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| | |
|---|---|
| Report type: | Flood Risk Assessment |
| Site: | Land West of White Post Road, Banbury, OX16 9HF |
| Client: | Gladman Developments |
| Ref: | GRM/P6194/FRA.FINAL |
| Date: | July 2015 |

# CONTENTS



# APPENDICES

# EXECUTIVE SUMMARY

1. This Flood Risk Assessment considers the proposed development of up to 280 dwellings on land west of White Post Road, Banbury OX16 9HF.

2. The Flood Risk Assessment has been carried out in accordance with the requirements of National Planning Policy Framework which replaced Planning Policy Statement 25 'Development and Flood Risk' (Ref. 4) in March 2012.

3. The site is classed as Very Low, (Old EA Flood Zone 1) according to the Environment Agency's classification.

4. There are parts of the site which are underlain by a Marlstone Rock formation which have soil infiltration characteristics suitable for conventional soakaways. However, these parts are located on higher ground and where a cricket pitch is proposed. Due to the onsite topography there is a potential for waterlogging in downhill areas, which may have an adverse effect on properties, services and groundwater. The use of soakaways has therefore been precluded in the Drainage Strategy. The potential use of individual soakaways would need to be investigated further in the detailed design stage.

5. An infiltration swale between the developable area and proposed cricket pitch is included as part of the proposals.

6. The storm water drainage strategy will be to connect into the existing surface water drainage network on-site subject to the results of Thames Water's (TW) Drainage Impact Study via an onsite balancing pond. Flows will be limited using SuDS to the equivalent of greenfield run-off. By ensuring the proposed outflow will match the existing discharge from the site, there will be negligible change to the downstream situation arising from the development.

7. For the foul water drainage strategy see ULS Foul Drainage Analysis.

8. There will be no flood risk to the dwellings from the local watercourses, overland flows, local sewers or groundwater. **It is therefore concluded that the development will be low risk in respect of flooding and there should be no impediment to development on flood risk grounds.**

# 1 INTRODUCTION

1.1. GRM has been commissioned by Gladman Developments Ltd to undertake a Flood Risk Assessment to support an outline planning application for a proposed residential development for the site on land west of White Post Road, Banbury OX16 9HF. A site location plan, drawing reference: 5713/ASP01, is included with the application.

1.2. The report considers flood risk from all sources as required by the NPPF. The entire site falls within the Very Low (Old EA Flood Zone 1), low probability, {land with a less than 0.1% (1 in 1000)} of fluvial flooding in any one year, as depicted on the EA's flood mapping information on its Internet site, there will not be significant risk of fluvial source flooding.

1.3. Details of the specific issues are summarised as follows:

- The proposal is for residential use comprising up to 280 dwellings.
- The site is currently is in agricultural/greenfield use.
- It is understood there is an existing storm pipe that runs through the site but no foul pipes within the curtilage.
- It is unknown at this stage if there is any agricultural land drainage system.
- There are no known existing critical drainage problems pertaining to the site.
- The development would be categorised as 'more vulnerable' as it is proposed for residential use.

**Scope of Report**

1.4. The report has been produced to satisfy the requirements of the EA, TW, which is the Lead Local Drainage Authority and Cherwell District Council (CDC), which is the Local Planning Authority for the area. Regulatory liaison during future detailed infrastructure design will be required which may supersede some advice within this document.

1.5. The potential for flood risk from a range of sources will be considered.

# 2 SITE DESCRIPTION

2.1 The site is a parcel of land located on land west of White Post Road, Banbury OX16 9HF northwest of the village of Bodicote.

2.2 The site is located on the southern edge of Banbury between the A4260 Oxford Road and the A361 Bloxham Road. The site is well linked to the existing public transport system and surrounding infrastructure. Banbury town centre is situated approximately 1.5 miles to the north.

2.3 Banbury is a rapidly expanding market and industrial town, located between London and Birmingham.


2.4 The proposal is to build a residential development of up to 280 dwellings and the area of the site is 17.53 hectares; the development area is approximately 8.30 hectares.

2.5 The site is currently greenfield.

2.6 There is a 375mm diameter public surface water sewer that flows eastwards into a 525mm diameter public surface water sewer that flows southwards through the site.

2.4 The proposal is to build a residential development of up to 280 dwellings and the area of the site is 17.53 hectares; the development area is approximately 8.61 hectares.

2.5 The site is currently greenfield.

2.6 There is a 375mm diameter public surface water sewer that flows eastwards into a 525mm diameter public surface water sewer that flows southwards through the site. Storm water manholes are also situated on site. No foul sewers run through the site.

2.7 A site walkover was undertaken and the presence of land drains was not identified. While no information was provided for the initial site walkover, it was established from the site walkover that manholes do not exist where shown on the sewer records. There is no visible sight of them at the surface and they could not be located by CCTV. The specific manholes are noted on a plan in **Appendix 5**.

2.8 The site is bounded to the north by Salt Way and the Salt Way track which forms the current southerly extent of the Banbury conurbation. White Post Road is to the east, and Wykham Lane to the south.

2.9 Wykham Lane links the A361 Bloxham Road and A4260 Oxford Road. Beyond Wykham Lane lies open agricultural land. The western boundary adjoins agricultural land. Wykham Farm is situated approximately 170m west of the western boundary.

2.10 Along the eastern boundary of the site is a cricket ground used by Bodicote Cricket Club. The access road to the Cricket Club and car park falls inside the site boundary.

**Topography**

2.11 The topographical survey shows that the site's general topography falls gently from the northwest (from the level of over 125.0m) to the southeast corner to a level of approximately 114.5m.

2.12 From inspection of the OS mapping it appears that there is a level of 112.8m which is a low point on Wykham Road adjacent to the Banbury Cricket Club ground. This rises to a level of 120.1m adjacent to the existing allotment gardens.

# 3 DEVELOPMENT PROPOSALS

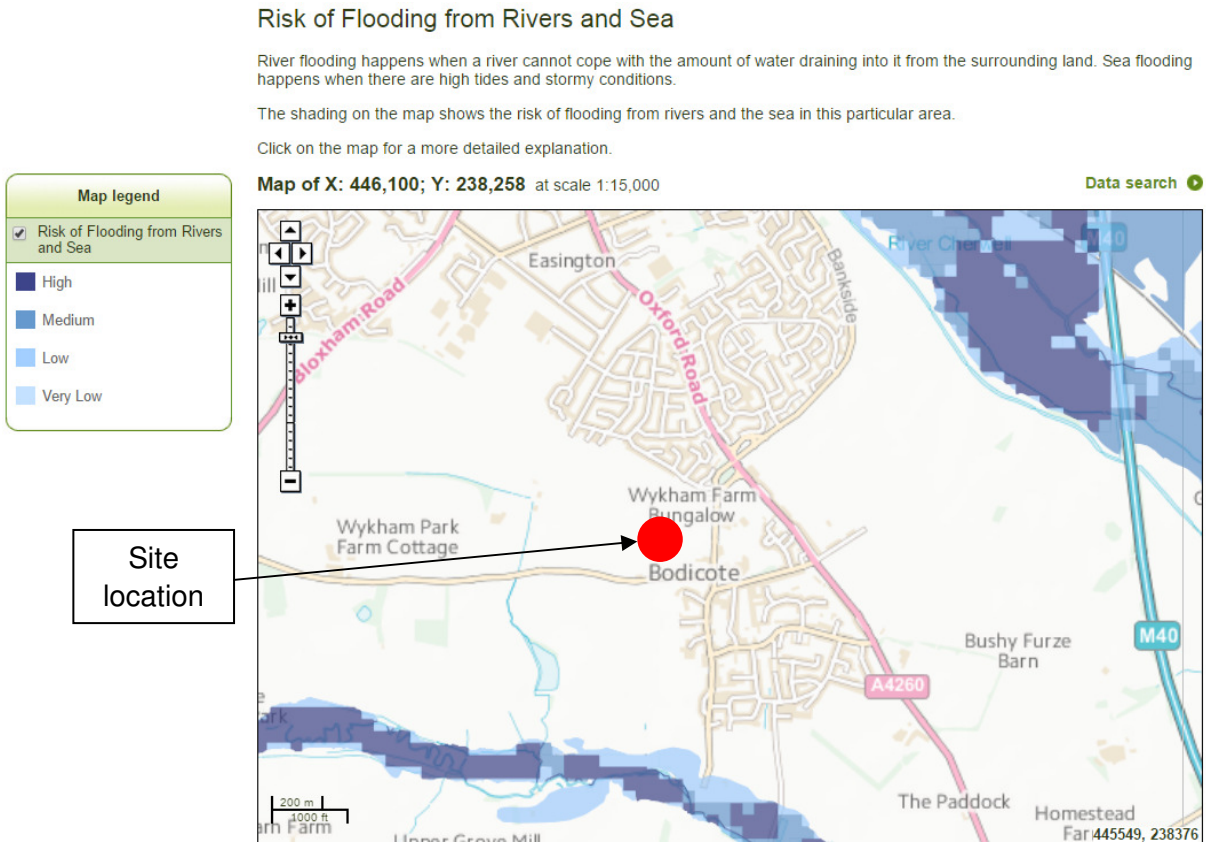
3.1 The proposed development comprises up to 280 dwellings.

3.2 The proposed design principles for the development are set out in the Design and Access Statement that accompanies this Flood Risk Assessment report in the planning application submission package.

3.3 A Development Framework Plan, drawing number: 5713/ASP03, has been developed showing proposed residential, recreational and public open space areas as well as areas for SuDS i.e. balancing pond. The Development Framework Plan has been submitted as part of this application.

# 4 ENVIRONMENT AGENCY FLOOD ZONE (FZ) MATRIX

4.1 The site has been checked against the flood maps which are available from the EA website. The results are shown below:-




4.2 The plan shows the Sor Brook and the River Cherwell. These are 880m to the south and 1610m north east of the site respectively. These watercourses are coloured dark blue, which designates these rivers as Main River and therefore controlled and monitored by the EA. It also shows the Oxford Canal which is 1225m to the north east of the site, which runs parallel with the River Cherwell.

4.3 The site is coloured white and as such is classified as Very Low Risk (Old EA Flood Zone 1), which is land that has a less than 0.1% chance of flooding (less than 1:1000).

4.4 Surrounding the Sor Brook and River Cherwell are blue coloured ribbons. This represents High Risk (Old EA Flood Zone 3b), which is land that has a chance of flooding of greater than 1 in 30 (3.3%). The nearest blue coloured area to the site is approximately 750-800m south of the site boundary (Sor Brook is the nearest watercourse to site). The other darker blue represents Medium Risk (Old EA Flood Zone 3a)

4.5 As the development site is in Very Low Risk, (Old EA Flood Zone 1), there will be no requirement to undertake a sequential test. All uses of land are appropriate in this

flood zone. As the proposed use of the land is residential it will be classified as “more vulnerable”.

4.6 The Planning Practice Guidance (PPG) Paragraph: 067 Reference ID: 7-067-20140306 includes Flood Zone and Flood Risk Tables. Table 3 shows that that the development site is appropriate.

**PPG Table 3: Flood risk vulnerability and flood zone ‘compatibility’**

| Flood Zones | Flood Risk Vulnerability Classification | | | | |
|---|---|---|---|---|---|
| | Essential infrastructure | Highly vulnerable | More vulnerable | Less vulnerable | Water compatible |
| Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Zone 2 | ✓ | Exception Test required | ✓ | ✓ | ✓ |
| Zone 3a † | Exception Test required † | ✗ | Exception Test required | ✓ | ✓ |
| Zone 3b * | Exception Test required * | ✗ | ✗ | ✗ | ✓* |

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;

- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

**Flood Risk Assessment Requirements**

4.6 For development proposals on sites comprising one hectare or above, the vulnerability to flooding from other sources as well as from rivers and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces plus the effect of new development on surface water run-off should be incorporated in a Flood Risk Assessment (FRA). In Flood Zone 1, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques. This FRA will be submitted as part of a planning application for the site.

4.7 There is a natural watercourse situated approximately 100-150m west of the western boundary of the site. This flows into a reservoir that in turn flows into the Sor Brook watercourse south of the site. Thus the FRA will assess the effect of this plus overland flows on the development together with the impact of the proposed development on the surrounding areas taking into account anticipated climate change and consideration of suitable Sustainable Drainage Systems.

# 5 FLOOD RISK TO THE SITE

**Categories of Flood Risk - Sources of Flooding**

5.1 The NPPF requires that the risk of flooding from a range of sources should be considered. The sources which have potential risk attached are shown below, with an assessment whether further assessment is required.

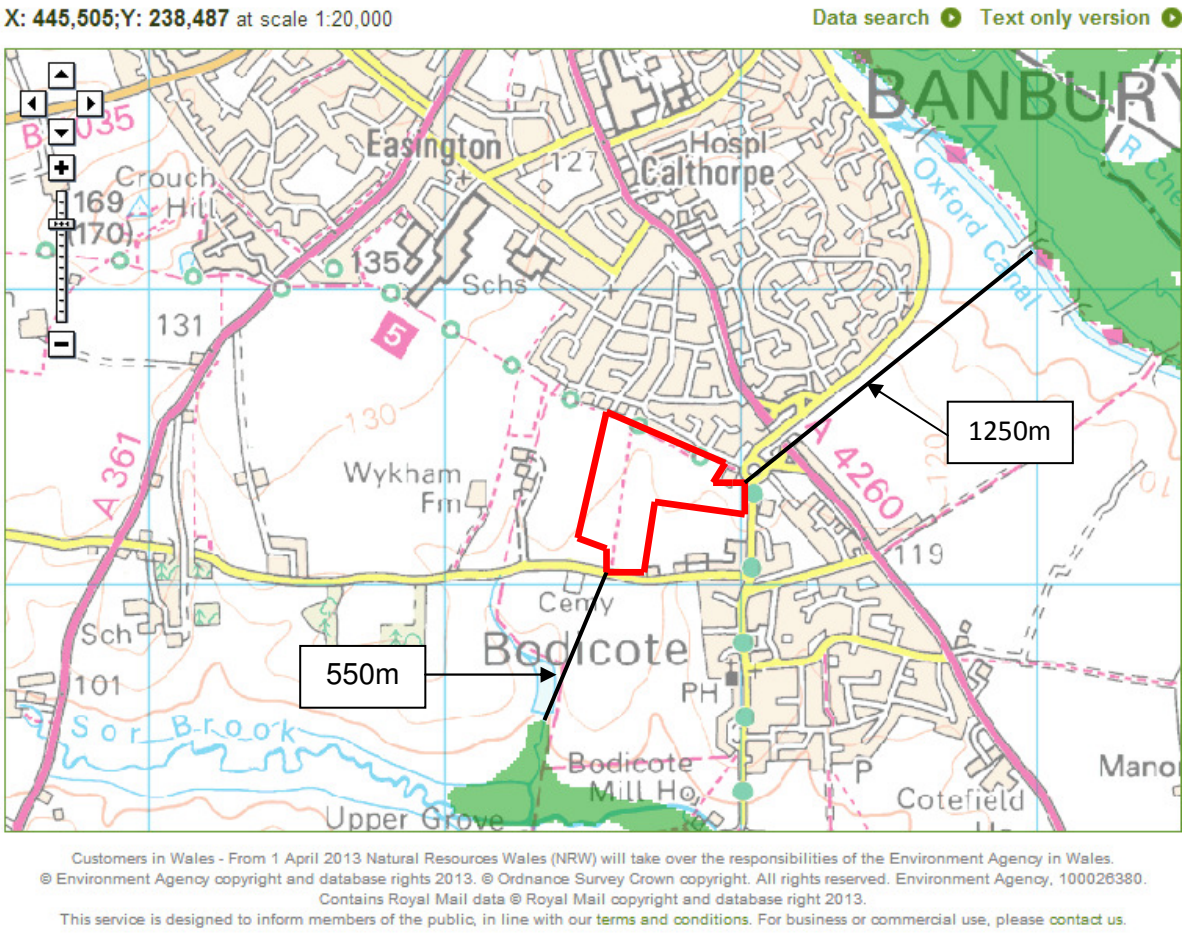
**Pluvial (Overland**) Overland flow occurs when rainfall cannot be collected by the designed drainage, and where drains/sewers become full and cannot accept additional water and/or the ground becomes saturated. The EA has mapping that shows a low risk of flooding from surface water which appears to follow the path of the existing sewer (north-south). The chance of flooding is between 1 in 1000 (0.1%) and 1 in 100 (1%). Should overland flooding occur on the development site, then overland flow will pass generally in north-south direction following the general topography of the land where surface water runoff would generally drain. Any overland flows from the development will be captured by the carriageway drainage, which would be designed to perform this function in extreme rainfall events. **Therefore, there is a minimal risk of flooding from this source and it will not be considered further.**

**Fluvial (River)** A natural watercourse runs to the west of the development site which discharges into the reservoir approximately 450m south of the site's south-western boundary. The reservoir discharges into a watercourse where it has a confluence with the Sor Brook 500m south of the reservoir. Sor Brook originates from the north-west of the development site. It flows eastwards under the A361 Bloxham Road (1.8km south-west of site) to a weir. Along its route it is fed by three drains. Meadows characterise the land alongside the Sor Brook that flows in an eastern direction where it finally flows into the River Cherwell. Inspection of the EA Flood Maps indicates that the area alongside the Sor Brook is affected by flooding, and the majority of land is classified by the EA as High Risk (Old EA Flood Zone 3), land that has a greater than 1 in 30 chance (3.3%) of flooding. The development site is on higher ground and is approximately 850m from the land affected by flooding. This information, together with inspection of the EA Flood Maps, indicates that the site is not affected by flooding caused from Rivers. **Therefore it is contended that the site will not be affected by Fluvial Flooding**

**Development** The site is bounded partly by Wykham Lane to the south and and White Post Road to the east. According to the sewer records there is a surface water manhole in Wykham Lane. The surface water sewer continues to flow southwards of Wykham Lane. White Post Road does not have surface water sewers. However there are gullies visible on both roads so it is assumed the carriageway is positively drained. Any overland surface water flow will be intercepted by highway and development drainage. **Therefore there will be negligible risk of flooding to the site from Development sources**.

**Reservoir and Canal Flooding** According to the Environment Agency the mapping shown below the development site is not within the area that might be

flooded if a reservoir were to fail and release the water it holds. The distance between the site and the area affected by reservoir flooding is approximately 550m south of the development site, and the site is on higher ground than the reservoir. **Consequently, there is a low risk of flooding from reservoirs.**




**Oxford Canal** The development site is approximately 1250m south-west of the Oxford Canal. **Therefore this document is not required to determine residual risks from breaching or overtopping of the Oxford Canal as directed by the Cherwell & West Oxfordshire SFRA**.

**Groundwater** A review of publicly available data has been carried out courtesy of Cranfield University National Soil Resources Institute records. Cranfield University has determined that the development site falls within an area of free-draining soils. **It is important to note that this "free-draining" refers to surface soils NOT strata at depths of conventional soakaways.** Reference was made to Scott Wilson's SFRA for Cherwell & West Oxfordshire Council. The variability in the geological conditions can be seen in Cranfield University's mapping (see 7.1).

