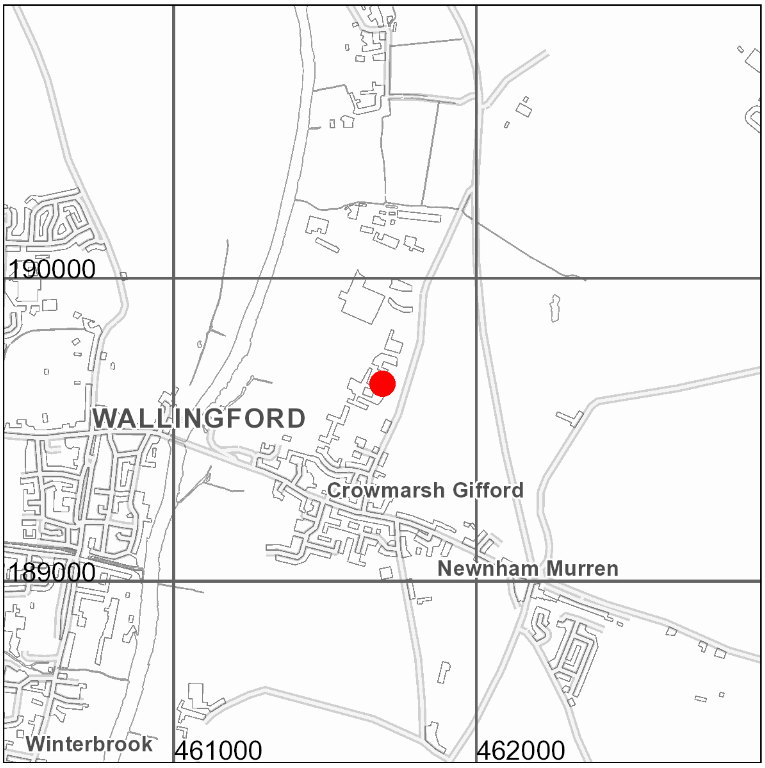
Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Key to Artificial ground:

Map colour	Computer Code	Name of geological unit	Composition
	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

Landslide deposits

These are deposits formed by localised mass-movement of soils and rocks on slopes under the action of gravity. Landslides may occur within the bedrock, superficial deposits or artificial ground; and the landslide deposits may themselves be artificially modified.



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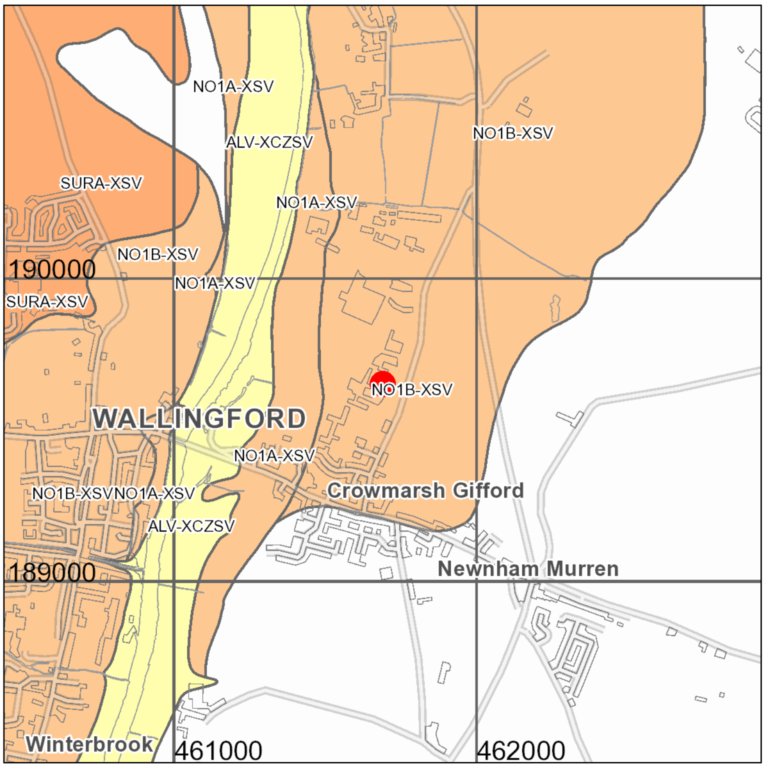
Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Key to Landslide deposits:

No deposits found in the search area

Superficial deposits

These are relatively young geological deposits, formerly known as 'Drift', which lie on the bedrock in many areas. They include deposits such as unconsolidated sands and gravels formed by rivers, and clayey tills formed by glacial action. They may be overlain by landslide deposits or by artificial deposits, or both.