The British Geological Society (BGS) consider there is a high risk of groundwater flooding, but have a low confidence in this assessment. Review of the geological maps suggests that whilst groundwater within some strata could potentially form

spring lines, the generally cohesive and low permeability nature of most strata will negate the risk of groundwater flooding.

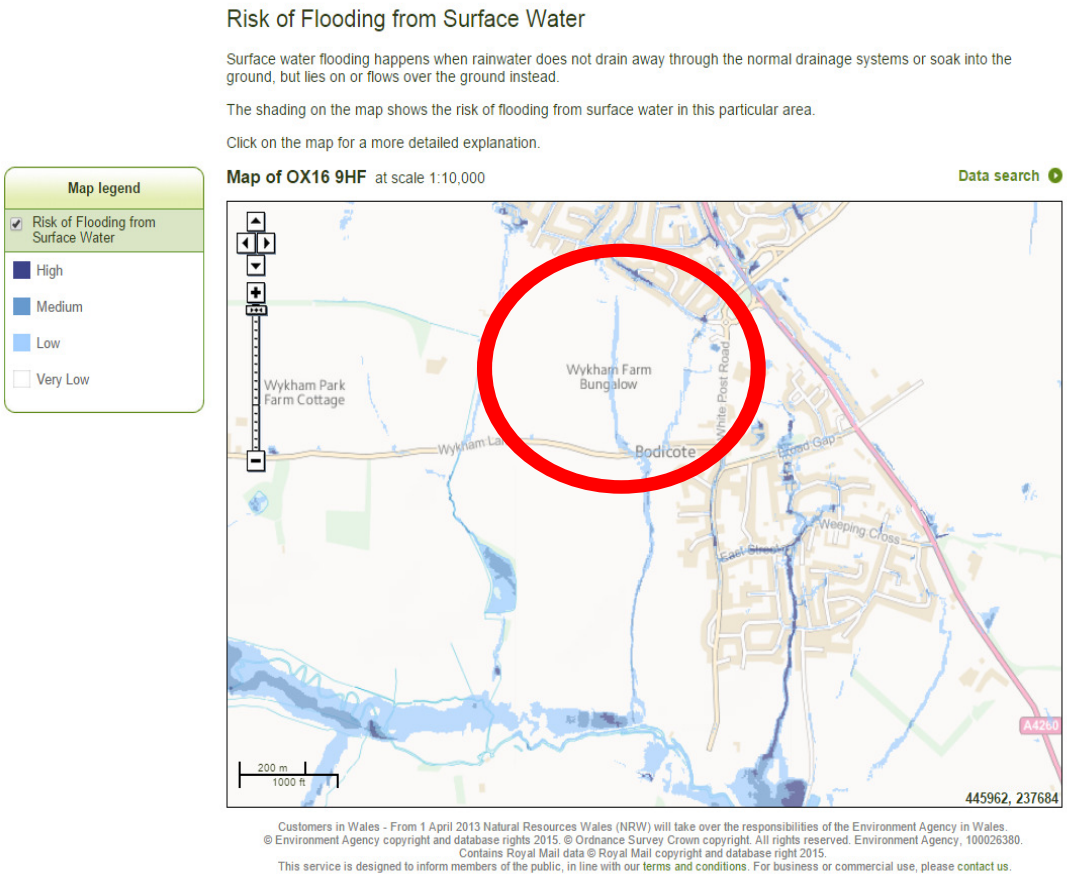
**Groundwater flooding would not constitute a risk to the development.**

**Sewer Sources** Sewers, including site drainage, can flood for several reasons. The reasons could be one of the following:

- blockages creating flooding at manholes
- undersized pipes causing surcharge

With reference to Scott Wilson's SFRA, only three incidences of sewer flooding over a ten year period have been recorded by Thames Water across the whole Cherwell & West Oxfordshire District. Three sewer flooding incidents are not classed as a high incidence of flooding and no evidence indicates that any of the three incidents of sewer flooding occurred on the development site.

Thames Water has reported no incidents of sewer flooding from the existing sewers crossing the site.




The EA's mapping shows Very Low to Low chance of flooding from surface water. It appears to show the surface water following the line of the existing 525 diameter surface water sewer. The overland flow flows further southwards from a low point on Wykham Lane to the Sor Brook watercourse.

Much of the greenfield surface water flow is likely to infiltrate into the soil which will

**The existing greenfield runoff does not currently flow into the sewers crossing the site. The proposals will connect into the onsite sewer, which means that the development will have an impact on the existing drainage and this impact will be fully assessed to prove that the new development does not have an adverse effect on the existing sewers. An agreed discharge rate would need to be agreed with the Water Company. Onsite flow control techniques will be used to achieve this.**

5.2 **There will therefore be no flood risk to the site from local watercourse, overland flows, reservoir and canal flooding, rivers and groundwater.**

5.3 **This FRA will fully assess that there will be no adverse effect on the existing sewer crossing the site; therefore not causing any sewer flooding.**

# 6 FLOOD RISK FROM THE DEVELOPMENT

6.1 The EA Standing Guidance states that in order to demonstrate that the development is low risk, the FRA should show:

a) *That it will be feasible to balance surface water run-off to the Greenfield run-off rate for all events up to the 1 in 100 year storm (including a 30% allowance for climate change) and set out how this will achieved.*

b) *How Sustainable Drainage Systems (SuDs) will be used, with any obstacles to their use clearly justified.*

6.2 The proposal is to construct a residential development on the site comprising up to 280 dwellings with associated infrastructure, landscaping and open space. Any piped storage/attenuation system will be offered for adoption by Thames Water under a Section 104 Agreement.

6.3 Thames Water has been consulted and following consideration of the proposed development requires that the existing drainage system will require an Impact Study, in order to determine the available capacity with the existing network.

6.4 No sewer information was supplied by Thames Water. However, sewer records have been obtained from other sources and are contained in **Appendix 5**. There is a watercourse to the west of the western boundary of the site.

6.5 The NPPF directs that the rate of surface water discharge leaving a development site is no more than its previous use, and where possible to reduce that discharge.

6.6 The site is currently 'greenfield'. The maximum allowable discharge is calculated based on Flood Estimation for Small Catchments, Report no.124 (Institute of Hydrology). Based on the entire site and the 1 in 100 year return period the greenfield runoff rate will be the equivalent of 55.92l/s; therefore the greenfield runoff rate is calculated as 56 l/s. This figure will require confirmation by the EA. See **Appendix 4** for HR Wallingford Greenfield Runoff Calculation.

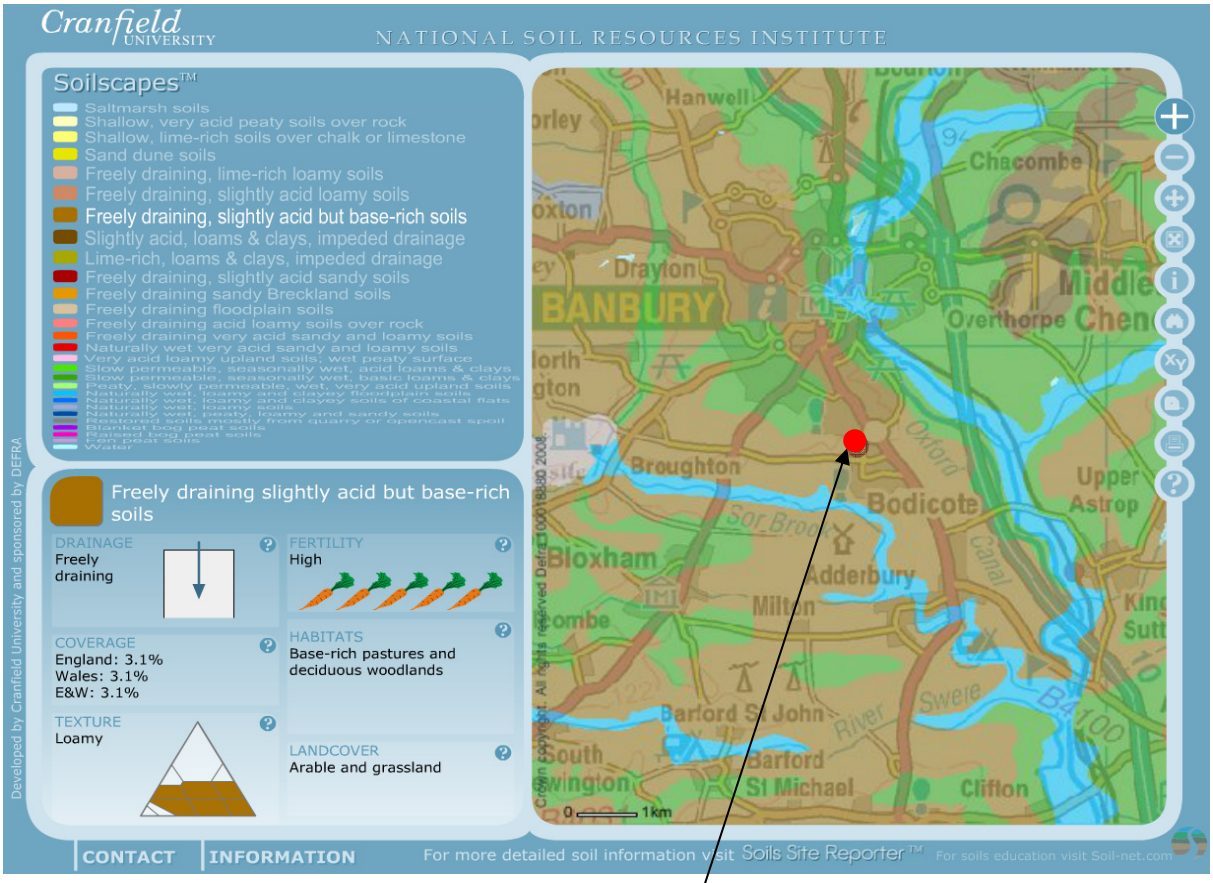
**NPPF states that:**

a) *The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development.*

b) *For new development, it may be necessary to provide surface water storage and infiltration to limit and reduce both the peak rate of discharge from the site and the total volume discharged from the site.*

# 7 STORM WATER DRAINAGE AND CONSIDERATION OF SUSTAINABLE DRAINAGE SYSTEMS

7.1 From the Cranfield University Soilscape website, the underlying soils comprise, "*Freely draining, slightly acid but base-rich soils*". The following plan is an extract from the Soilscapes website.




7.2 Additional research using British Geological Society (BGS) data (see **Appendix 1**) has found evidence which contradicts the information on the Soilscapes website. The cohesive (clayey) and low permeability soils below the topsoils on this site are unlikely to be suitable for soakaways. There is a small chance that should fractured bedrock be encountered at shallow depth then this could be tested as a potential soakaway stratum. There is also a slight chance that some of the bedrock could weather to a more granular soil, with greater permeability. Soakaways and swales could possibly be used to dispose of storm water on this site. **To investigate this further a site investigation was undertaken.**

7.3 GRM has undertaken the Infiltration Rate Testing on the site. This report also contained in **Appendix 2.** Where the Marlstone Rock was encountered, infiltration rates ranged from 2.68 x $10^{-4}$ and 3.36 x $10^{-5}$ m/s, which indicates a good possibility that conventional soakaways will work. GRM's plan shows that Soaks 1, 2, 4, 5, 9,

and 10 as locations where the Marlstone Rock Formation was encountered, and soakaways are possible.

7.4 However, the locations given in paragraph 7.3 are on higher ground and on land where a Cricket Pitch (Soak 10) is proposed. Individual soakaways could be used on higher ground but these would be constructed next to an adjacent valley. Consequently it must be considered where the soakaway discharge will go if it encountered an impervious soil formation in the ground. This discharge may come to the surface further down the valley slope causing potential waterlogging in adjacent downhill areas. As a result the impacts on adjacent structures, services and groundwater must be considered when constructing individual soakaways.

7.5 An assessment of the potential use of localised soakaways will be undertaken in the detailed design. Their use may benefit the site by reducing storm volumes. Rainwater harvesting techniques could be used on the site in general and for the proposed cricket ground in particular for irrigation purposes.

7.6 A standard conveyance swale has been sited along the contours, where possible, between the proposed cricket ground and the development area. Swales are particularly effective ways of collecting and conveying runoff from the drained area which is approximately 1.185ha to another stage of the surface water management train; the proposed attenuation storage pond which acts as another SuDS component.

7.7 The swale must be effectively incorporated into landscaping and public open spaces as they demand significant land-take due to their shallow side-slopes. The shape of the swale will be trapezoidal in cross section as these are easiest to construct and maintain, and offer good hydraulic performance. The swale side slopes should be no greater than 1 in 4 to promote low velocities, maximise the wetted perimeter, and enable moving equipment to be used to maintain.

7.8 Conveyance swales should have a minimum longitudinal slope of 1 in 300, although those with slopes of less than 1 in 100 are at risk of becoming waterlogged and underdrains may be appropriate. It is recommended that swales should have a minimum length of 30m to maximise water quality. The proposed swale is approximately 185m long. The base of the swale should be flat, preferably with a width of 0.5m and 2.0m. The proposed swale is 1.5m wide so a flow divider will not be required. The cross-sectional area of the proposed swale with 1 in 4 side slopes is 5.5m$^2$.

7.9 Check dams can be installed to promote additional infiltration to increase storage and reduce flow velocities.

7.10 It must be approximated how much water will be drained via infiltration based on the following parameters:

- A trapezoidal swale with dimensions, 1.5m wide at the base, 1 in 4 slopes and 185m length to replicate performance of the swale, and an appropriate depth to accommodate rainfall event with a factor of safety of 2.0
- Total length of wetted surface: 5.62m (when full)
- Rainfall event: Assume 30 minute storm at 50mm/hr
- Interpolated soil infiltration rate: Assume 1.36 x $10^{-4}$ m/s (between Soaks 8 and 9)
- Catchment area: 11,850$m^2$ of impermeable surface

7.11 A) Volume of surface water runoff:

Calculate volume from 50mm/hr for 30 minutes on 11,850$m^2$ of impermeable area:

0.05m/hr x 0.5hr x 11,850$m^2$ = 296.25$m^3$

**Thus: 296.25 cubic metres of surface water runoff would need to be accommodated in the swale.**

B) For a storage requirement of 296.25$m^3$, and a F.O.S of 2.0, the total swale volume would be at least 2 x 296.25 = 592.5$m^3$.

To accommodate 592.5$m^3$ with a 185m long swale. By iteration, the depth of the swale would need to be around 600mm.

Total Volume = 185 x [(0.60 x 4.0) + (0.60 x 1.5)]

Total Volume = 185 x [(2.4 + 0.9)]

Total Volume = 185 x 3.3

Total Volume = 610.5$m^3$

F.O.S = Total Volume/Volume of Surface Water Runoff

F.O.S = 610.5/296.25 = 2.06

**Thus with a 600mm deep swale the F.O.S would be 2.06**

C) When the swale fills, some of the water will soak away to the ground, and the purpose of the is next calculation is to estimate how much will take this route, and thus how much would be passed onto the downstream attenuation pond.

If the outflow control only allows a relatively slow discharge from the swale onwards to the main storage facility, then the water could be held in the swale for several hours.

For the purpose of this calculation, it has been assumed that water is held in the swale for 2 hours, and the average depth of water is 360mm.

To determine the volume that will soak away from this surface, the wetted surface area at the average depth will be calculated and using the infiltration rate provided by the geotechnical advisors, the total volume that will soak away in 2 hours will be calculated.

For a depth of 360mm the wetted surface area per linear metre of swale would be:

Wetted surface area per metre run = $[(\sqrt{} (0.36 \times 4)^2 + (0.36)^2) \times 2] + 1.50$

Wetted surface area per metre run = 3.52 m per linear metre

**Thus the wetted area within the swale would be: 3.52 x 185m = 651.2m$^2$**

D) Calculate the volume of surface water that would soak away.

Wetted surface area x soil infiltration rate x duration water remains in the swale

Soil infiltration rate is 3 x $10^{-6}$ m/s; 2 hour storm is 7200 seconds and wetted surface area found in calculation C, 651.2m$^2$

651.2m$^2$ x (1.36x$10^{-4}$m/s) x 7200s = 635.59m$^3$, therefore 635m$^3$

**Thus: 635 cubic metres is the volume of water that will infiltrate into the soil**

7.12 The calculated volume storage of the proposed storage pond can therefore be reduced by 635m$^3$.

7.13 The storage pond will be lined with a geotextile membrane which will prevent infiltration into the ground because the pond is located on the side of the valley.

7.14 It is proposed to use a storage pond. This will be lined with a geotextile membrane which will prevent infiltration into the ground because the pond is located on the side of the valley.

7.15 In order to prevent an increase in flood risk to adjacent land and downstream of the site, it will be necessary to restrict the surface water discharge from the 8.61 ha development, which will be assumed to have 56% impermeability to the equivalent Greenfield runoff rate from the site of 56 l/s.

7.16 The prime surface water drainage strategy option indicated in **Appendix 3** shows the surface water flows from the 2 storm catchments draining to a balancing pond. Using a flow control chamber these flows will outfall into the existing public storm sewer

crossing the site. A discharge rate would need to be agreed with the Water Company.

7.17 The viability of this solution is subject to the conclusions of Thames Water's Impact Study. According to the Thames Water sewer records, there are eight surface water manholes on site. However, the sewer records do not hold any information with respect to cover and invert levels. A drainage CCTV survey was undertaken on 24th October 2013 to confirm the location of the manholes, and determine cover and invert levels of the manholes plus the condition of the sewers.

7.18 It was established on site manholes 6301 and 6201 do not exist where shown on the sewer records, there is no visible sight of them at the surface and they could not be located by CCTV. Manhole 7101 was located (CL=114.955 IL=112.495) and a CCTV camera was inserted upstream, at 180m upstream of MH 7101 no manholes, connection or vents had been found. The normal maximum spacing of manholes on a sewer run in 100m. Manhole 6201 is shown on the records as approximately 140-145m upstream of MH 7101. MH 6553 was located (CL=121.923 IL=120.093). The pipe between MH 6553 and 7101 was confirmed as 525mm diameter and was free from blockages and debris. See **Appendix 4**.

7.19 Storage calculations have been undertaken to establish an outline of the scale of the required storage. Provided that the residential area is 8.61 hectares with 56% impermeability; the appropriate storages has been sized to accommodate for 30 year and 100 year storm events respectively:

- 30 year storm + climate change event: 2213m$^3$ volume storage
- 100 year storm + climate change event: 3127m$^3$ volume storage

7.20 Therefore subtracting the 635m$^3$ calculated from the 100 year pond volume storage will be 2492m$^3$.

7.13 The depth of the balancing pond has been sized using 1.3m depth for indicative purposes with 1:4 sloping sides. The area required for the 100 year storm event was calculated as approximately 2341m$^2$. The storage calculations are also shown in **Appendix 3**.

7.13 Normally public sewers are subject to an easement, where the Water Company will not allow building within. This is likely to be the case on the existing sewer crossing the site with a projected 3.5m wide either side of the centre-line of the sewer.

7.14 The surface water run-off from the dwellings, roads and hard pavings will be connected into a piped network which will cater for the 1 in 30 year storm event and will be adopted and maintained by the Water Authority.

# 8 FOUL WATER FLOWS

8.1 For the foul water drainage strategy refer to ULS Foul Drainage Analysis.

# 9 CONCLUSIONS & RECOMMENDATIONS

9.1 This Flood Risk Assessment considered the proposed development of up to 280 dwellings on land west of White Post Road, Banbury OX16 9HF.

9.2 The Flood Risk Assessment has been carried out in accordance with the requirements of National Planning Policy Framework which replaced Planning Policy Statement 25 'Development and Flood Risk' (Ref. 4) in March 2012.

9.3 The dwellings are not at risk from fluvial flooding; they are located in Very Low, (Old EA Flood Zone 1) according to the Environment Agency's classification, and are situated on ground outside any sources of overland flooding.

9.4 There is only a slight chance that soakaways may be used on the site subject to ground investigation.

9.5 The storm water drainage strategy is to limit flows to the equivalent of agricultural run-off. By ensuring the proposed outflow will match the existing discharge from the site, (56.0 l/s); therefore there will be negligible changes to the downstream situation from the existing arrangement.

9.6 With the appropriate level of on-site attenuation by implementing ponds and flow controls, there will be negligible risk of flooding from surface water run-off on this site or any neighbouring land parcels.

9.7 For the foul water drainage strategy refer to ULS Foul Drainage Analysis.

9.8 **It is therefore concluded that the development will be low risk in respect of flooding and there should be no impediment to development on flood risk grounds.**

# 10 REFERENCES

The following documents have been referred to in this report:


- The Building Regulations Approved Document H.
- Sewers for Adoption 7th Edition.
- Civil Engineering Specification for the Water Industry,
- National Planning Policy Framework (March 2012)
- Planning Policy Statement 25: Development and Flood Risk
- Environment Agency Flood Risk Standing Advice version 1.0 (Pipe Networking Website).
- The SUDS Manual - CIRIA C697.
- Interim Code of Practice for Sustainable Drainage Systems - National SUDS Working Group, July 2004.
- British Geological Survey map 1:50000 Solid and Drift, Sheet170.
- Preliminary rainfall runoff management for development: R&D Technical Report W5-074/AlTRl1 Revision C
- Level 1 Strategic Flood Risk Assessment Including Minerals and Waste Site Allocations – Cherwell & West Oxfordshire Council – Living Document (April 2009)

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# APPENDIX 1

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EmapSite
Masdar House,
Eversley, RG27 0RP

| | |
|---|---|
| Report Reference: | EMS-208122_273629 |
| Your Reference: | EMS_208122_273629 |
| Report Date | 7 Jun 2013 |
| Report Delivery Method: | Email - pdf |

## GroundSure GeoInsight

## Address: ,

Dear Sir/Madam,

Thank you for placing your order with GroundSure. Please find enclosed the **GroundSure GeoInsight** as requested.

If you would like further assistance regarding this report then please contact the emapsite customer services team on 0118 9736883 quoting the above report reference number.

Yours faithfully,

emapsite customer services team

Enc.
GroundSure GeoInsight

# Aerial Photograph of Study Site

NW N NE

W E

SW S SE



Site Name: ,
Grid Reference: 445645,238319
Size of Site: 18.73 ha

# Overview of Findings

The GroundSure GeoInsight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Shallow Mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and GroundSure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

| Report Section | Number of records found within (X) m of the study site boundary |
|---|---|
| **1. Geology** | **Description** |
| **1.1 Artificial Ground,** | |
| 1.1.1 Is there any Artificial Ground /Made Ground present beneath the study site?* | No |
| 1.1.2 Are there any records relating to permeability of artificial ground within the study site* boundary? | No |
| **1.2 Superficial Geology & Landslips** | |
| 1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?* | No |
| 1.2.2 Are there any records relating to permeability of superficial geology within the study site* boundary? | No |
| 1.2.3 Are there any records of landslip within 500m of the study site boundary? | No |
| 1.2.4 Are there any records relating to permeability of landslips within the study site* boundary? | No |
| **1.3 Bedrock, Solid Geology & Faults** | |
| 1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section. | |
| 1.3.2 Are there any records relating to permeability of bedrock within the study site* boundary? | Yes |
| 1.3.3 Are there any records of faults within 500m of the study site boundary? | No |
| 1.3.4 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? | The property is in a Radon Affected Area, as between 10 and 30% of properties are above the Action Level |
| 1.3.5 Is the property in an area where Radon Protection Measures are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? | Full radon protective measures are necessary |

* This includes an automatically generated 50m buffer zone around the site

Source:Scale 1:50,000 BGS Sheet No:218

| 2. Ground Workings | on-site | 0-50 | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 2.1 Historical Surface Ground Working Features from Small Scale Mapping | 0 | 2 | 3 | - | - |
| 2.2 Historical Underground Workings Features from Small Scale Mapping | 0 | 0 | 0 | 0 | 0 |
| 2.3 Current Ground Workings | 0 | 0 | 0 | 0 | 0 |

| 3. Mining, Extraction & Natural Cavities | on-site | 0-50 | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 3.1 Historical Mining | 0 | 0 | 0 | 0 | 0 |
| 3.2 Coal Mining | 0 | 0 | 0 | 0 | 0 |
| 3.3 Johnson Poole and Bloomer Mining Area | 2 | 1 | 0 | 4 | 3 |
| 3.4 Non-Coal Mining* | 0 | 0 | 0 | 0 | 0 |
| 3.5 Non–Coal Mining Cavities | 0 | 0 | 0 | 0 | 0 |
| 3.6 Natural Cavities | 0 | 0 | 0 | 0 | 0 |
| 3.7 Brine Extraction | 0 | 0 | 0 | 0 | 0 |
| 3.8 Gypsum Extraction | 0 | 0 | 0 | 0 | 0 |
| 3.9 Tin Mining | 0 | 0 | 0 | 0 | 0 |
| 3.10 Clay Mining | 0 | 0 | 0 | 0 | 0 |

*This includes an automatically generated 50m buffer zone around the site

| 4. Natural Ground Subsidence | on-site* | 0-50 | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 4.1 Shrink-Swell Clay | Low | - | - | - | - |
| 4.2 Landslides | Very Low | - | - | - | - |
| 4.3 Ground Dissolution of Soluble Rocks | Null | - | - | - | - |
| 4.4 Compressible Deposits | Negligible | - | - | - | - |
| 4.5 Collapsible Deposits | Very Low | - | - | - | - |
| 4.6 Running Sand | Negligible | - | - | - | - |

* This includes an automatically generated 50m buffer zone around the site

| 5. Borehole Records | on-site | 0-50 | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 5.1 BGS Recorded Boreholes | 0 | 0 | 1 | - | - |

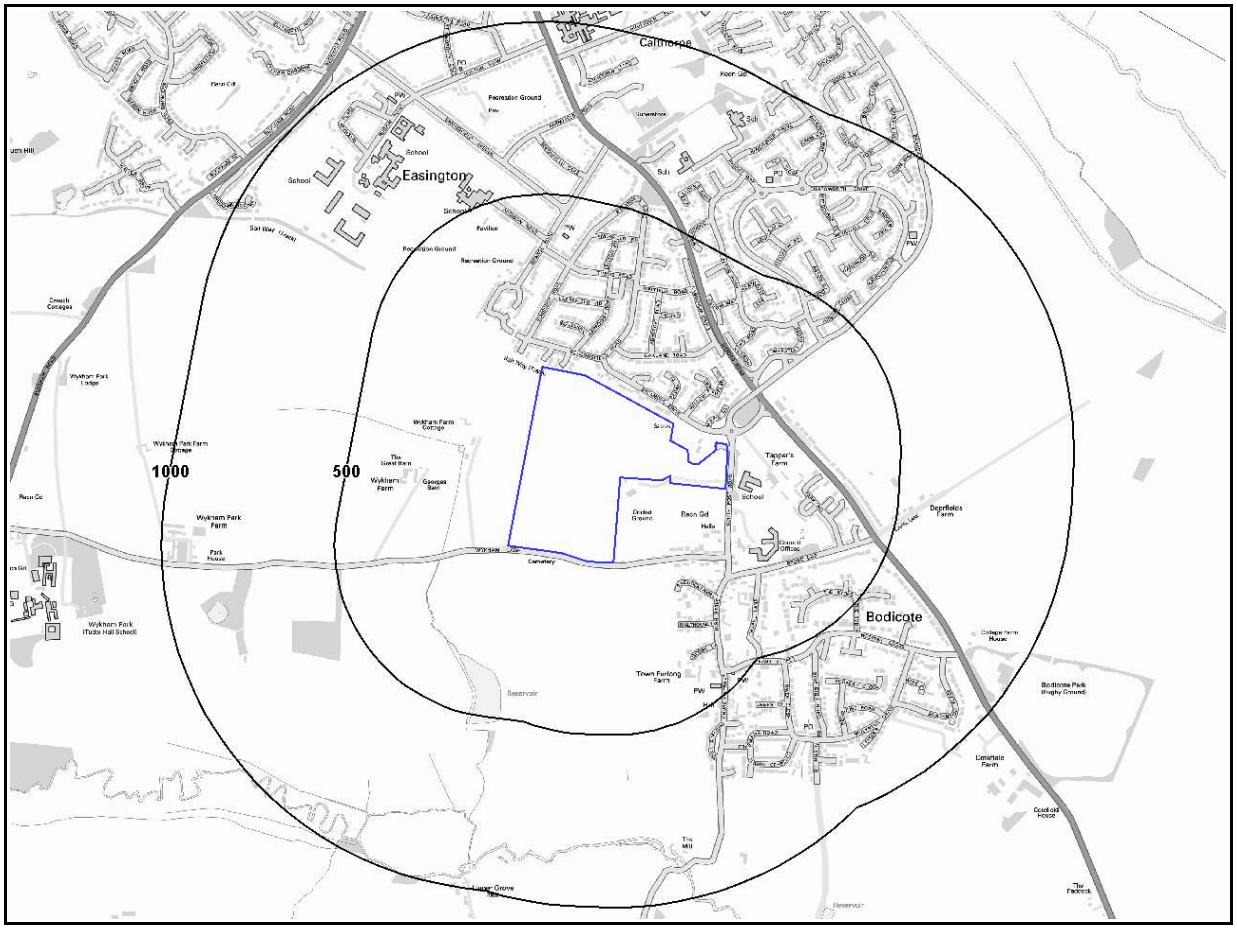
| 6. Estimated Background Soil Chemistry | on-site | 0-50 | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 6.1 Records of Background Soil Chemistry | 3 | 1 | 0 | - | - |

# 1.1 Artificial Ground Map

NW N NE

W E

SW S SE




Artificial Ground Legend



Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

# 1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:218

## 1.1.1 Artificial/Made Ground

**Are there any records of Artificial/Made Ground within 500m of the study site boundary?** **No**

Database searched and no data found.

---

## 1.1.2 Permeability of Artificial Ground

**Are there any records relating to permeability of artificial ground within the study site* boundary?** **No**

Database searched and no data found.

---

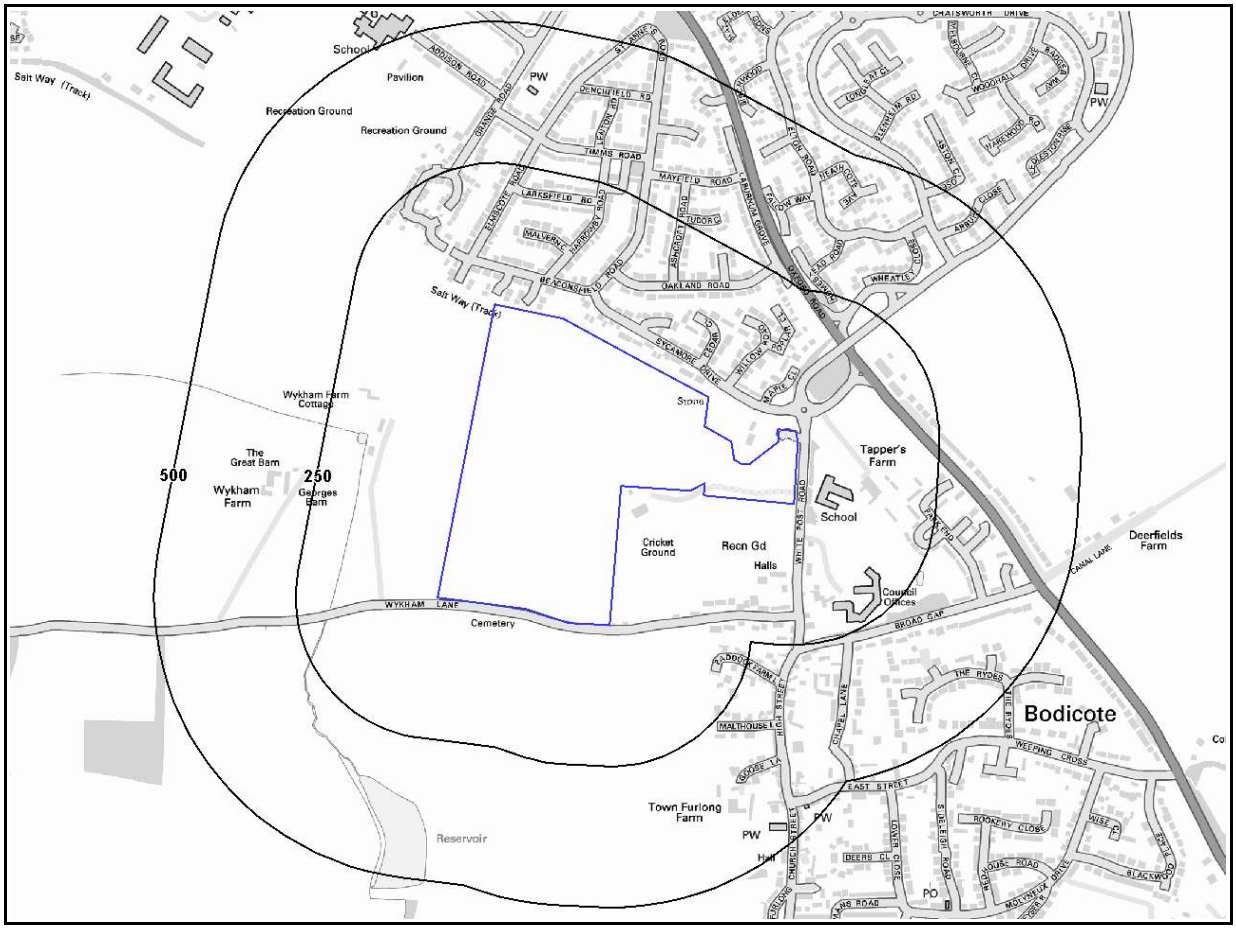
* This includes an automatically generated 50m buffer zone around the site.

# 1.2 Superficial Deposits and Landslips Map

NW N NE

W E

SW S SE




Superficial and Landslips Legend



Site Outline

500
1000

Search Buffers (m)

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

# 1.2 Superficial Deposits and Landslips

## 1.2.1 Superficial Deposits/Drift Geology

**Are there any records of Superficial Deposits/Drift Geology within 500m of the study site boundary? No**

Database searched and no data found.

---

## 1.2.2 Permeability of Superficial Ground

**Are there any records relating to permeability of superficial ground within the study site* boundary? No**

Database searched and no data found.

---

## 1.2.3 Landslip

**Are there any records of Landslip within 500m of the study site boundary? No**

Database searched and no data found.

---

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

---

## 1.2.4 Landslip Permeability

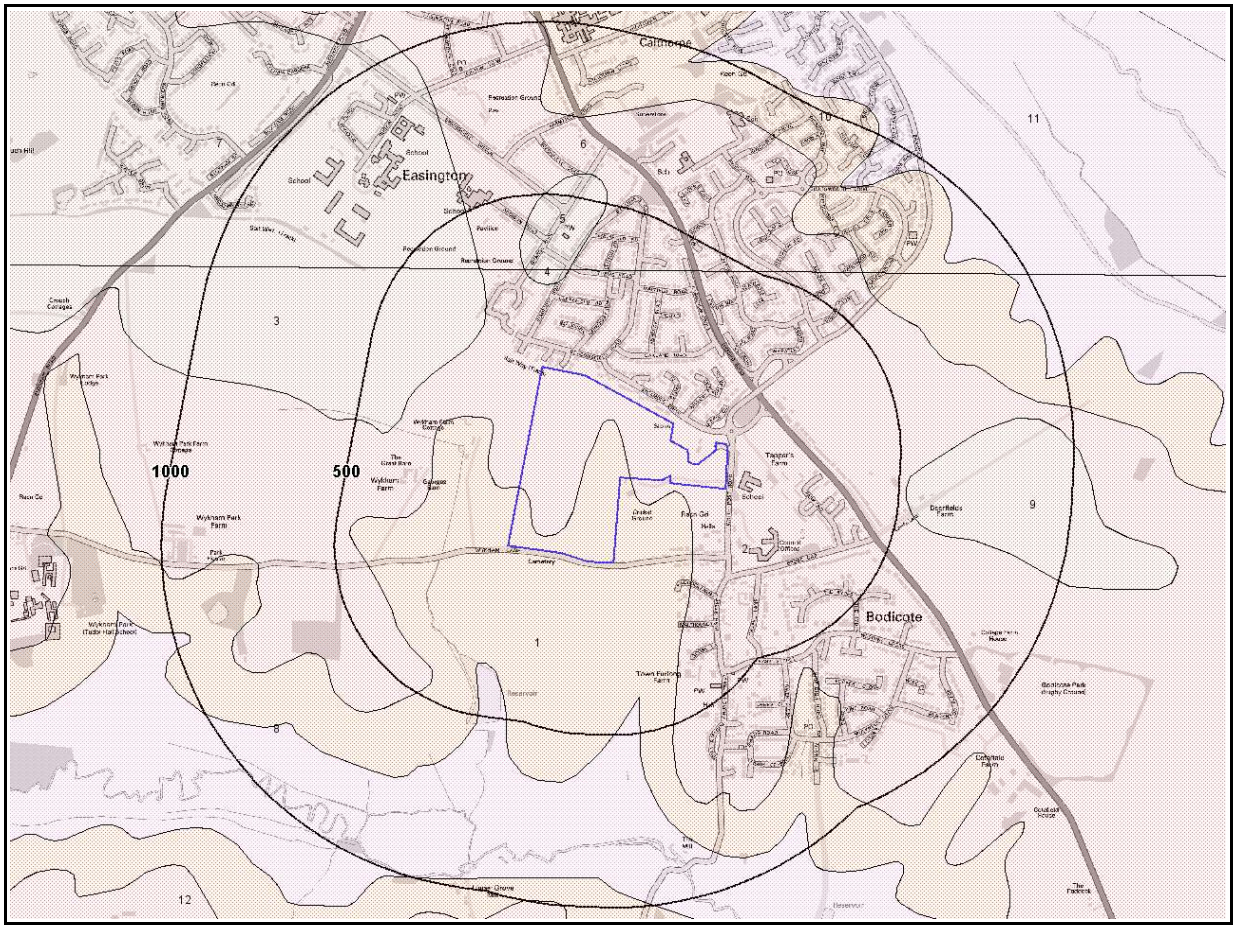
**Are there any records relating to permeability of landslips within the study site* boundary? No**

Database searched and no data found.