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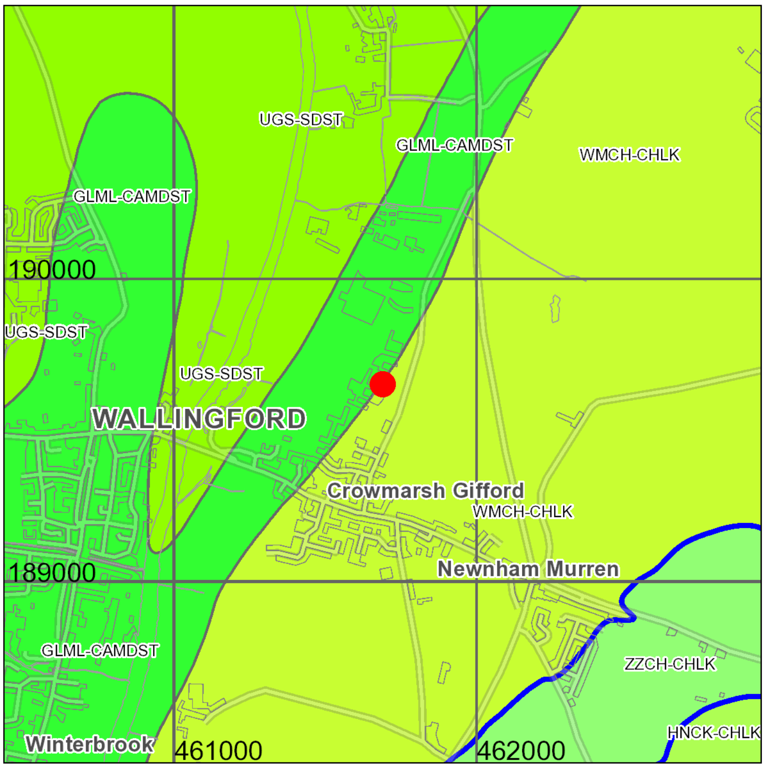
Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Key to Superficial deposits:

Map colour	Computer Code	Name of geological unit	Composition
	ALV-XCZSV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
	SURA-XSV	SUMMERTOWN-RADLEY SAND AND GRAVEL MEMBER	SAND AND GRAVEL
	NO1A-XSV	NORTHMOOR SAND AND GRAVEL MEMBER, LOWER FACET	SAND AND GRAVEL
	NO1B-XSV	NORTHMOOR SAND AND GRAVEL MEMBER, UPPER FACET	SAND AND GRAVEL

Bedrock

Bedrock forms the ground underlying the whole of an area, commonly overlain by superficial deposits, landslide deposits or artificial deposits, in any combination. The bedrock formations were formerly known as the 'Solid Geology'.



Search area indicated in red

Fault

Coal, ironstone or mineral vein

Note: Faults are shown for illustration and to aid interpretation of the map. Because these maps are generalised from more detailed versions not all such features are shown and their absence on the map face does not necessarily mean that none are present. Coals, ironstone beds and mineral veins occur only in certain rock types and regions of the UK; if present here, they will be described under 'bedrock' below.

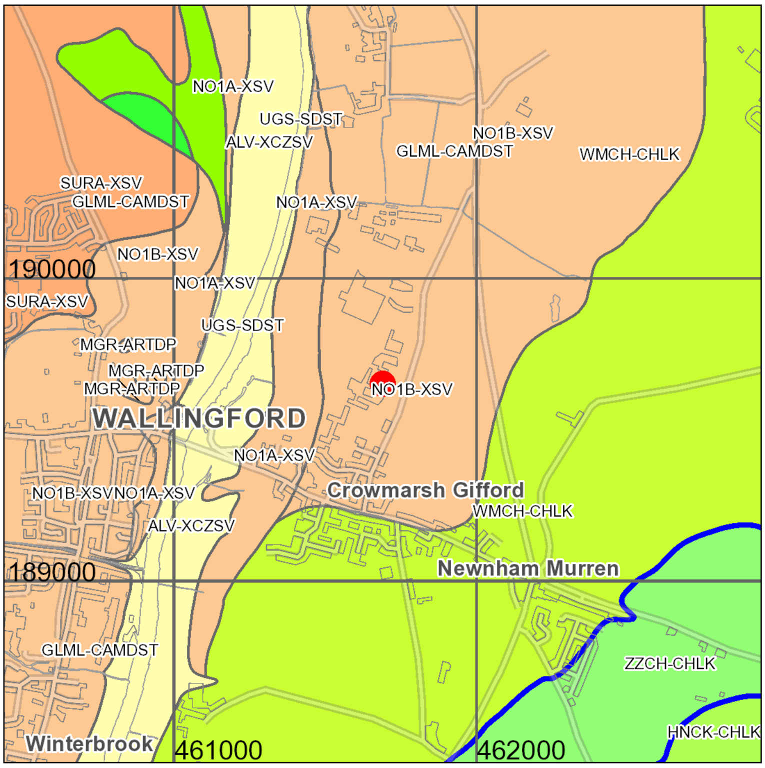
Scale: 1:25 000 (1cm = 250 m)

Key to Bedrock geology:

Map colour	Computer Code	Name of geological unit	Rock type
	GLML-CAMDST	GLAUCONITIC MARL MEMBER	CALCAREOUS MUDSTONE
	HNCK-CHLK	HOLYWELL NODULAR CHALK FORMATION AND NEW PIT CHALK FORMATION (UNDIFFERENTIATED)	CHALK
	WMCH-CHLK	WEST MELBURY MARLY CHALK FORMATION	CHALK
	ZZCH-CHLK	ZIG ZAG CHALK FORMATION	CHALK
	UGS-SDST	UPPER GREENSAND FORMATION	SANDSTONE

Combined 'Surface Geology' Map

This map shows all the geological themes from the previous four maps overlaid in order of age.



Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Please see the Keys to the Artificial, Landslide, Superficial and Bedrock geology maps.

Borehole Prognosis

This module provides an evaluation of the expected geological sequence beneath a site to a depth appropriate for the specified use. This interpretation is based on the information available in the surrounding area. Due to natural geological variation the conditions encountered on drilling may differ. This module does not cover the possibility of artesian conditions or gas being encountered. (Information on artesian conditions is included in the 'Groundwater abstraction' and 'Hydrogeology – non abstraction' modules).

Setting:

The site lies at an elevation of about 48 m above Ordnance Datum (OD) on the edge of the village of Crowmarsh Gifford. The proposed borehole site lies about 450 m east of the River Thames that flows approximately north to south at an elevation of about 44 m above OD. The site is about 300 m east of the Thames flood plain. There are open drains in places on the nearby flood plain, and also a longer open drain flowing from east to west, about 500 m north of the site.

Geology

It is anticipated that the following succession of strata will be encountered in a deep borehole below the site:

Unit	Typical composition	Potential for difficult ground i.e possible running sands possible undermining or possible dissolution	Thickness in metres	Depth in metres to the base of the unit
Artificial ground				
Made Ground	Unknown		Up to 1 m	Less than 1 m
Superficial deposits				
Northmoor Sand and Gravel Member (upper facet)	Sand and gravel	Possible running sands	Up to 5 m	Less than 6 m
Bedrock (below rockhead)				
West Melbury Marly Chalk Formation	Grey marly (clay-rich) chalk with thin limestone beds		Up to 2 m	Less than 8 m
Glauconitic Marl Member	Pale brownish-grey clay-rich chalk marl with grains of glauconite; commonly contains phosphatic pebbles		Up to 2 m	Less than 10 m
Upper Greensand Formation	Dark green glauconitic sand and sandstone with a clay matrix underlain by whitish, micaceous, calcareous siltstone and fine-grained sandstone with some chert and siliceous sandstone ('malmstone')		About 15 m	Less than 25 m

Gault Formation	Grey, silty mudstone; silty towards top, gravelly at base		About 60 m	Less than 85 m
Lower Greensand Group	Coarse-grained, ferruginous, quartzose sand with small quartzite pebbles; locally passes into sandy clay	Possible running sands	Less than 8 m	Less than 93 m
Portland Formation	Sand and limestone	Possible running sands	Probably absent	
Kimmeridge Clay Formation	Silty mudstones, some sandy		About 35 m	Less than 128 m

The blue line in this table indicates 'rockhead', which is the base of superficial deposits. This is the 'geological rockhead', as distinct from the 'engineering rockhead', which is the base of 'engineering soil' (in the sense of BS5930:1999).

For further definitions of stratigraphic terms that appear in the table above, on our maps and in our publications please see 'The BGS Lexicon' www.bgs.ac.uk/lexicon

Information on the distribution of contaminated ground is not held by BGS but by the relevant Local Authority.

Potential drilling hazards considered at your site

This section of the report only describes geological hazards that might be directly encountered by drilling at this site.

Running sand conditions hazard

Running sand conditions occur when loosely-packed sand moves as a result of water flowing through the spaces between the sand grains. The pressure of the flowing water reduces the contact between the grains and they are carried along by the flow. Excavations or boreholes in water-saturated sand are likely to encounter running conditions: the sand will tend to flow into the void. This can lead to subsidence of the surrounding ground.

Temperature and Thermal Properties (Detailed)

This module provides temperature and interpreted thermal properties data for the geological units at depth.

Surface temperature

The temperature of the ground determines the temperature gradient within the collector loops of the ground source heat pump. The UK Meteorological Office collects and archives climate temperature data. Monthly and annual long-term average datasets have been generated for the periods 1961-1990 and 1971-2000. Mean annual air temperatures at sea level in mainland UK varies from north to south from about 8 – 12 °C and the January - July mean air temperature swing for much of the UK is less than 15 °C. Mean annual air temperatures show a general decrease eastwards and northwards from highest values in the south-west of England. Mean annual air temperatures are mainly affected by position and elevation. Since the contribution to surface temperature from the heat conducted upwards from the sub-surface is very small, the mean annual ground surface temperature should be close to the mean annual air temperature although often shows a variation of ± 1 °C. Mean site temperature has been estimated using a model based on the 30-year station averages published by the UK Meteorological Office (UKMO) web site www.metoffice.gov.uk.