*This includes an automatically generated 50m buffer zone around the site.

# 1.3 Bedrock and Faults Map

NW N NE




W E

SW S SE

Bedrock & Faults Deposits Legend



Site Outline

500
1000
Search Buffers (m)

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

# 1.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:218

## 1.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

| ID | Distance (m) | Direction | LEX Code | Rock Description | Rock Age |
|---|---|---|---|---|---|
| 1 | 0.0 | On Site | DYS-SIMD | Dyrham Formation - Siltstone And Mudstone, Interbedded | Pliensbachian |
| 2 | 0.0 | On Site | MRB-FLIR | Marlstone Rock Formation - Ferruginous Limestone And Ironstone | Toarcian / Pliensbachian |
| 3 | 208.0 | NW | WHM-MDST | Whitby Mudstone Formation - Mudstone | Toarcian |
| 4 | 237.0 | N | WHM-MDST | Whitby Mudstone Formation - Mudstone | Toarcian |
| 5 | 282.0 | N | WHM-MDST | Whitby Mudstone Formation - Mudstone | Toarcian |
| 6 | 287.0 | N | MRB-FLIR | Marlstone Rock Formation - Ferruginous Limestone And Ironstone | Toarcian / Pliensbachian |
| 7 | 337.0 | NW | WHM-MDST | Whitby Mudstone Formation - Mudstone | Toarcian |
| 8 | 344.0 | S | CHAM-MDST | Charmouth Mudstone Formation - Mudstone | Pliensbachian / Sinemurian |

## 1.3.2 Permeability of Bedrock Ground

**Are there any records relating to permeability of bedrock ground within the study site* boundary? Yes**

| Distance (m) | Direction | Flow type | Maximum Permeability | Minimum Permeability |
|---|---|---|---|---|
| 0.0 | On Site | Mixed | Moderate | Low |
| 0.0 | On Site | Mixed | High | Moderate |

## 1.3.3 Faults

**Are there any records of Faults within 500m of the study site boundary? No**

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

## 1.3.4 Radon Affected Areas

**Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?**

* This includes an automatically generated 50m buffer zone around the site.

**The property is in a Radon Affected Area, as between 10 and 30% of properties are above the Action Level**

## 1.3.5 Radon Protection

**Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?**

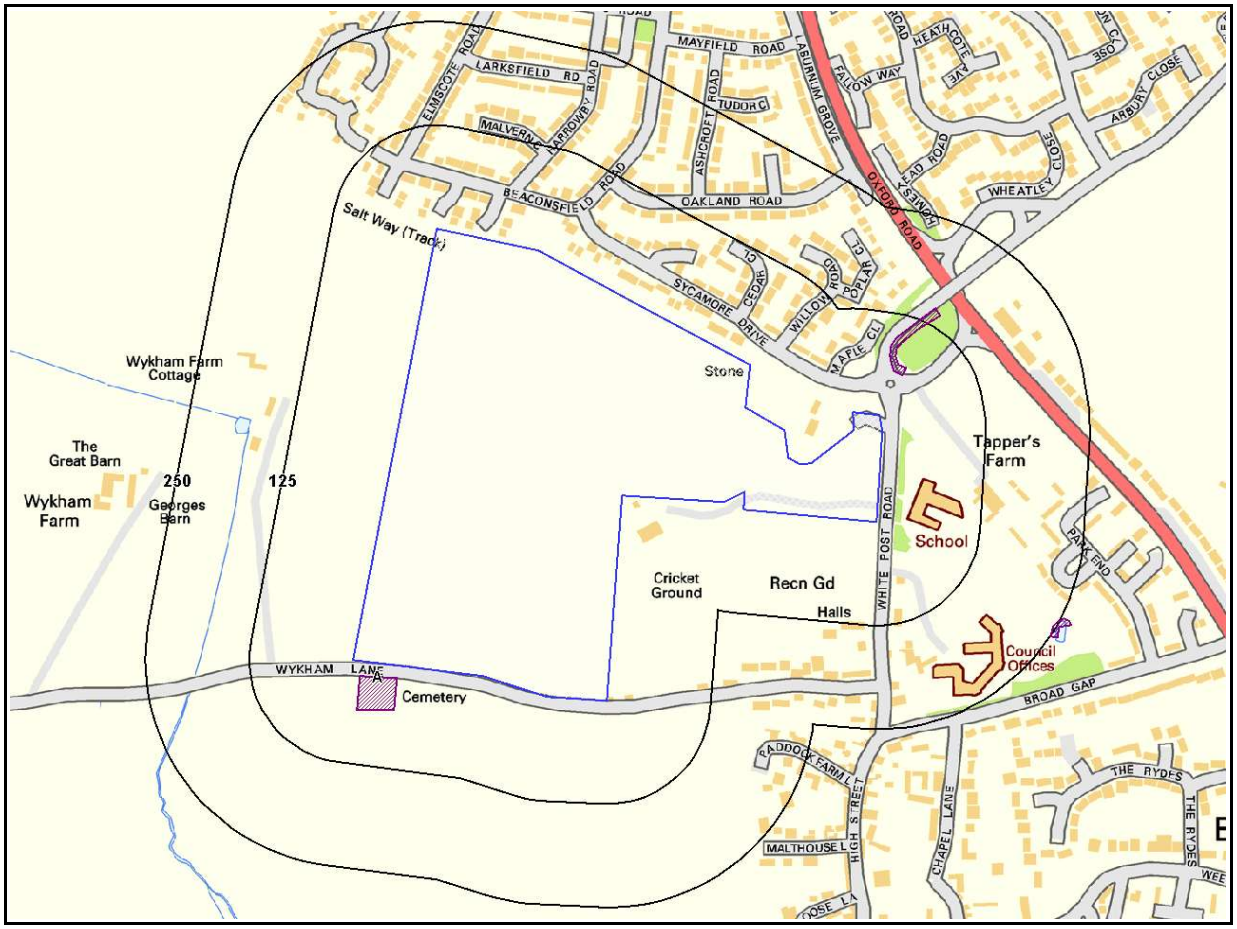
**Full radon protective measures are necessary**

# 2. Ground Workings Map

NW N NE

W E

SW S SE




Ground Workings Legend



Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

Historic Underground Workings

Current Ground Workings

# 2. Ground Workings

## 2.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on GroundSure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping.

**Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes**

The following Historical Surface Ground Working Features are provided by GroundSure:

| ID | Distance (m) | Direction | NGR | Use | Date |
|---|---|---|---|---|---|
| 1A | 15.0 | S | 445426,238047 | Cemetery | 1976 |
| 2A | 15.0 | S | 445426,238047 | Cemetery | 1992 |
| 3B | 56.0 | NE | 446053,238471 | Unspecified Ground Workings | 1992 |
| 4B | 56.0 | NE | 446053,238471 | Unspecified Ground Workings | 1976 |
| 5 | 246.0 | SE | 446242,238126 | Pond | 1881 |

## 2.2 Historical Underground Workings Features derived from Historical Mapping

This data is derived from the GroundSure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

**Are there any Historical Underground Working Features within 1000m of the study site boundary? No**

Database searched and no data found.

## 2.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

**Are there any BGS Current Ground Workings within 1000m of the study site boundary? No**

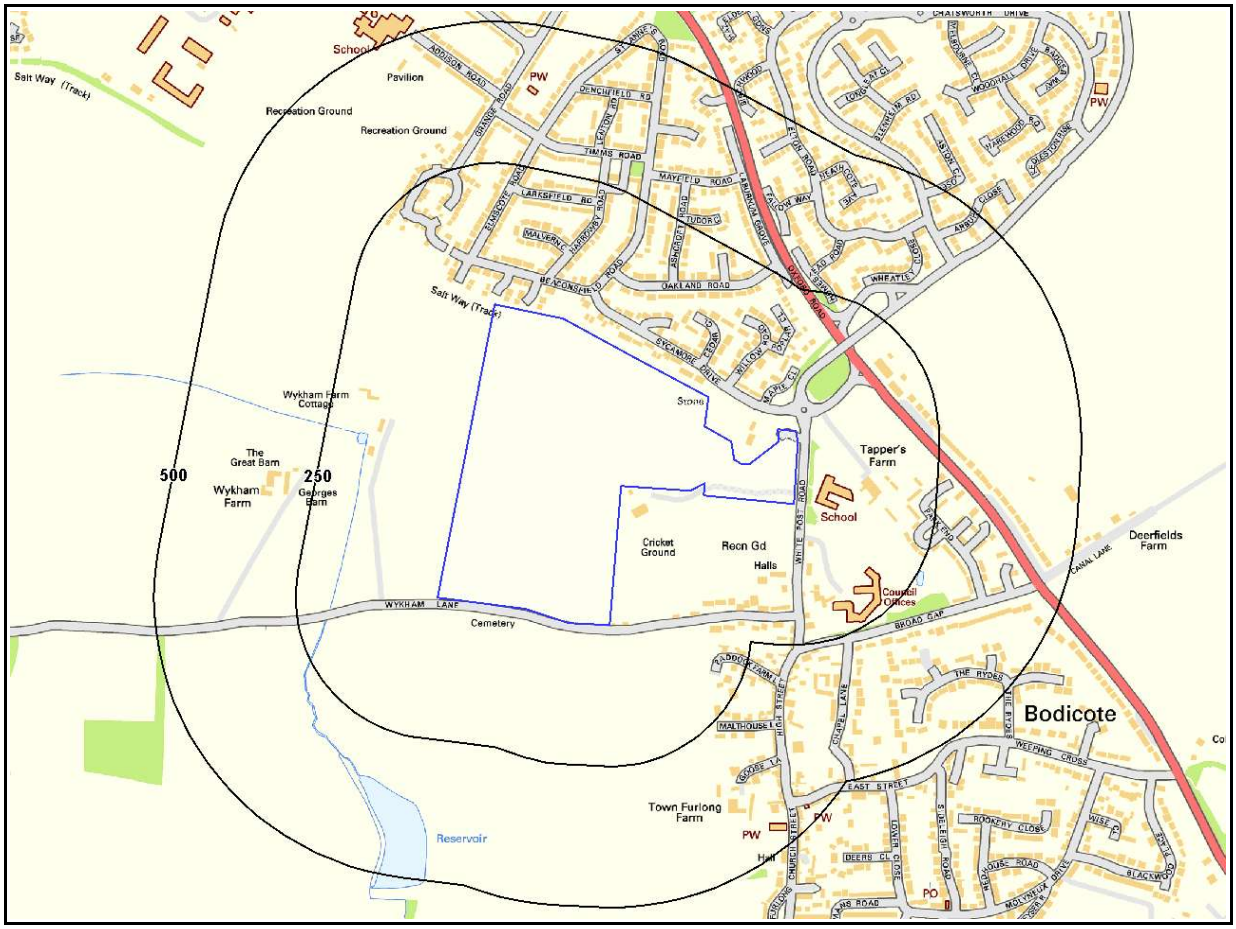
Database searched and no data found.

# 3. Mining, Extraction & Natural Cavities Map

NW N NE

W E

SW S SE




Mining, Extraction & Natural Cavities Legend



Site Outline

250
500
Search Buffers (m)

Historical Mining

Non-Coal Mining Cavities

Natural Cavities

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

# 3.Mining, Extraction & Natural Cavities

## 3.1 Historical Mining

This dataset is derived from GroundSure unique Historical Land-use Database that are indicative of mining or extraction activities.

**Are there any Historical Mining areas within 1000m of the study site boundary?** **No**

Database searched and no data found.

---

## 3.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

**Are there any Coal Mining areas within 1000m of the study site boundary?** **No**

Database searched and no data found.

---

## 3.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

**Are there any JPB Mining areas within 1000m of the study site boundary?** **Yes**

The following information provided by JPB is not represented on Mapping:

Whilst outside of an area where The Coal Authority have information on coal mining activities, Johnson Poole & Bloomer (JPB) have information such as mining plans and maps held within their archive of mining activities that have occurred within 1km of this property. Further details and a quote for services can be obtained by emailing this report to enquiries.gs@jpb.co.uk.

---

## 3.4 Non – Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

**Are there any Non-Coal Mining areas within 1000m of the study site boundary?** **No**

Database searched and no data found.

---

## 3.5 Non – Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great

Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

**Are there any Non-Coal Mining cavities within 1000m of the study site boundary?** **No**

Database searched and no data found.

## 3.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

**Are there any Natural Cavities within 1000m of the study site boundary?** **No**

Database searched and no data found.

## 3.7 Brine Extraction

This dataset provides information from the Brine Compensation Board which has been discontinued and is now covered by the Coal Authority.

**Are there any Brine Extraction areas within 1000m of the study site boundary?** **No**

Database searched and no data found.

## 3.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

**Are there any Gypsum Extraction areas within 1000m of the study site boundary?** **No**

Database searched and no data found.

## 3.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level. More detailed information on potential Tin Mining may be found in Section 3.4 – Non-Coal Mining Hazards.

**Are there any Tin Mining areas within 1000m of the study site boundary?** **No**

Database searched and no data found.

## 3.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

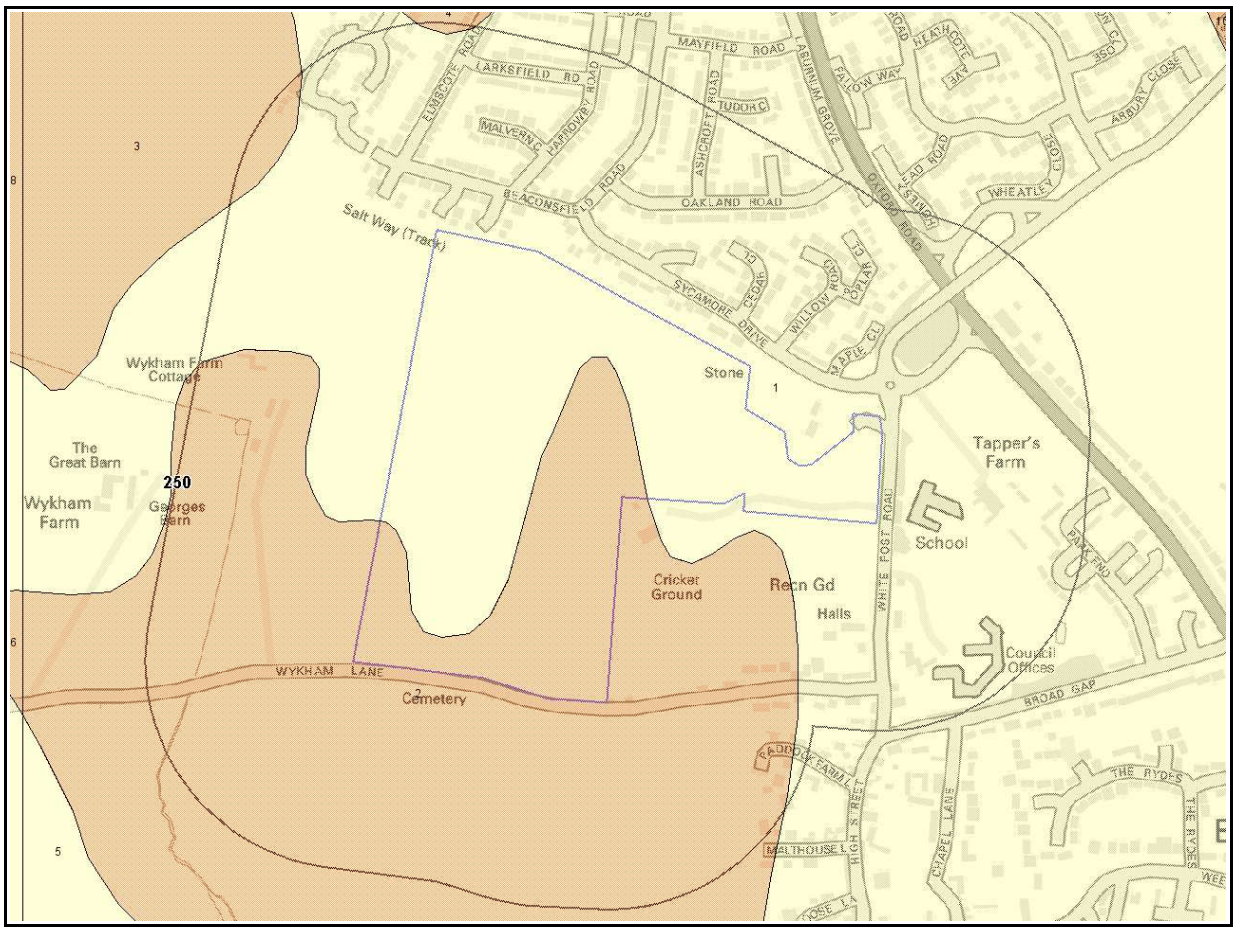
**Are there any Clay Mining areas within 1000m of the study site boundary?** **No**

# 4. Natural Ground Subsidence
# 4.1 Shrink-Swell Clay Map

NW N NE

W E

SW S SE




Shrink-Swell Clay Legend

Mapping sourced from Ordnance Survey



Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

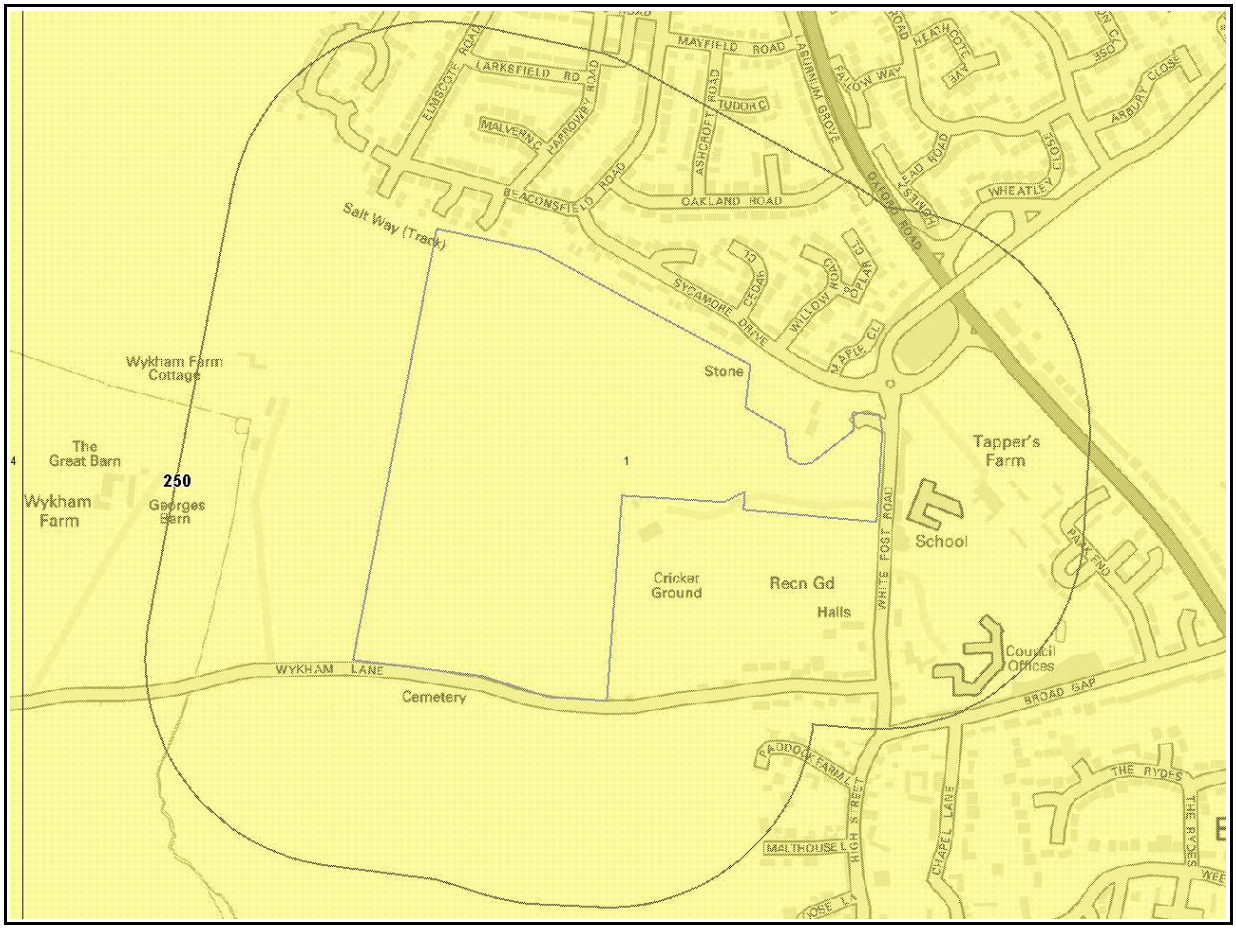
Low
Moderate
High

# 4.2 Landslides Map

NW N NE

W E

SW S SE




Landslides Legend



Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

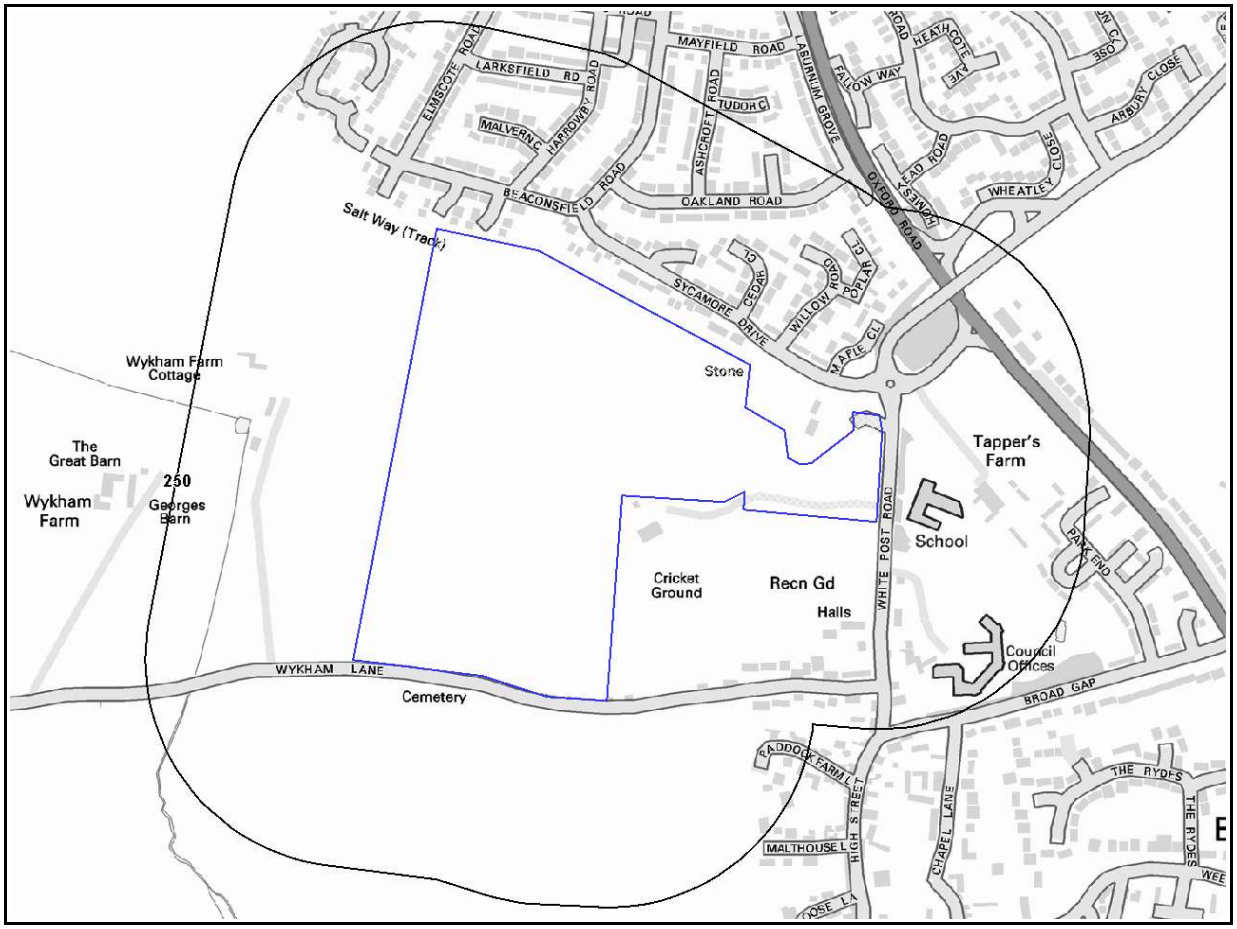
High

# 4.3 Ground Dissolution Soluble Rocks Map

NW N NE

W E

SW S SE




Ground Dissolution Soluble Rocks Legend



Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

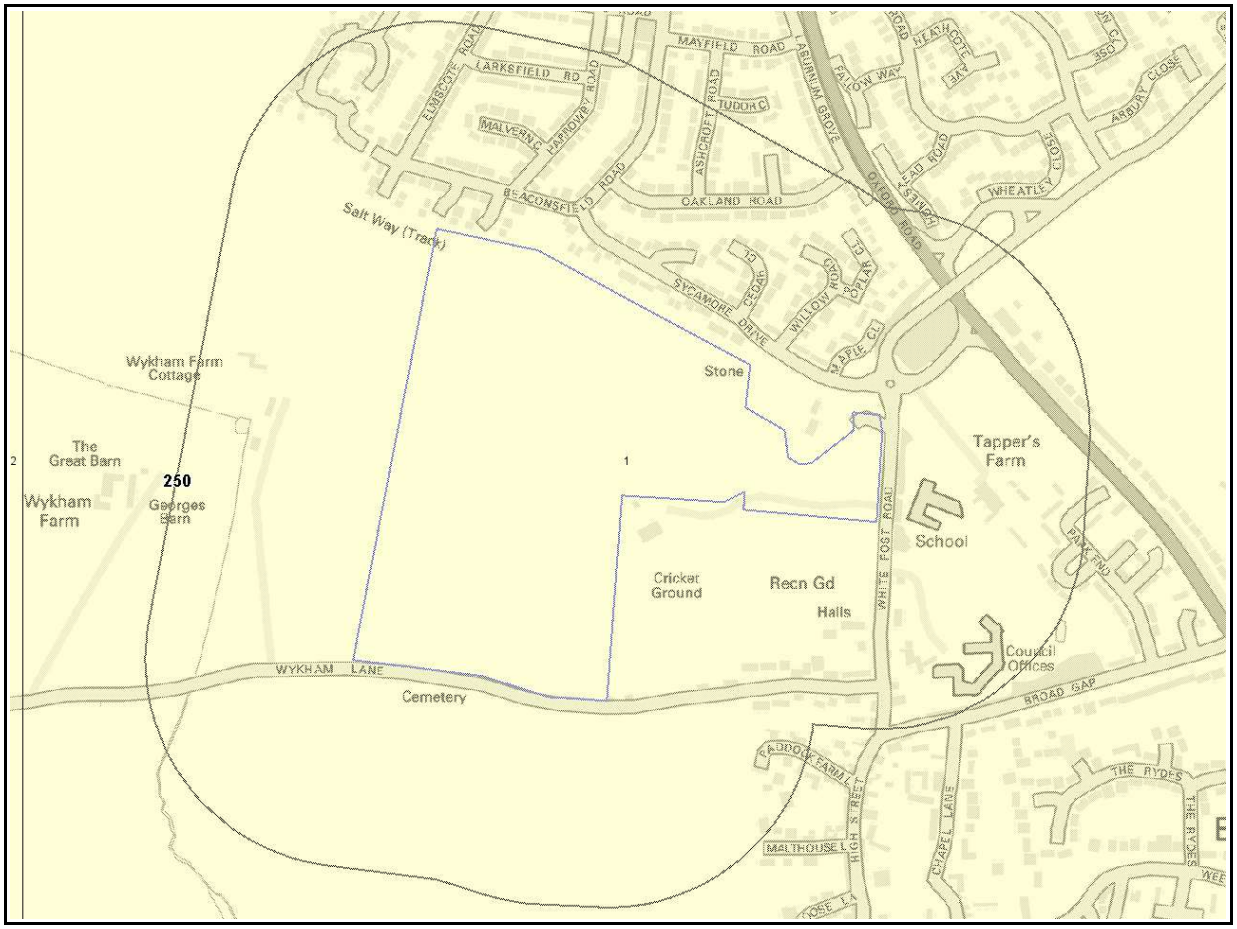
High

# 4.4 Compressible Deposits Map

NW N NE

W E

SW S SE




Compressible Deposits Legend



Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

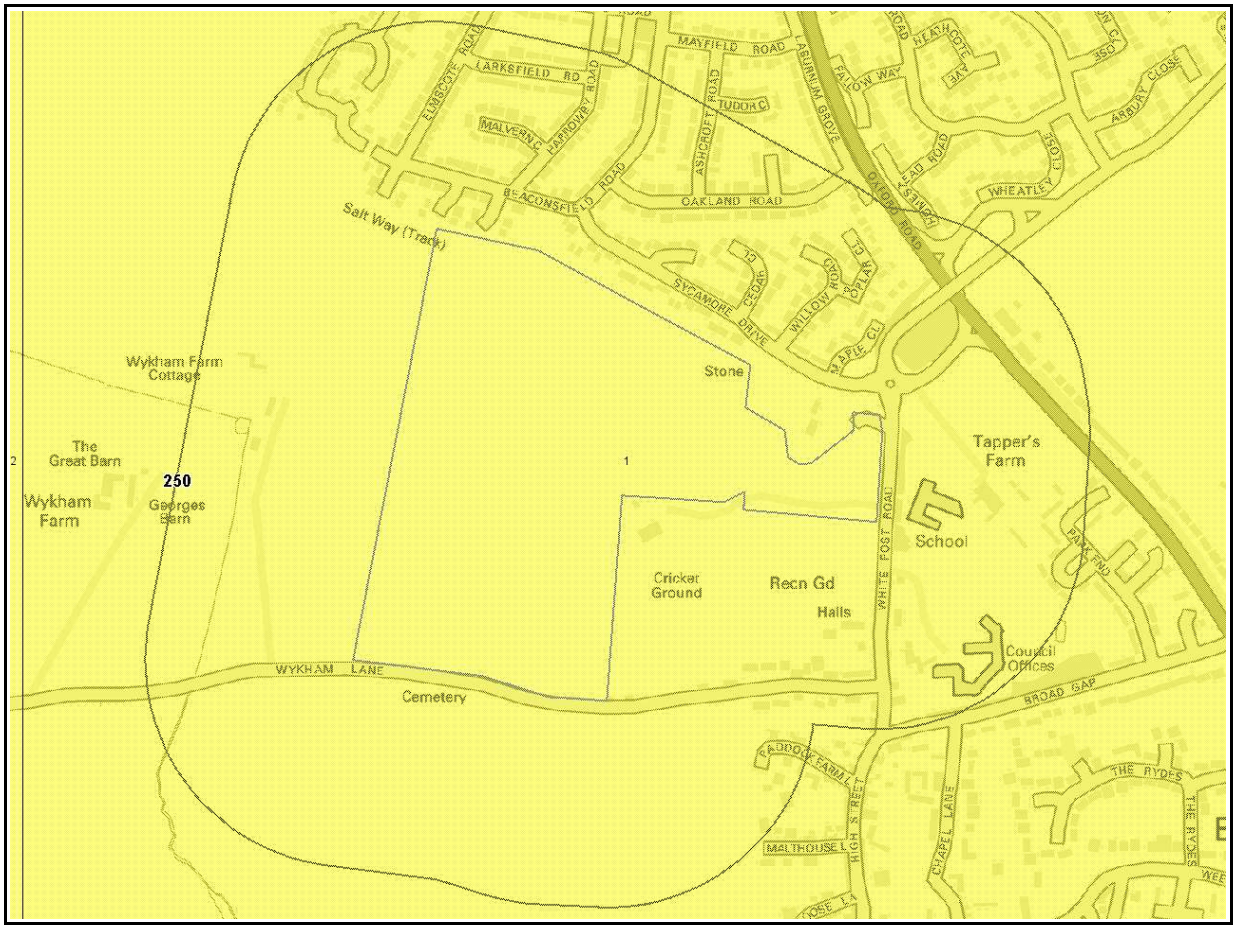
High

# 4.5 Collapsible Deposits Map

NW N NE

W E

SW S SE




Collapsible Deposits Legend



Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

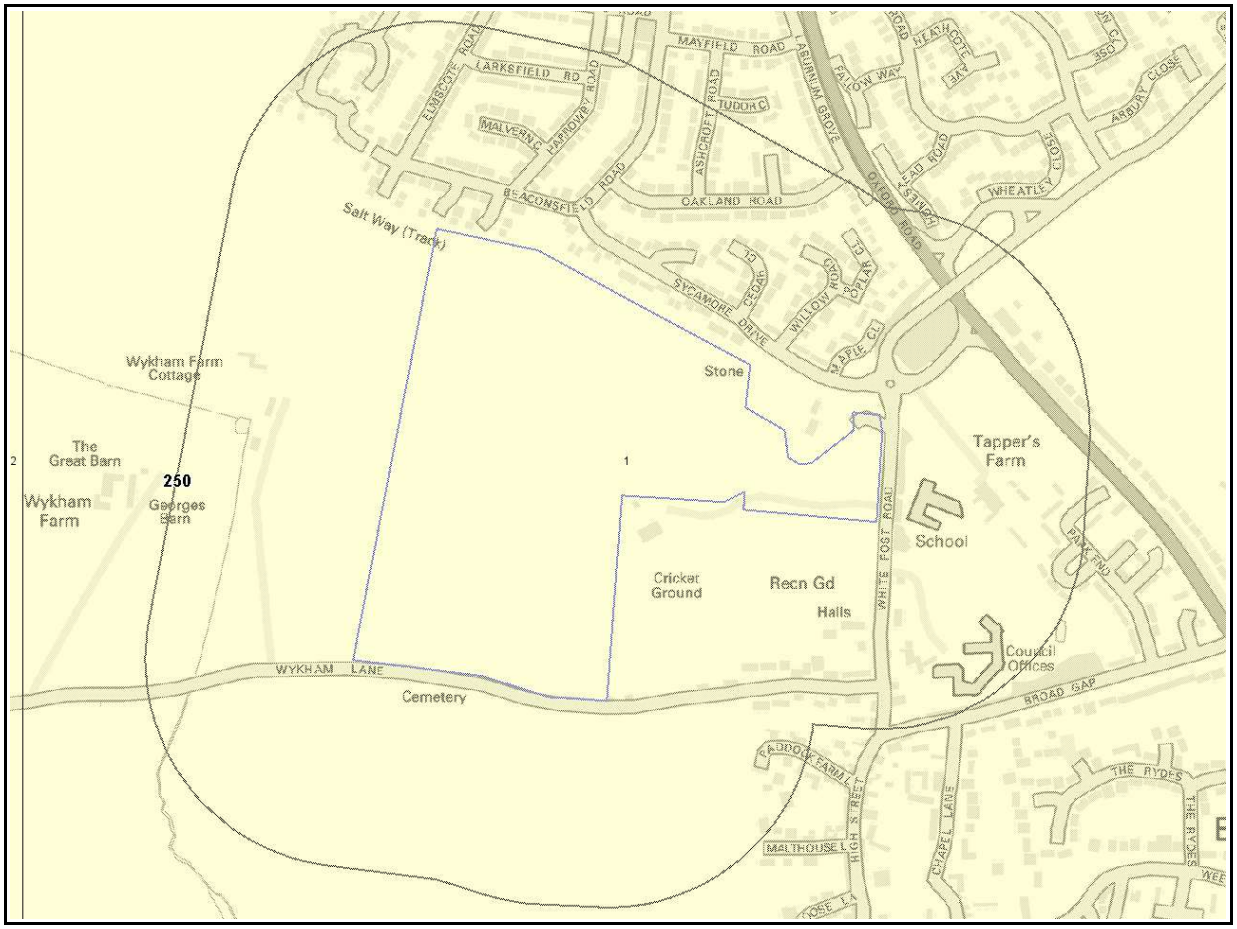
High

# 4.6 Running Sand Map

NW N NE

W E

SW S SE




Running Sand Legend



Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

High

# 4.Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

**What is the maximum hazard rating of natural subsidence within the study site* boundary? Low**

## 4.1 Shrink – Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

| ID | Distance (m) * | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Negligible | Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays. |
| 2 | 0.0 | On Site | Low | Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present. |

## 4.2 Landslides

The following Landslides information provided by the British Geological Survey:

| ID | Distance (m)* | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Very Low | Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides. |

## 4.3 Ground Dissolution of Soluble Rocks

The following Soluble Rocks information provided by the British Geological Survey:

| Distance (m)* | Direction | Hazard Rating | Details |
|---|---|---|---|
| 0.0 | On site | Null-Negligible | Soluble rocks are not present in the search area. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks. |

*This includes an automatically generated 50m buffer zone around the study site boundary.