Sub-surface temperatures

Soil temperatures vary both diurnally and seasonally, the former variation fading out within a few 10s of cm and the latter at greater depths. At depths of about 15 m the temperature is approximately constant and equal to the mean annual air temperature. The temperature is transmitted down through the earth at a rate dependent on thermal diffusivity. Consequently the temperature in the near sub-surface has a progressive phase shift, i.e. at times of minimum air temperature ground temperatures are generally slightly higher and at times of maximum air temperatures ground temperatures are lower. Hence, at a depth of 3.5 m the minimum soil temperature is likely to be in the first two weeks of April and the maximum temperature about the end of October. The range of temperatures at 3.5 m depth is also likely to be about one quarter that at the surface. Soil temperatures at depth have been estimated using a soil diffusivity of 0.05 m^2 day^{-1}. Annual temperature swing is based on a model of the difference in mean January and July air temperatures derived from published UKMO long-term records.

At depths below about 15 m temperatures are affected by the small amount of heat conducted upwards from the sub-surface. In the UK this creates an increase of temperature with depth that has an average value of 2.6 °C per 100 m. This geothermal gradient will vary depending upon the nature of the rocks and their thermal properties. In addition moving groundwater can create warmer regions by transporting heat from depth, or cooler regions when cold water flows down from near the ground surface. Observed equilibrium temperature data for the UK indicate that some areas have stable ground temperatures of 15 °C at depths of 100 m. Conversely other regions show stable temperatures at 100 m depth of only 7 °C.

The mean observed equilibrium temperature for the UK at a depth of 100 m is close to 12 ±1.6 °C with a range of about 7-15 °C. Estimates of the temperatures at 100 and 200 m depths have been made from an estimate of the local heat flow and the thermal conductivity of the bedrock geology from the 1:250 000 scale geological map. It should be noted that anomalies caused by flowing groundwater are not included here.

Estimated temperature parameters of the site

Mean annual air temperature	10.1 °C
Mean annual temperature swing	8.3 °C
Estimated mean soil temperature	11.1 °C
Minimum annual soil temperature at 1 m	5.6 °C
Maximum annual soil temperature at 1 m	16.6 °C
Estimated temperature at 50 m depth	12 °C
Estimated temperature at 100 m depth	13 °C
Estimated temperature at 150 m depth	13.9 °C
Estimated temperature at 200 m depth	14.8 °C

Soil temperatures at 1 m estimated using a soil diffusivity of 0.05 m^2 day^{-1}.
Annual temperature swing based on mean January and July air temperatures.

Thermal properties
The rate at which heat is exchanged between the collector loop of the ground source heat pump and the ground is determined mainly by the thermal properties of the earth. Thermal conductivity is the capacity of a material to conduct or transmit heat, whilst thermal diffusivity describes the rate at which heat is conducted through a medium. For a horizontal loop system in a shallow (1-2 m) trench then the properties of the superficial deposits are important, whilst for a vertical loop system it is the properties of the bedrock geology that are important.

Thermal conductivity
Thermal conductivity varies by a factor of more than two (1.5 - 3.5 W m^{-1} K^{-1}) for the range of common rocks encountered at the surface. Superficial deposits and soils are complex aggregates of mineral and organic particles and so exhibit a wide range of thermal characteristics. The thermal conductivity of superficial deposits and soils will depend on the nature of the deposit, the bulk porosity of the soil and the degree of saturation. An approximate guide to the thermal conductivity of a superficial deposit can be made using a simple classification based on soil particle size and composition. Deposits containing silt or clay portions will have higher thermal conductivities than those of unsaturated clean granular sand. Clean sands have a

low thermal conductivity when dry but a higher value when saturated. For sedimentary rocks the primary control on thermal conductivity is the lithology of the sedimentary rock, porosity, and the extent of saturation. Mudstones have thermal conductivities in the range 1.2-2.3 W m^{-1} K^{-1}.

For chemical sediments and low porosity (<30%) shale, sandstone and siltstone the mean thermal conductivity is in the range 2.2-2.6 W m^{-1} K^{-1}. Water has a thermal conductivity of 0.6 W m^{-1} K^{-1} and air a thermal conductivity of 0.0252 W m^{-1} K^{-1}. A saturated quartz sandstone with 5% porosity might have a thermal conductivity of about 6.5 W m^{-1} K^{-1} but this would decrease to about 2.5 W m^{-1} K^{-1} if the rock had a porosity of 30%. Porosity is also the main influence on thermal conductivity of volcanic rocks. Low porosity tuffs, lavas and basalts may have values above 2 W m^{-1} K^{-1}, but at 10% porosity with water saturation this might reduce to about 1.5 W m^{-1} K^{-1}. For intrusive igneous rocks, which generally have a much lower porosity, the thermal conductivity variation is less. Intrusive rocks with low feldspar content (<60%), including granite, granodiorite, diorite, gabbro and many dykes, have a mean thermal conductivity of about 3.0 W m^{-1} K^{-1}. For metamorphic rocks, porosity is often very low and thermal conductivity can be related to quartz content. The thermal conductivity of quartzites is high, typically above 5.5 W m^{-1} K^{-1}. For schists, hornfels, quartz mica schists, serpentinites and marbles the mean thermal conductivity is about 2.9 W m^{-1} K^{-1}.

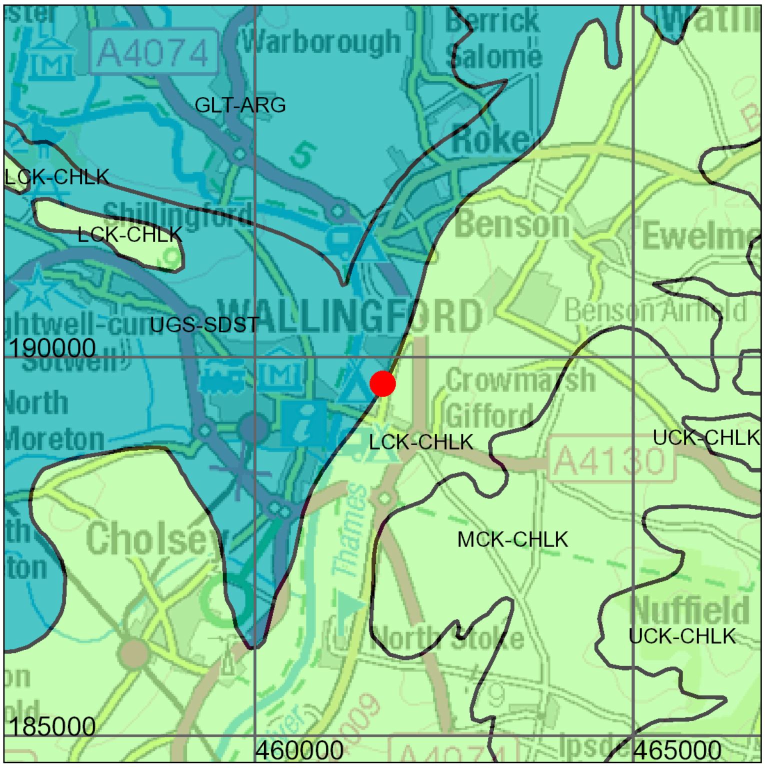
Thermal diffusivity
Typical rock thermal diffusivities range from about 0.065 m^2 day^{-1} for clays to about 0.17 m^2 day^{-1} for high conductivity rocks such quartzites. Many rocks have thermal diffusivities in the range 0.077–0.103 m^2 day^{-1}. Generally, thermal conductivity and specific heat are increased for saturated rocks and diffusivity is also enhanced.

Typical values of thermal conductivity and diffusivity for superficial deposits

Class	Thermal Conductivity W m^{-1} K^{-1}	Thermal diffusivity m^2 day^{-1}
Sand (gravel)	0.77	0.039
Silt	1.67	0.050
Clay	1.11	0.046
Loam	0.91	0.042
Saturated sand	2.50	0.079
Saturated silt or clay	1.67	0.056

W m^{-1} K^{-1} = Watts per Metre per Kelvin

Thermal conductivity-diffusivity (based on 1:250 000 Bedrock Geology map)



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Scale: 1:100 000 (1cm = 1000 m)
Search area indicated in red

Key to Thermal conductivity-diffusivity:

Map colour	Computer Code	Geological unit	Composition	Thermal conductivity W m^{-1} K^{-1}	Thermal diffusivity m^2 day^{-1}
	GLT-ARG	GAULT FORMATION	ARGILLACEOUS ROCKS, UNDIFFERENTIATED	2.18	0.098
	LCK-CHLK	LOWER CHALK FORMATION	CHALK	1.67	0.0745
	MCK-CHLK	MIDDLE CHALK FORMATION	CHALK	1.67	0.0745
	UCK-CHLK	UPPER CHALK FORMATION	CHALK	1.67	0.0745
	UGS-SDST	UPPER GREENSAND FORMATION	SANDSTONE	2.59	0.111

This mapping is based on the BGS Digital Map of Great Britain at the 1:250 000 scale (DiGMapGB-250), so the linework and formation names displayed may differ to a certain extent from those shown in other modules that are based on 1:50 000 scale mapping.