## 4.4 Compressible Deposits

The following Compressible Ground information provided by the British Geological Survey:

| ID | Distance (m)* | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Negligible | No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits. |

## 4.5 Collapsible Deposits

The following Collapsible Rocks information is provided by the British Geological Survey:

| ID | Distance (m)* | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Very Low | Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits. |

## 4.6 Running Sands

The following Running Sands information is provided by the British Geological Survey:

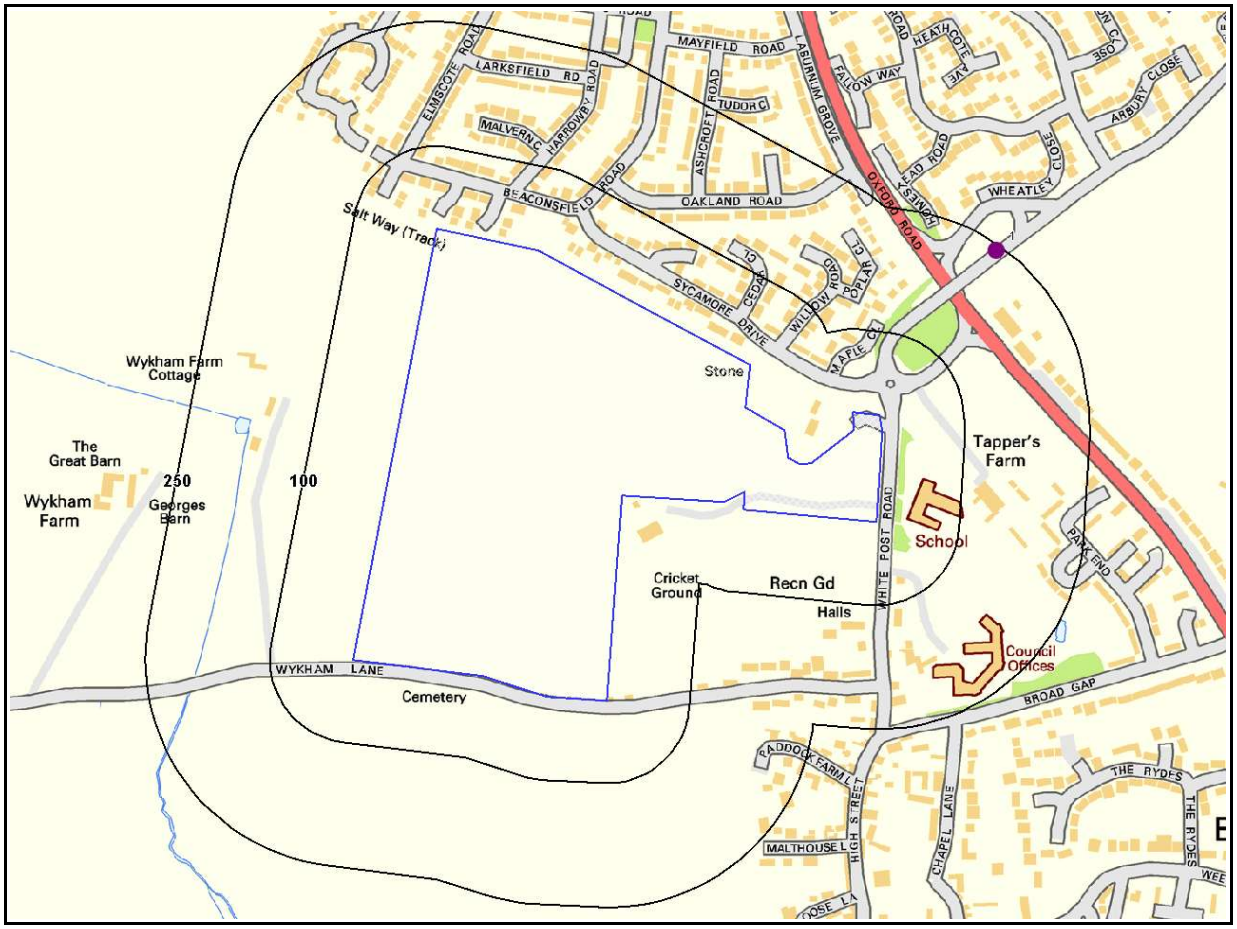
| ID | Distance (m)* | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Negligible | No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand. |

# 5. Borehole Records Map

NW N NE

W E

SW S SE




Borehole Records Legend



Site Outline

Borehole Locations

125
250
Search Buffers (m)

# 5.Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

**Records of boreholes within 250m of the study site boundary:** **1**

| ID | Distance (m) | Direction | NGR | BGS Reference | Drilled Length (m) | Borehole Name |
|---|---|---|---|---|---|---|
| 1 | 242.0 | NE | 446170,238580 | SP43NE8 | 6.0 | BANBURY S1 |

Additional online information is available for the following boreholes listed above:

#1: http://scans.bgs.ac.uk/sobi_scans/boreholes/331091

# 6.Estimated Background Soil Chemistry

**Records of background estimated soil chemistry within 250m of the study site boundary: 4**

For further information on how this data is calculated and limitations upon its use, please see the GroundSure GeoInsight User Guide, available on request.

| | | | Estimated Geometric Mean Soil Concentrations (mg/kg) | | | | |
|---|---|---|---|---|---|---|---|
| Distance (m)* | Direction | Sample Type | Arsenic (As) | Cadmium (Cd) | Chromium (Cr) | Nickel (Ni) | Lead (Pb) |
| 0.0 | On Site | RuralSoil | 60 - 120 mg/kg | <1.8 mg/kg | >180 mg/kg | >100 mg/kg | <150 mg/kg |
| 0.0 | On Site | RuralSoil | 60 - 120 mg/kg | <1.8 mg/kg | >180 mg/kg | 80 - 100 mg/kg | <150 mg/kg |
| 0.0 | On Site | RuralSoil | 60 - 120 mg/kg | <1.8 mg/kg | >180 mg/kg | 80 - 100 mg/kg | <150 mg/kg |
| 38.0 | S | RuralSoil | 60 - 120 mg/kg | <1.8 mg/kg | >180 mg/kg | 80 - 100 mg/kg | <150 mg/kg |

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

# 7. Contacts

## EmapSite
Telephone: 0118 9736883
sales@emapsite.com

## British Geological Survey Enquiries
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143. Fax: 0115 936 3276.
Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk
BGS Geological Hazards Reports and general geological enquiries

## British Gypsum
British Gypsum Ltd, East Leake, Loughborough, Leicestershire, LE12 6HX
Tel: www.british-gypsum.com

## The Coal Authority
200 Lichfield Lane, Mansfield, Notts NG18 4RG
Tel: 0845 762 6848
DX 716176 Mansfield 5 www.coal.gov.uk

## Johnson Poole & Bloomer Limited
Harris and Pearson Building, Brettel Lane, Brierley Hill, West Midlands DY5 3LH
Tel: +44 (0) 1384 262 000
Email: enquiries.gs@jpb.co.uk
Website: www.jpb.co.uk

## Ordnance Survey
Romsey Road, Southampton SO16 4GU
Tel: 08456 050505

## Getmapping PLC
Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

## Peter Brett Associates
Caversham Bridge House, Waterman Place, Reading
Berkshire RG1 8DN
Tel: +44 (0)118 950 0761 E-mail: reading@pba.co.uk

Acknowledgements

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# Standard Terms and Conditions

## 1 Definitions

In these terms and conditions unless the context otherwise requires:

**"Beneficiary"** means the person or entity for whose benefit the Client has obtained the Services.

**"Client"** means the party or parties entering into a Contract with GroundSure.

**"Commercial"** means any building or property which is not Residential.

**"Confidential Information"** means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than

(i) information which the Client can prove was rightfully in its possession prior to disclosure by GroundSure and

(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).

**"Support Services"** means Support Services provided by GroundSure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

**"Contract"** means the contract between GroundSure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.

**"Third Party Data Provider"** means any third party providing Third Party Content to GroundSure.

**"Data Reports"** means reports comprising factual data with no accompanying interpretation.

**"Fees"** has the meaning set out in clause 5.1.

**"GroundSure"** means GroundSure Limited, a company registered in England and Wales under number 03421028.

**"GroundSure Materials"** means all materials prepared by GroundSure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.

**"Intellectual Property"** means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.

**"Mapping"** means a map, map data or a combination of historical maps of various ages, time periods and scales.

**"Order"** means an electronic, written or other order form submitted by the Client requesting Services from GroundSure in respect of a specified Site.

**"Ordnance Survey"** means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.

**"Order Website"** means the online platform through which Orders may be placed by the Client and accepted by GroundSure.

**"Report"** means a Risk Screening Report or Data Report for Commercial or Residential property.

**"Residential"** means any building or property used as or intended to be used as a single dwelling.

**"Risk Screening Report"** means a risk screening report comprising factual data with an accompanying interpretation by GroundSure.

**"Services"** means any Report, Mapping and/or Support Services which GroundSure has agreed to provide by accepting an Order pursuant to clause 2.6.

**"Site"** means the area of land in respect of which the Client has requested GroundSure to provide the Services.

**"Third Party Content"** means data, database information or other information which is provided to GroundSure by a Third Party Data Provider.

**"User Guide"** means the user guide, as amended from time to time, available upon request from GroundSure and on the website (www.groundsure.com) and forming part of this Contract.

## 2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 GroundSure agrees to provide the Services in accordance with the Contract.

2.2 GroundSure shall exercise reasonable skill and care in the provision of the Services.

2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.

2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.

2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. In addition you acknowledge and agree that GroundSure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.

2.6 GroundSure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by Groundsure. GroundSure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by GroundSure. GroundSure's acceptance of an Order shall be binding only when made in writing and signed by GroundSure's authorised representative or when accepted through the Order Website.

## 3 The Client's obligations

3.1 The Client shall comply with the terms of this Contract and

(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and

(ii) be liable to GroundSure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.

3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.

3.3 The Client shall supply to GroundSure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as GroundSure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.

3.4 Where the Client's approval or decision is required to enable GroundSure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.

3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the GroundSure Materials, or use the GroundSure Materials in a manner for which they were not intended. The Client may make the GroundSure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that GroundSure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

## 4 Reliance

4.1The Client acknowledges that the Services provided by GroundSure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by GroundSure to be reliable.
4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;
(i) the Beneficiary,
(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),
(iv) the first purchaser or first tenant of the Site, and
(v) the professional advisers and lenders of the first purchaser or tenant of the Site.
4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.
4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by GroundSure. Any party considering such Reports and Services does so at their own risk.

## 5 Fees and Disbursements

5.1GroundSure shall charge and the Client shall pay fees at the rate and frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by GroundSure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").
5.2 The Client shall pay all outstanding Fees to GroundSure in full without deduction, counterclaim or set off within 30 days of the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.
5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of GroundSure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

## 6 Intellectual Property and Confidentiality

6.1 Subject to
(i) full payment of all relevant Fees and
(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the GroundSure Materials.
6.2 All Intellectual Property in the GroundSure Materials are and shall remain owned by GroundSure or GroundSure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.
6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.
6.4 The Client shall, and shall procure that any recipients of the GroundSure Materials shall:
(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;
(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;
(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);
(iv) not combine the Services with or incorporate such Services into any other information data or service;
(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);
(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and
(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,
6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the GroundSure Materials in order to advise the Beneficiary in a professional capacity. However, GroundSure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.
6.6 The Client shall procure that any person to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

## 7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of GroundSure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:
(i) any breach of contract, including any deliberate breach of the Contract by GroundSure or its employees, agents or subcontractors;
(ii) any use made of the Reports, Services, Materials or any part of them; and
(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.
7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.
7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.
7.4 GroundSure shall not be liable for
(i) loss of profits;
(ii) loss of business;
(iii) depletion of goodwill and/or similar losses;
(iv) loss of anticipated savings;
(v) loss of goods;
(vi) loss of contract;
(vii) loss of use;
(viii) loss or corruption of data or information;
(ix) business interruption;
(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;
(xi) loss or damage that arise as a result of the use of all or part of the GroundSure Materials in breach of the Contract;
(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;
(xiii) loss or damage to a computer, software, modem, telephone or other property; and
(xiv) loss or damage caused by a delay or loss of use of GroundSure's internet ordering service.
7.5 GroundSure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.
7.6 GroundSure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of GroundSure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against GroundSure in relation to the Services or other matters arising pursuant to the Contract.

## 8 GroundSure's right to suspend or terminate

8.1 If GroundSure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, GroundSure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.
8.2 GroundSure shall be entitled to terminate the Contract immediately on written notice in the event that:
(i) the Client fails to pay any sum due to GroundSure within 30 days of the Payment Date; or
(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or
(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or
(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

### 9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.
9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:
(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon GroundSure's acceptance of the Order; and
(ii) the Reports and/or Mapping provided under this Contract are
(a) supplied to the Client's specification(s) and in any event
(b) by their nature cannot be returned.

### 10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:
(i) GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in GroundSure's possession or control; and
(ii) the Client shall pay to GroundSure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination or suspension of the Contract. 11 Anti-Bribery
11.1 The Client warrants that it shall:
(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;
(ii) comply with such of GroundSure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and
(iii) promptly report to GroundSure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.
11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

### 12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.
12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through GroundSure.
12.3 GroundSure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of GroundSure.
12.4 No failure on the part of GroundSure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.
12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.
12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.
12.7 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:
(i) the Client or Beneficiary's failure to provide facilities, access or information;
(ii) fire, storm, flood, tempest or epidemic;
(iii) Acts of God or the public enemy;
(iv) riot, civil commotion or war;
(v) strikes, labour disputes or industrial action;
(vi) acts or regulations of any governmental or other agency;
(vii) suspension or delay of services at public registries by Third Party Data Providers;
(viii) changes in law; or
(ix) any other reason beyond GroundSure's reasonable control.
In the event that GroundSure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then GroundSure shall be entitled to terminate this Contract immediately on written notice to the Client.
12.8 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.
12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.
12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.
12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.
12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.
12.13 GroundSure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.
12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at GroundSure who will respond in a timely manner.
12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law.

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# APPENDIX 2

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GRM Development Solutions Ltd
Laurus House
First Avenue
Centrum 100
Burton upon Trent
Staffordshire
DE14 2WH

Tel: 01283 551249
Web: www.grm-uk.com
Our Ref: P6194-SOAK.1
Date: 10th June 2015

Mr Andy Green
Gladman Developments Ltd
Gladman House
Alexandria Way
Congleton Business Park
Congleton
Cheshire
CW12 1LB

Dear Mr Green

**RE: Infiltration Rate Testing on Land to the South of Salt Way Banbury.**

Further to our instruction from Gladman Developments Ltd (Client), GRM Development Solutions have attended the above site on 8th and 9th June 2015 to carry out infiltration tests from trial pits. This investigation took the form of the excavation of ten trial pits and subsequent infiltration testing. A soakaway test location plan is provided in Appendix A.

The geological map indicates that the northern part of the site is underlain by the Marlstone Formation, which comprises limestone and ironstone and the southern part is underlain by the Dyrham Formation, which comprises mudstone and siltstone. The boundary between the two formations undulates from the east to the west of the site as shown on the sketch presented in Appendix B.

Weathered Marlstone was encountered in the infiltration test pits Soak 1, 2, 4, 5, 9 and 10. Infiltration test pits Soak 3, 6, 7 and 8 encountered clays, silts and very clayey sands, typical of the Dyrham Formation.

Infiltration test pits Soak 1, 2, 3, 4, 5, 8 and 9 were targeted within the area of proposed residential development, where soakaways might be considered for domestic and highways surface water drainage. Infiltration test pits Soak 6 and 7 were targeted in the south of the site where it is proposed to construct an attenuation feature. Infiltration test Soak 10 was completed in the extreme south west corner of the site in case attenuation might be considered in this area of POS.

The following table summarises the results of infiltration tests:

| Infiltration Test | 1st Test | 2nd Test | 3rd Test | Main Geology |
|---|---|---|---|---|
| Soak 1 | $2.51 \times 10^{-4}$ m/s | $1.50 \times 10^{-4}$ m/s | $1.22 \times 10^{-4}$ m/s | Marlstone |
| Soak 2 | $4.35 \times 10^{-5}$ m/s | $3.99 \times 10^{-5}$ m/s | $3.36 \times 10^{-5}$ m/s | Marlstone |
| Soak 3 | 8% infiltration recorded after 3½ hours | | | Dyrham |
| Soak 4 | $1.03 \times 10^{-4}$ m/s | $9.09 \times 10^{-5}$ m/s | $7.06 \times 10^{-5}$ m/s | Marlstone |
| Soak 5 | $1.46 \times 10^{-4}$ m/s | $1.24 \times 10^{-4}$ m/s | $1.18 \times 10^{-4}$ m/s | Marlstone |

| Infiltration Test | 1st Test | 2nd Test | 3rd Test | Main Geology |
|---|---|---|---|---|
| Soak 6 | 1% infiltration recorded after 4 hours 20 minutes | | | Dyrham |
| Soak 7 | 2.04 x $10^{-6}$ m/s | Dyrham | | Dyrham |
| Soak 8 | 3.12 x $10^{-6}$ m/s | Dyrham | | Dyrham s |
| Soak 9 | 2.68 x $10^{-4}$ m/s | 1.85 x $10^{-4}$ m/s | 2.13 x $10^{-4}$ m/s | Marlstone |
| Soak 10 | 4.71 x $10^{-5}$ m/s | 4.55 x $10^{-5}$ m/s | 3.77 x $10^{-5}$ m/s | Marlstone |

Where the Marlstone Rock was encountered, infiltration rates ranged from 2.68 x $10^{-4}$ m/s to 3.36 x $10^{-5}$ m/s, which indicates a good possibility that conventional soakaways will work..

Where the Dyrham Formation was encountered, infiltration rates were generally much poorer, ranging from 3.12 x $10^{-6}$ m/s (which was an interpolated rate) to a point that insufficient infiltration occurred to permit the calculation of an infiltration rate. The results indicate that it is unlikely that conventional soakaways will work in the Dyrham Formation.

I trust that the above is sufficient for your current purposes, however if you have any queries please do not hesitate to contact us.