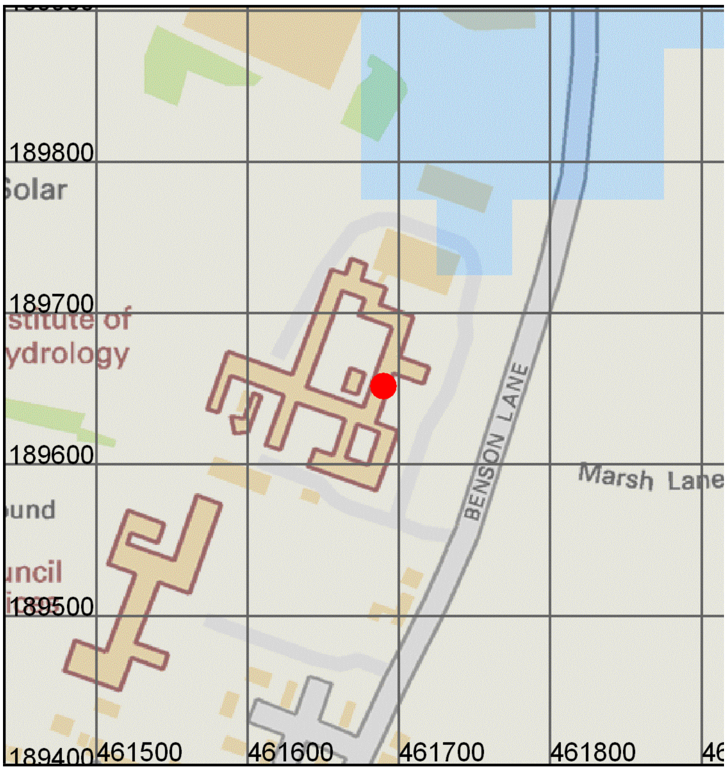
Site specific thermal conductivity-diffusivity values based on the Borehole Prognosis

Unit	Thermal conductivity W m^{-1} K^{-1}	Thermal diffusivity m^2 day^{-1}	Thickness in metres
West Melbury Marly Chalk Formation	1.67	0.0745	Up to 2 m
Glauconitic Marl Member	1.67	0.0745	Up to 2 m
Upper Greensand Formation	2.59	0.1110	About 15 m
Gault Formation	2.18	0.0980	About 60 m
Lower Greensand Group	2.59	0.1110	Less than 8 m
Portland Formation	2.1	0.0882	Probably absent
Kimmeridge Clay Formation	1.30	0.0509	Up to 35 m
Corallian Group-limestone	2.00	0.0783	About 25 m
Corallian Group-sandstone	2.23	0.0917	
West Walton and Oxford Clay Formations	1.30	0.0509	Over 90 m

A typical 150 m deep borehole would therefore penetrate 5 m of Northmoor Sand and Gravel Member (of which the basal 3 m would be saturated), 1 m of West Melbury Marly Chalk Formation, 2 m of Glauconitic Marl Member, 15 m of Upper Greensand Formation, 60 m of Gault Formation, 6 m of Lower Greensand Group, 35 m of Kimmeridge Clay Formation, 15 m of Corallian Group limestone, 10 m of Corallian Group sandstone and 1 m of West Walton and Oxford Clay Formations. It will have an average thermal conductivity of 1.85 W m^{-1} K^{-1} and average thermal diffusivity of 0.0845 m^2 day^{-1}.

Most ground source heat pump design techniques are based on the assumption that the heat will be dissipated by conduction. If heat advection due to groundwater flow is significant at a site it is likely that this will have a beneficial effect. The significance of advection is controlled by the hydraulic gradient, the hydraulic conductivity and the thermal conductivity of the saturated rock. In most aquifers advection will be significant except where the groundwater gradient is low; e.g. in coastal plains or confined conditions. At this site, the hydraulic gradient is generally low, but advection due to groundwater flow may improve heat transfer in the Northmoor Sand and Gravel Member and Upper Greensand Formation.

Superficial thickness
The following map is derived from a mathematical model of the thickness of Superficial Deposits produced by analysing information from approximately 600 000 borehole logs held in the BGS archives. It also uses the digital data on the extent of Superficial Deposits. As a model, the map is a guide only and may differ from the value for superficial deposits thickness given in the borehole prognosis above, but it indicates where thin superficial deposits are likely. In general, depending on the hardness of the bedrock, horizontal collector loops will be easier to install within superficial deposits.



	Expected Minimum Thickness (m)
	100
	70
	50
	40
	30
	20
	10
	5
	Thickness unknown, but > 1m
	No mapped superficial deposits

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Scale: 1:5 000 (1cm = 50 m)
Search area indicated in red

Geoscience Data List

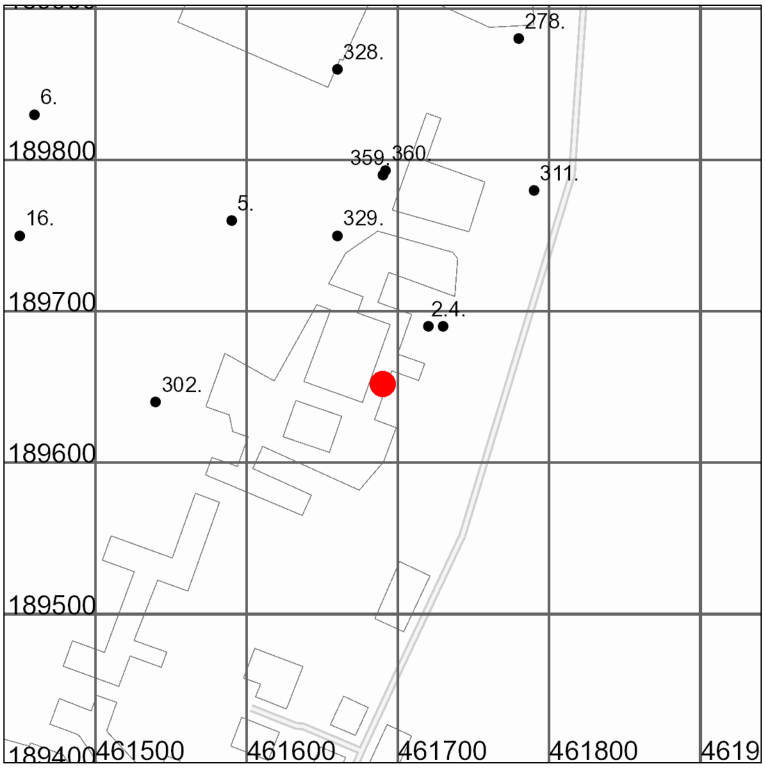
List of available geological data

This part of the report lists the principal data sets held in the National Geoscience Records Centre that are relevant to your enquiry and explains how to obtain copies of the records. Users can make their own index searches using the BGS web page (go to 'Online shops' at www.bgs.ac.uk). This will give access to the BGS Bookshop, Publications catalogue, GeoRecords (borehole browser) and GeoReports.

For current pricing see these internet pages or contact us using the list found at the back of this report.

Note that this report contains selective datasets and is not a definitive listing of all data held in BGS.

Borehole location map



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Scale: 1:5 000 (1cm = 50 m)

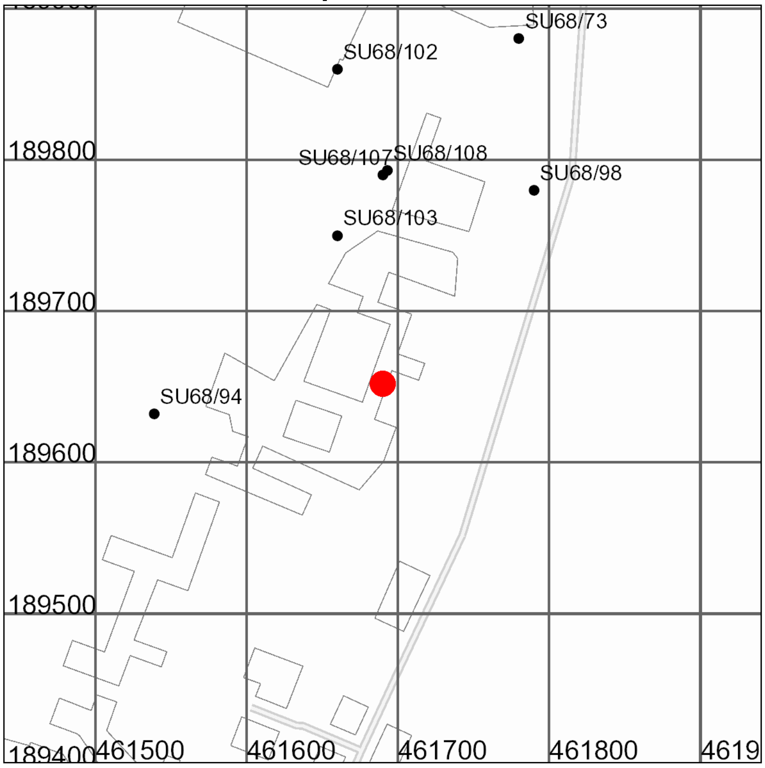
Borehole records

Number of records in map area: 12

In the following table a blank 'Length' field indicates that the borehole is confidential or that no depth has been recorded digitally.
Enquiry staff may be able to provide you with contact details for the originator if you wish to seek release of confidential information.

Borehole registered no	Grid reference	Borehole name	Length (m)
SU68NW16	SU 61450 89750	HOWBERRY PARK CROWMARSH	4
SU68NW2	SU 61720 89690	HOWBERRY PARK BH6 BENSON OXON	8.83
SU68NW278	SU 61780 89880	HYDRAULICS RESEARCH STATION	2.59
SU68NW302	SU 61540 89640	WALLINGFORD TEST BORE, MACLEAN BUILDING	53
SU68NW311	SU 61790 89780	HR WALLINGFORD, HOWBERY PARK OBH	30
SU68NW328	SU 61660 89860	H R WALLINGFORD, HOWBERRY PARK	25
SU68NW329	SU 61660 89750	MACLEAN BUILDING, CROWMARSH GIFFORD	6
SU68NW359	SU 61690 89790	CEH WALLINGFORD WAL84	5
SU68NW360	SU 61692 89793	CEH WALLINGFORD WAL85	4.8
SU68NW4	SU 61730 89690	HOWBERRY PARK TH4 BENSON OXON	3.04
SU68NW5	SU 61590 89760	HOWBERRY PARK TH5 BENSON OXON	2.43
SU68NW6	SU 61460 89830	HOWBERRY PARK TH6 BENSON OXON	4.26

Water well location map



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Scale: 1:5 000 (1cm = 50 m)

Water Well records

Number of records in map area: 7

All of these records are registered in the main Borehole Records collections (see Borehole Records Table and map above), but please note that some may be duplicate or part duplicate copies. This map shows records of water wells and boreholes in the National Well Record Archive held at Wallingford (WL) or Murchison House (MH). Each record has a Well Registration number which should be quoted when applying for copies.