Yours sincerely

pp

Clive Kirby FGS CGeol
Principal Engineering Geologist

Attached

Appendix A – Infiltration Test Location Plan
Appendix B – Summary of the Geology

# APPENDIX A

**GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:**

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

**Tel:** 01283 551249

**Fax:** 01283 211968

info@grm-uk.com

www.grm-uk.com

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DO NOT SCALE

NOTES:

⊕ Infiltration test locations

**GRM Development Solutions Ltd**
Laurus House, First Ave, Centrum 100,
Burton-on-Trent, Staffordshire
Tel: 01283 551 249 Fax: 01283 211 968
mail@grm-uk.com www.grm-uk.com

CLIENT:
**Gladman**

PROJECT:
**Land to South of Salt Way Banbury**

TITLE:
**Infiltration Test Location Plan**

| SCALE@SIZE : | ISSUE: |
|---|---|
| NTS | FINAL |
| DESIGN/DRAWN : | DATE: |
| AJHR | June 2015 |
| PROJECT No: | DRAWING No: |
| P6194 | ITLP-01 |

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# APPENDIX B

**GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:**

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

**Tel:** 01283 551249

**Fax:** 01283 211968

info@grm-uk.com

www.grm-uk.com

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DO NOT SCALE

NOTES:

Infiltration test locations

Estimated Geological Boundary

**GRM Development Solutions Ltd**
Laurus House, First Ave, Centrum 100,
Burton-on-Trent, Staffordshire
Tel: 01283 551 249 Fax: 01283 211 968
mail@grm-uk.com www.grm-uk.com

CLIENT:

**Gladman**

PROJECT:

**Land to South of Salt Way Banbury**

TITLE:

**Infiltration Test Location Plan And Geological Boundary**

| SCALE@SIZE : | ISSUE: |
|---|---|
| NTS | FINAL |
| DESIGN/DRAWN : | DATE: |
| AJHR | June 2015 |
| PROJECT No: | DRAWING No: |
| P6194 | ITLP-01 |

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# APPENDIX 3

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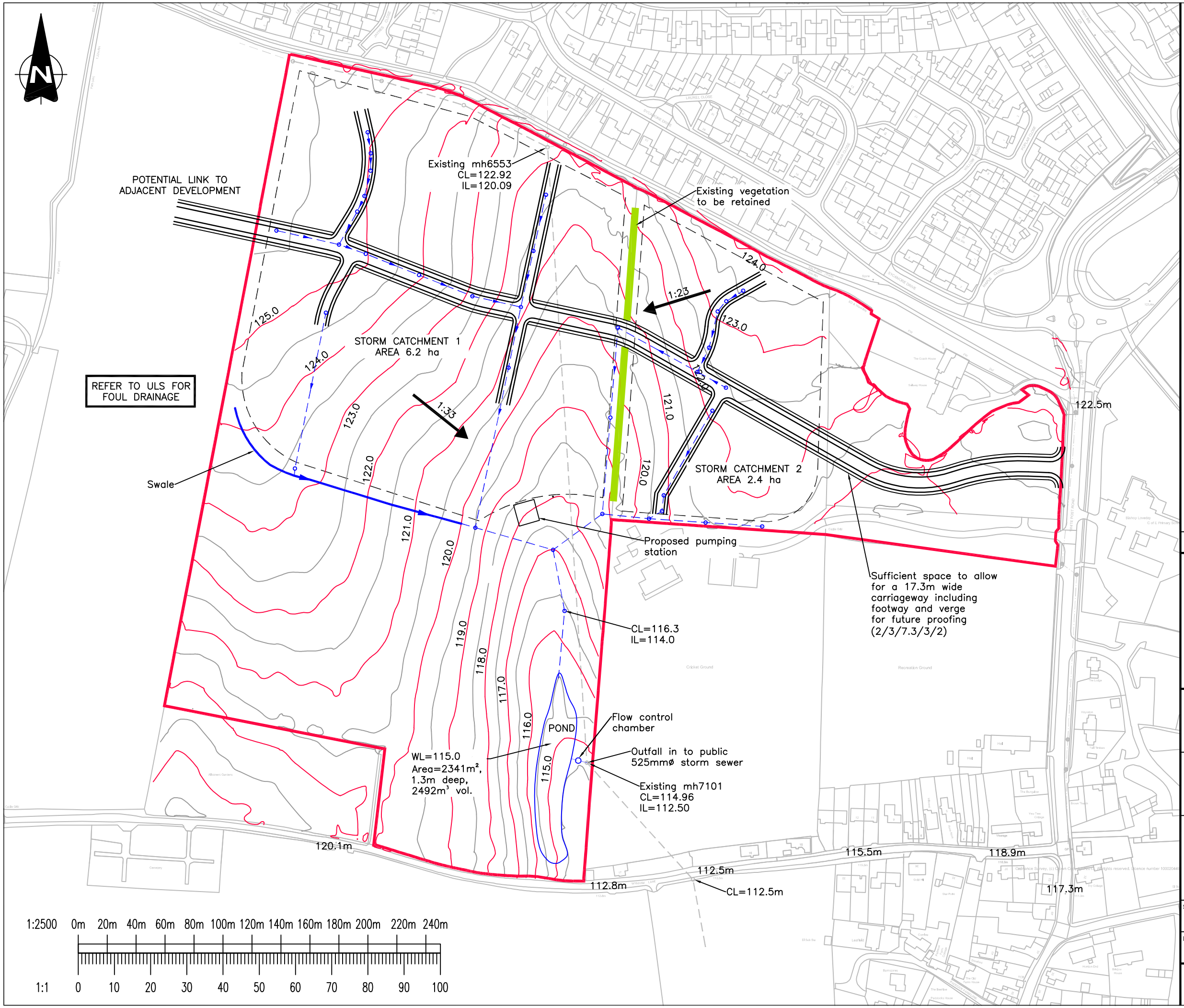


NOTES:

1. Do not scale from this drawing.

KEY:

- Proposed site boundary
- Proposed catchment area
- Proposed storm water sewer
- Proposed swale

| | | | | |
|---|---|---|---|---|
| | | Description | | |

GRM Development Solutions
geoenvironmental - civil - structural

Client
GLADMAN DEVELOPMENTS

Project title
LAND SOUTH OF
SALT WAY, BANBURY

Drawing title
DRAINAGE STRATEGY PLAN

| Scale | Original drg. size | Date |
|---|---|---|
| 1:2500 | A3 | 03/07/2015 |
| Drawn | Checked | Approved |
| CG | SEF | RNP |

Drawing Number

Rev
-

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# APPENDIX 4

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HR Wallingford
*Working with water*

# Greenfield runoff estimation for sites

| | |
|---|---|
| Site name: | White Post Road |
| Site location: | Banbury |

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

## Site coordinates

| | |
|---|---|
| Latitude: | 52.04135° N |
| Longitude: | 1.33595° W |

| | |
|---|---|
| Reference: | gcr019g4y4g2 / 17.53 |
| Date: | 10 Jun 2015 |

## Site characteristics

| | | |
|---|---|---|
| Total site area | 17.53 | ha |
| Significant public open space | 0 | ha |
| Area positively drained | 17.53 | ha |

## Methodology

| | |
|---|---|
| Greenfield runoff method | IH124 |

| | |
|---|---|
| Qbar estimation method | Calculate from SPR and SAAR |
| SPR estimation method | Calculate from SOIL type |
| SOIL type | 1 |
| HOST class | N/A |
| SPR | 0.10 |

## Hydrological characteristics

| | Default | Edited | |
|---|---|---|---|
| SAAR | 653 | 653 | mm |
| M5-60 Rainfall Depth | 20 | 20 | mm |
| 'r' Ratio M5-60/M5-2 day | 0.4 | 0.4 | |
| FEH/FSR conversion factor | 0.84 | 0.84 | |
| Hydrological region | 6 | 6 | |
| Growth curve factor: 1 year | 0.85 | 0.85 | |
| Growth curve factor: 10 year | 1.62 | 1.62 | |
| Growth curve factor: 30 year | 2.3 | 2.3 | |
| Growth curve factor: 100 year | 3.19 | 3.19 | |

## Greenfield runoff rates

| | Default | Edited | |
|---|---|---|---|
| Qbar | 2.71 | 2.71 | l/s |
| 1 in 1 year | 14.90 | 14.90 | l/s |
| 1 in 30 years | 40.32 | 40.32 | l/s |
| 1 in 100 years | 55.92 | 55.92 | l/s |

*Please note that a minimum flow of 5 l/s applies to any site*

DETERMINATION OF STORAGE VOLUMES IN PARTIALLY URBANISED CATCHMENTS AT
Version 1.01

# Site Name

Land to the West of White Post Road, Banbury

30-Jun-15

METHOD DAVIES GRAPHICAL SOLUTION

| | | | | |
|---|---|---|---|---|
| **Catchment Area** | **At** | 8.300 | **Ha** | *0.08 Sq Km* |
| **Soil Index** | **SOIL** | 0.42 | | *Run off Parameters from* |
| **UCWI** | **UCWI** | 42.0 | | *Flood study Maps* |
| **Routing Coefficient** | **Cr** | 1.3 | | |
| **Design Pimp** | **PIMP** | 56.0 | **%** | |

| | | | |
|---|---|---|---|
| **Resultant PR** | **PR** | 39.500 | **%** |
| **F1** | | 0.016 | |
| **F2** | | 0.359 | |

ARF =1-f1D^F2

*From Wallingford 7.3*
*From Wallingford Table 6.4*
*From Wallingford Table 6.4*
*Calculated for each line using wallingford equation 6.6*

| | | | |
|---|---|---|---|
| **M5-60** | 20.00 | | *Rainfall parameter from* |
| **Ratio R** | 0.40 | | *Flood study maps* |
| **Return Period 1 in** | 100 | ***Years*** | |
| **Permissible Discharge** | 56.00 | ***L/s*** | |
| **Nominal Time Step** | 30 | ***Mins*** | |
| **Climate Change Allowance** | 30 | % | |

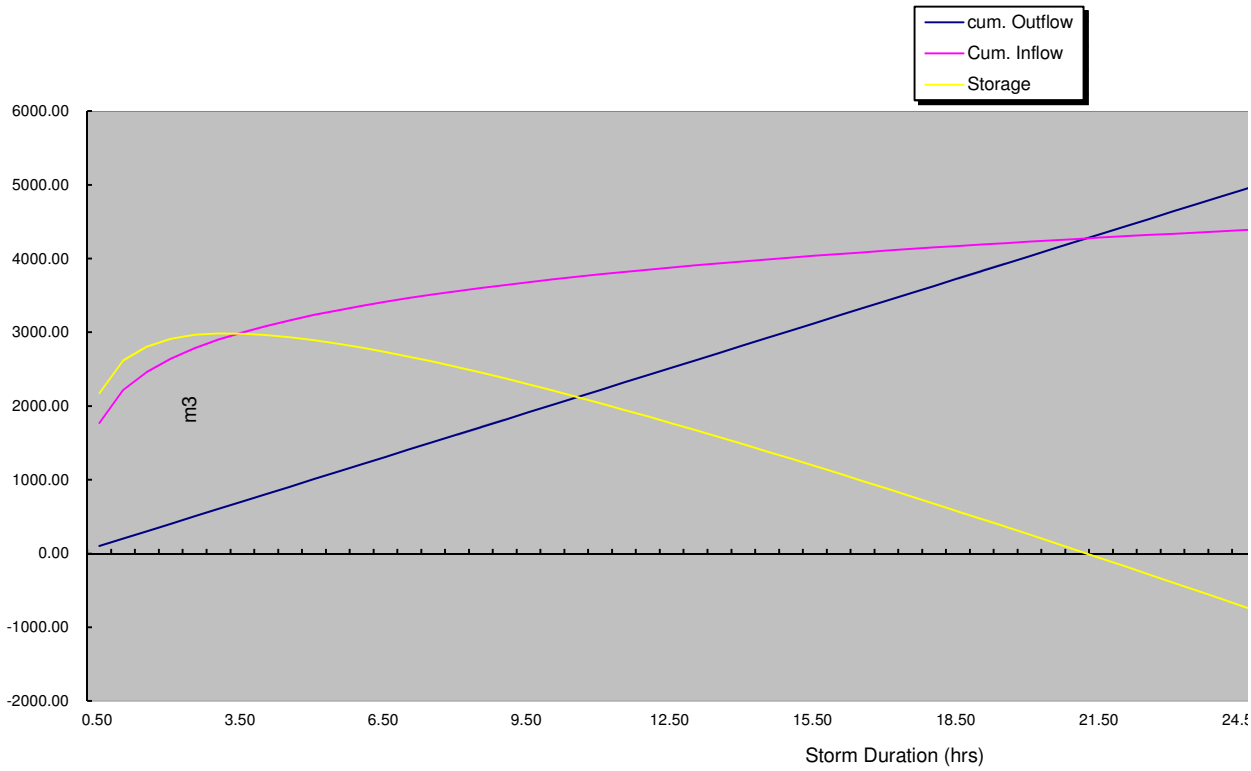
| Multiples of Tc | Storm Duration | Rainfall Rate | ARF | Average Rate Of inflow | Cummulative inflow m3 | Cummulative outflow m3 | Storage m3 | |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.50 | 84.11 | 0.9873 | 983.87 | 1770.96 | 100.80 | 2171.21 | |
| 2 | 1.00 | 52.78 | 0.9837 | 615.15 | 2214.56 | 201.60 | 2616.84 | |
| 3 | 1.50 | 39.21 | 0.9811 | 455.84 | 2461.51 | 302.40 | 2806.85 | |
| 4 | 2.00 | 31.65 | 0.9791 | 367.16 | 2643.52 | 403.20 | 2912.42 | |
| 5 | 2.50 | 26.73 | 0.9773 | 309.52 | 2785.68 | 504.00 | 2966.18 | |
| 6 | 3.00 | 23.23 | 0.9758 | 268.58 | 2900.62 | 604.80 | 2984.57 | Peak Storage |
| 7 | 3.50 | 20.62 | 0.9744 | 238.06 | 2999.51 | 705.60 | 2982.08 | |
| 8 | 4.00 | 18.59 | 0.9731 | 214.34 | 3086.46 | 806.40 | 2964.08 | |
| 9 | 4.50 | 16.96 | 0.9720 | 195.32 | 3164.18 | 907.20 | 2934.07 | |
| 10 | 5.00 | 15.62 | 0.9709 | 179.70 | 3234.52 | 1008.00 | 2894.47 | |
| 11 | 5.50 | 14.50 | 0.9699 | 166.61 | 3298.82 | 1108.80 | 2847.03 | |
| 12 | 6.00 | 13.54 | 0.9689 | 155.47 | 3358.09 | 1209.60 | 2793.03 | |
| 13 | 6.50 | 12.72 | 0.9680 | 145.86 | 3413.08 | 1310.40 | 2733.48 | |
| 14 | 7.00 | 12.00 | 0.9672 | 137.48 | 3464.39 | 1411.20 | 2669.15 | |
| 15 | 7.50 | 11.36 | 0.9663 | 130.09 | 3512.50 | 1512.00 | 2600.66 | |
| 16 | 8.00 | 10.80 | 0.9655 | 123.54 | 3557.81 | 1612.80 | 2528.51 | |
| 17 | 8.50 | 10.29 | 0.9648 | 117.67 | 3600.63 | 1713.60 | 2453.14 | |
| 18 | 9.00 | 9.84 | 0.9641 | 112.38 | 3641.23 | 1814.40 | 2374.88 | |
| 19 | 9.50 | 9.43 | 0.9633 | 107.60 | 3679.84 | 1915.20 | 2294.03 | |
| 20 | 10.00 | 9.05 | 0.9627 | 103.24 | 3716.64 | 2016.00 | 2210.83 | |
| 21 | 10.50 | 8.71 | 0.9620 | 99.25 | 3751.81 | 2116.80 | 2125.51 | |
| 22 | 11.00 | 8.39 | 0.9614 | 95.59 | 3785.48 | 2217.60 | 2038.25 | |
| 23 | 11.50 | 8.10 | 0.9607 | 92.22 | 3817.79 | 2318.40 | 1949.21 | |
| 24 | 12.00 | 7.83 | 0.9601 | 89.09 | 3848.84 | 2419.20 | 1858.53 | |
| 25 | 12.50 | 7.58 | 0.9595 | 86.19 | 3878.72 | 2520.00 | 1766.34 | |
| 26 | 13.00 | 7.35 | 0.9590 | 83.49 | 3907.53 | 2620.80 | 1672.75 | |
| 27 | 13.50 | 7.13 | 0.9584 | 80.97 | 3935.34 | 2721.60 | 1577.86 | |
| 28 | 14.00 | 6.93 | 0.9579 | 78.62 | 3962.21 | 2822.40 | 1481.76 | |
| 29 | 14.50 | 6.74 | 0.9573 | 76.40 | 3988.22 | 2923.20 | 1384.52 | |
| 30 | 15.00 | 6.56 | 0.9568 | 74.32 | 4013.40 | 3024.00 | 1286.23 | |
| 31 | 15.50 | 6.39 | 0.9563 | 72.36 | 4037.83 | 3124.80 | 1186.94 | |
| 32 | 16.00 | 6.23 | 0.9558 | 70.51 | 4061.53 | 3225.60 | 1086.71 | |
| 33 | 16.50 | 6.08 | 0.9553 | 68.76 | 4084.56 | 3326.40 | 985.60 | |
| 34 | 17.00 | 5.93 | 0.9548 | 67.11 | 4106.94 | 3427.20 | 883.66 | |
| 35 | 17.50 | 5.80 | 0.9544 | 65.54 | 4128.72 | 3528.00 | 780.94 | |
| 36 | 18.00 | 5.67 | 0.9539 | 64.04 | 4149.93 | 3628.80 | 677.46 | |
| 37 | 18.50 | 5.54 | 0.9534 | 62.62 | 4170.59 | 3729.60 | 573.28 | |
| 38 | 19.00 | 5.43 | 0.9530 | 61.27 | 4190.73 | 3830.40 | 468.43 | |
| 39 | 19.50 | 5.31 | 0.9525 | 59.98 | 4210.39 | 3931.20 | 362.94 | |
| 40 | 20.00 | 5.21 | 0.9521 | 58.74 | 4229.57 | 4032.00 | 256.85 | |
| 41 | 20.50 | 5.11 | 0.9517 | 57.57 | 4248.31 | 4132.80 | 150.17 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42 | 21.00 | 5.01 | 0.9513 | 56.44 | 4266.63 | 4233.60 | 42.94 |
| 43 | 21.50 | 4.91 | 0.9508 | 55.36 | 4284.53 | 4334.40 | -64.82 |
| 44 | 22.00 | 4.82 | 0.9504 | 54.32 | 4302.05 | 4435.20 | -173.09 |
| 45 | 22.50 | 4.74 | 0.9500 | 53.32 | 4319.20 | 4536.00 | -281.84 |
| 46 | 23.00 | 4.65 | 0.9496 | 52.37 | 4335.98 | 4636.80 | -391.06 |
| 47 | 23.50 | 4.57 | 0.9493 | 51.45 | 4352.43 | 4737.60 | -500.73 |
| 48 | 24.00 | 4.50 | 0.9489 | 50.56 | 4368.54 | 4838.40 | -610.82 |
| 49 | 24.50 | 4.42 | 0.9485 | 49.71 | 4384.34 | 4939.20 | -721.32 |
| 50 | 25.00 | 4.35 | 0.9481 | 48.89 | 4399.83 | 5040.00 | -832.22 |

*THE ABOVE PROGRAMME TAKES NO ACCOUNT OF FLOW ROUTING, AND WILL, THEREFORE, OVERESTIMATE STORAGE VOLUMES DELIVERED TO A POINT OUTFALL, AS CATCHMENT AREA INCREASES. TO THAT END, THE PROGRAMME SHOULD NOT BE USED FOR CATCHMENTS IN EXCESS OF 20 SQ KM*

| | | |
|---|---|---|
| **MAXIMUM STORAGE** | 2984.57 | m3 |
| Drain down time | 14.80 | Hours |

## Site Name



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# APPENDIX 5

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Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

# CDWS/CDWS Standard/2013_2508117

0 15 30 60 90 120
Meters



| | |
|---|---|
| **Scale:** | 1:2863 |
| **Width:** | 800m |
| **Printed By:** | mabdul |
| **Print Date:** | 26/06/2013 |
| **Map Centre:** | 445715,238318 |
| **Grid Reference:** | SP4538SE |