Additional index information may be held for the Water Well Records as shown below, indicating the information that can be found on the well record itself. If fields are blank, then the well record has not been examined and its contents are unknown. A ‘Yes’ or a ‘No’ indicates that the well record has been examined and the information indicated is, or is not, present. This information should help you when requesting copies of records.

British Geological Survey

Water Well records

Well Reg No.	BH Reg No.	Name	Easting	Northing	Depth (m)	Date	Aquifer	G	C	W	Ch
SU68/73	SU68NW278/BJ	HYDRAULICS RESEARCH STATION	461780	189880	2.6		UPPER GREENSAND FORMATION	No	Yes	Yes	No
SU68/94	SU68NW302/BJ	INSTITUTE OF HYDROLOGY, CROWMARSH GIFFORD	461539	189632	0	1979	UPPER GREENSAND FORMATION	Yes	Yes	Yes	No
SU68/98	SU68NW311/BJ	H R WALLINGFORD, HOWBERY PARK OBH	461790	189780	30	2004	SUPERFICIAL DEPOSITS	Yes	Yes	Yes	No
SU68/102	SU68NW328/BJ	HOWBERRY PARK, WALLINGFORD	461660	189860	25	2008	UPPER GREENSAND FORMATION	Yes	Yes	Yes	No
SU68/103	SU68NW329/BJ	MACLEAN BUILDING, CROWMARSH GIFFORD	461660	189750	6		NOT ENTERED	No	Yes	Yes	No
SU68/107	SU68NW359/BJ	CEH WALLINGFORD WAL84	461690	189790	5	2011	SUPERFICIAL DEPOSITS	Yes	Yes	Yes	No
SU68/108	SU68NW360/BJ	CEH WALLINGFORD WAL85	461693	189793	4.8	2011	SUPERFICIAL DEPOSITS	Yes	Yes	Yes	No

KEY:
Aquifer = The principal aquifer recorded in the borehole
G = Geological Information present on the log
C = Borehole construction information present on the log
W = Water level or yield information present on the log
Ch = Water chemistry information present on the log

Boreholes with water level readings

Number of records in map area: 1

Reference	Easting	Northing	Location	Start_date	End_date	Readings
SU68/73	461780	189880	HYDRAULICS RESEARCH STATION	1960	1971	15

Locations with aquifer properties

Number of records in map area: 0
BGS holds no locations with aquifer properties for the selected area

Site investigation reports
Number of records in search area: 4

Additional laboratory and test data may be available in these reports, subject to any copyright and confidentiality conditions. The grid references used are based on an un-refined rectangle and therefore may not be applicable to a specific site. Borehole records in these reports will be individually referenced within the borehole records collection, described above.

Number	Site investigation title
13340	WHITE CROSS FARM, WALLINGFORD
36074	PRIORY MEADOWS CROWMARSH
39056	HOWBERRY FARM CROWMARSH
54083	STATION ROAD INDUSTRIAL ESTATE WALLINGFORD

National Grid geological maps (1:10 000 and 1:10 560 scale)
Number of records in search area: 1

Map	Type	Survey
SU68NW	C	1974

County Series geological maps (1:10 560 scale)
Number of records in search area: 2

Map	Type	Published
Berkshire16SE		1910
Oxfordshire49SE	C	0

New Series medium scale geological maps (1:50 000 and 1:63 360 scale)
Number of records in search area: 2

Sheet number	Sheet name	Type	Published
254	Henley-on-Thames	C	1980
254	Henley-on-Thames	C	1905

Old Series one inch geological maps (1:63 360 scale)
Number of records in search area: 1

Sheet number	Sheet name	Type	Published
13	Bampton	S	1859

Hydrogeological maps (various scales)
Number of records in search area: 1

Map	Scale
South West Chilterns	1:100,000

Geological Memoirs

Number of records in search area: 1

Geological memoir	Date
Henley on Thames & Wallingford	1908

Technical reports

Technical reports may be available for this area. Please email sales@bgs.ac.uk for further information.

BGS non-coal mining plans

Number of records in search area: 1

This listing shows mining plans, including abandonment plans. The coverage is not comprehensive.

Record Type	Plan No.	Title
KP	18191	WESTPHALIAN A & B OF THE COALFIELDS OF ENGLAND & WALES (INCLUDING CANONBIE)

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