**Comments:**

# CDWS/CDWS Standard/2013_2508117

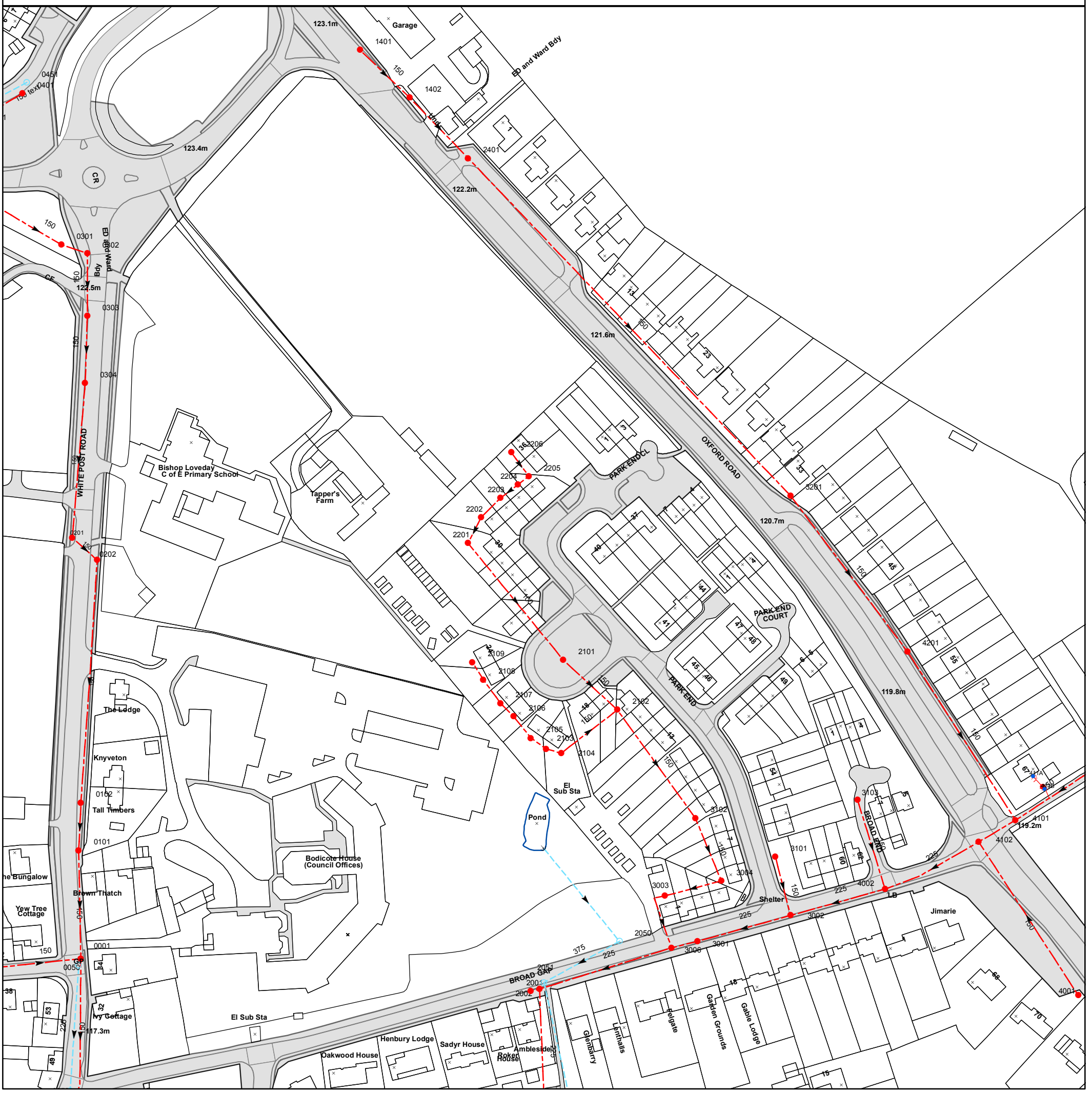
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 961E | | |
| 961D | | |
| 961C | | |
| 061A | | |
| 071I | | |
| 0601 | 124.34 | 122.25 |
| 0651 | 124.46 | 122.93 |
| 1550 | 124.14 | 122.57 |
| 9507 | 124.58 | 123.28 |
| 8554 | 124.91 | 123.61 |
| 8507 | 124.98 | 123.77 |
| 8601 | 125.46 | 124.08 |
| 8650 | 125.35 | 123.01 |
| 9650 | 124.97 | 123.36 |
| 8651 | 125.64 | 123.53 |
| 8603 | 125.34 | 124.75 |
| 0451 | 123.4 | 122.37 |
| 9452 | 123.78 | 122.16 |
| 8451 | 124.08 | 121.65 |
| 9554 | 123.95 | 122.27 |
| 9505 | 123.95 | 123.35 |
| 9550 | 123.97 | 122.3 |
| 8551 | 124.34 | 122.93 |
| 0501 | 124.12 | 123.66 |
| 0550 | 124.11 | 123.05 |
| 9502 | 123.92 | 123.08 |
| 8552 | 124.58 | 123.32 |
| 8553 | 124.78 | 123.47 |
| 8505 | 124.82 | 123.29 |
| 9903 | 116.97 | 115.57 |
| 0950 | 116.76 | 115.09 |
| 0952 | 117.07 | 115.44 |
| 0050 | 117.94 | 116.32 |
| 0101 | 119.56 | 118.13 |
| 0202 | | |
| 0304 | 121.96 | 120.49 |
| 0302 | 123.67 | |
| 9403 | 123.08 | 121.23 |
| 9456 | 123.26 | 122.25 |
| 9406 | 123.29 | 121.7 |
| 9451 | 123.63 | 121.71 |
| 1901 | 117.8 | 114.62 |
| 0951 | 116.24 | 114.64 |
| 3707 | | |
| 4703 | | |
| 4651 | 126.81 | 125.5 |
| 4603 | 126.56 | 126.11 |
| 4602 | 126.61 | 125.96 |
| 5653 | 126.26 | 125.07 |
| 5603 | 126.24 | 125.15 |
| 5652 | 125.88 | 125.07 |
| 5651 | 125.48 | 124.51 |
| 6705 | 125.65 | 124.35 |
| 6650 | 124.66 | 122.32 |
| 6754 | | |
| 7602 | 125.3 | 123.61 |
| 7601 | 125.75 | 123.51 |
| 7604 | 125.72 | 123.74 |
| 7001 | | |
| 6201 | | |
| 8502 | 124.25 | 122.53 |
| 6550 | | |
| 7554 | 124.16 | 121.45 |
| 7551 | 124.19 | 121.38 |
| 7552 | 124.38 | 122.81 |
| 6552 | | |
| 7504 | 124.77 | 123.35 |
| 5501 | | |
| 6652 | | |
| 3602 | | |

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 9652 | 124.57 | 123.8 |
| 961A | | |
| 961B | | |
| 0603 | 124.2 | 122.61 |
| 0650 | 124.31 | 122.65 |
| 0602 | 124.18 | 122.43 |
| 1704 | 124.52 | 121.99 |
| 9506 | 124.31 | 123.2 |
| 8506 | 124.87 | 123.47 |
| 9508 | 124.74 | 123.48 |
| 961F | | |
| 9601 | 125.18 | 124.13 |
| 9651 | 124.78 | 123.56 |
| 8602 | 125.59 | 124.21 |
| 9653 | | |
| 8750 | 125.68 | 123.74 |
| 9404 | 123.79 | 122.72 |
| 8401 | 123.98 | 122.02 |
| 9509 | 123.91 | 123.31 |
| 8501 | 124.21 | 122.15 |
| 8550 | 124.2 | 121.67 |
| 9504 | 124.06 | 123.25 |
| 9551 | 124.06 | 122.3 |
| 8503 | 124.37 | 122.62 |
| 9503 | 124.04 | 123.18 |
| 9552 | 123.98 | 122.47 |
| 8504 | 124.63 | 123.02 |
| 9501 | 124.18 | 122.96 |
| 9553 | 124.17 | 122.78 |
| 9905 | | |
| 9904 | | |
| 9002 | 118.76 | 117.85 |
| 0001 | 117.93 | 116.94 |
| 0102 | 119.73 | 118.47 |
| 0201 | 121.26 | 120.12 |
| 0303 | 123.7 | 120.89 |
| 0301 | | |
| 9455 | 123.13 | 122.06 |
| 9401 | 123.44 | 121.84 |
| 9402 | 123.62 | 121.7 |
| 0401 | 123.45 | 122.12 |
| 0901 | 116.13 | 114.95 |
| 3714 | | |
| 3601 | | |
| 4652 | | |
| 4604 | 126.86 | 126.16 |
| 4650 | 126.56 | 124.25 |
| 4601 | 126.56 | 125.54 |
| 5650 | 126.18 | 124.4 |
| 5602 | 125.89 | 125.17 |
| 5601 | 125.76 | 124.93 |
| 6753 | 125.95 | 125.17 |
| 6651 | 125.75 | 124.69 |
| 6601 | 124.49 | 123.42 |
| 7650 | 125.44 | 122.61 |
| 7603 | 125.59 | 123.7 |
| 7651 | 125.55 | 122.79 |
| 7901 | | |
| 7101 | | |
| 6301 | | |
| 6553 | | |
| 6551 | | |
| 7501 | 124.17 | 122.78 |
| 7502 | 124.22 | 122.85 |
| 7503 | 124.38 | 123.06 |
| 7553 | 124.68 | 123.37 |
| 7550 | 124.28 | 121.25 |
| 5654 | | |
| 3603 | | |

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

# CDWS/CDWS Standard/2013_2508117




0 10 20 40 60 80 Meters



| | |
|---|---|
| **Scale:** | 1:1791 |
| **Width:** | 500m |
| **Printed By:** | mabdul |
| **Print Date:** | 26/06/2013 |
| **Map Centre:** | 446250,238250 |
| **Grid Reference:** | SP4638SW |

**Comments:**

# CDWS/CDWS Standard/2013_2508117

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 0451 | 123.4 | 122.37 |
| 2401 | | |
| 2109 | 119.15 | 118.48 |
| 2108 | 119.07 | 118.17 |
| 2107 | 118.71 | 117.88 |
| 2106 | 118.38 | 117.58 |
| 2205 | 121.07 | 120.02 |
| 2002 | 116.72 | 114.04 |
| 2051 | 116.59 | 114.42 |
| 2104 | 117.88 | 116.96 |
| 0050 | 117.94 | 116.32 |
| 0101 | 119.56 | 118.13 |
| 0202 | | |
| 0304 | 121.96 | 120.49 |
| 0302 | 123.67 | |
| 1402 | | |
| 4001 | | |
| 2050 | | |
| 3002 | 118.54 | 115.1 |
| 4002 | 118.74 | 116.25 |
| 3101 | 118.86 | 116.83 |
| 4101 | 119.41 | 116.61 |
| 3103 | 119.16 | 117.26 |
| 411A | | |
| 4201 | 119.98 | 117.47 |

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 1401 | 122.96 | 121.79 |
| 2201 | 120.26 | 118.86 |
| 2202 | | |
| 2203 | 120.64 | 119.12 |
| 2206 | | |
| 2204 | 121.1 | 119.81 |
| 2105 | 118.18 | 117.27 |
| 2001 | 116.7 | 113.83 |
| 2103 | 117.98 | 117.09 |
| 2101 | 119.38 | 117.36 |
| 0001 | 117.93 | 116.94 |
| 0102 | 119.73 | 118.47 |
| 0201 | 121.26 | 120.12 |
| 0303 | 123.7 | 120.89 |
| 0301 | | |
| 0401 | 123.45 | 122.12 |
| 3006 | | |
| 3001 | 117.94 | 114.64 |
| 3003 | | |
| 3004 | | |
| 4102 | 119.28 | 116.16 |
| 3102 | 118.62 | 115.65 |
| 411B | | |
| 2102 | 118.9 | 116.5 |
| 3201 | 120.81 | 118.36 |

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

# CDWS/CDWS Standard/2013_2508117


The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

| | |
|---|---|
| **Scale:** | 1:1791 |
| **Width:** | 500m |
| **Printed By:** | mabdul |
| **Print Date:** | 26/06/2013 |
| **Map Centre:** | 445750,238250 |
| **Grid Reference:** | SP4538SE |

**Comments:**

# CDWS/CDWS Standard/2013_2508117

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 9404 | 123.79 | 122.72 |
| 8401 | 123.98 | 122.02 |
| 9002 | 118.76 | 117.85 |
| 9455 | 123.13 | 122.06 |
| 9401 | 123.44 | 121.84 |
| 9402 | 123.62 | 121.7 |
| 7001 | | |
| 6201 | | |

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 9452 | 123.78 | 122.16 |
| 8451 | 124.08 | 121.65 |
| 9403 | 123.08 | 121.23 |
| 9456 | 123.26 | 122.25 |
| 9406 | 123.29 | 121.7 |
| 9451 | 123.63 | 121.71 |
| 7101 | | |
| 6301 | | |

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

# CDWS/CDWS Standard/2013_2508117


0 10 20 40 60 80
Meters

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

| | |
|---|---|
| **Scale:** | 1:1791 |
| **Width:** | 500m |
| **Printed By:** | mabdul |
| **Print Date:** | 26/06/2013 |
| **Map Centre:** | 445250,238250 |
| **Grid Reference:** | SP4538SW |

**Comments:**

# CDWS/CDWS Standard/2013_2508117

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

# CDWS/CDWS Standard/2013_2508117


0 10 20 40 60 80 Meters



| | |
|---|---|
| **Scale:** | 1:1791 |
| **Width:** | 500m |
| **Printed By:** | mabdul |
| **Print Date:** | 26/06/2013 |
| **Map Centre:** | 445750,238750 |
| **Grid Reference:** | SP4538NE |

**Comments:**

# CDWS/CDWS Standard/2013_2508117

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 591B | | |
| 8967 | | |
| 8965 | | |
| 8084 | | |
| 8959 | | |
| 8953 | | |
| 8955 | | |
| 9954 | | |
| 8950 | 127.27 | 126.1 |
| 8850 | 126.1 | 125.23 |
| 8961 | | |
| 8960 | | |
| 8801 | 126.08 | 124.54 |
| 9801 | 125.87 | 124.61 |
| 9852 | 125.9 | 124.57 |
| 9802 | 125.7 | 124.83 |
| 9851 | 125.65 | 124.7 |
| 961E | | |
| 961D | | |
| 961C | | |
| 9506 | 124.31 | 123.2 |
| 8506 | 124.87 | 123.47 |
| 9508 | 124.74 | 123.48 |
| 961F | | |
| 9601 | 125.18 | 124.13 |
| 9651 | 124.78 | 123.56 |
| 8602 | 125.59 | 124.21 |
| 9653 | | |
| 8750 | 125.68 | 123.74 |
| 8703 | 125.73 | 124.67 |
| 8701 | 125.78 | 124.54 |
| 8752 | 125.74 | 124.54 |
| 8751 | 125.93 | 124.28 |
| 8702 | 126.07 | 124.77 |
| 9554 | 123.95 | 122.27 |
| 9505 | 123.95 | 123.35 |
| 9550 | 123.97 | 122.3 |
| 8551 | 124.34 | 122.93 |
| 8503 | 124.37 | 122.62 |
| 9502 | 123.92 | 123.08 |
| 8552 | 124.58 | 123.32 |
| 8553 | 124.78 | 123.47 |
| 8505 | 124.82 | 123.29 |
| 5953 | | |
| 5952 | 127.75 | 126.83 |
| 691F | | |
| 6952 | 127.99 | 126.45 |
| 6951 | 127.62 | 126.31 |
| 7951 | 126.86 | 125.81 |
| 5802 | 127.13 | 125.35 |
| 5901 | 128.62 | 127.4 |
| 6751 | 126.37 | 124.88 |
| 6703 | 126.3 | 124.45 |
| 6803 | 126.59 | 124.89 |
| 6850 | 126.52 | 124.99 |
| 7850 | 126.43 | 123.7 |
| 7804 | 126.35 | 124.14 |
| 7801 | 126.61 | 124.96 |
| 7852 | 126.4 | 125.14 |
| 7802 | 126.59 | 124.98 |
| 6851 | 126.87 | 125.78 |
| 6801 | 126.88 | 125.56 |
| 6802 | 127.23 | 125.92 |
| 5951 | 127.65 | 126.9 |
| 7901 | 126.7 | 125.34 |
| 5653 | 126.26 | 125.07 |
| 5603 | 126.24 | 125.15 |
| 5750 | 126.15 | 125.37 |
| 5652 | 125.88 | 125.07 |
| 5651 | 125.48 | 124.51 |
| 6753 | 125.95 | 125.17 |
| 6651 | 125.75 | 124.69 |
| 6701 | 125.95 | 124.06 |
| 6650 | 124.66 | 122.32 |
| 6601 | 124.49 | 123.42 |
| 6754 | | |
| 7602 | 125.3 | 123.61 |
| 7601 | 125.75 | 123.51 |
| 7651 | 125.55 | 122.79 |
| 7701 | 125.94 | 123.66 |
| 7702 | 126.23 | 123.9 |

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 591C | | |
| 8968 | | |
| 8966 | | |
| 8969 | | |
| 8970 | | |
| 8951 | | |
| 9956 | | |
| 8851 | 126.21 | 123.92 |
| 8901 | 126.95 | 125.56 |
| 8963 | | |
| 8964 | | |
| 8962 | | |
| 8852 | 126.02 | 124.39 |
| 9951 | 126.58 | 125.61 |
| 9853 | 125.94 | 125.16 |
| 9950 | 125.89 | 124.25 |
| 9850 | 125.46 | |
| 9652 | 124.57 | 123.8 |
| 961A | | |
| 961B | | |
| 9507 | 124.58 | 123.28 |
| 8554 | 124.91 | 123.61 |
| 8507 | 124.98 | 123.77 |
| 8601 | 125.46 | 124.08 |
| 8650 | 125.35 | 123.01 |
| 9650 | 124.97 | 123.36 |
| 8651 | 125.64 | 123.53 |
| 8603 | 125.34 | 124.75 |
| 9750 | 125.19 | 124.2 |
| 8704 | 125.56 | 124.8 |
| 9751 | | |
| 8753 | 125.48 | 124.79 |
| 9701 | 125.55 | 125.12 |
| 9509 | 123.91 | 123.31 |
| 8501 | 124.21 | 122.15 |
| 8550 | 124.2 | 121.67 |
| 9504 | 124.06 | 123.25 |
| 9551 | 124.06 | 122.3 |
| 9503 | 124.04 | 123.18 |
| 9552 | 123.98 | 122.47 |
| 8504 | 124.63 | 123.02 |
| 9501 | 124.18 | 122.96 |
| 9553 | 124.17 | 122.78 |
| 591A | | |
| 6901 | 127.85 | 127.17 |
| 691E | | |
| 691D | | |
| 7952 | 127.21 | 126.25 |
| 7902 | 126.99 | 125.59 |
| 5950 | 128.64 | 127.29 |
| 5954 | | |
| 6752 | 126.48 | 125.48 |
| 6704 | 126.43 | 124.6 |
| 5851 | 126.96 | 125.8 |
| 5801 | 126.98 | 125.16 |
| 7851 | 126.48 | 125.12 |
| 5803 | 127.33 | 125.42 |
| 7854 | | |
| 7853 | 126.71 | 125.53 |
| 7803 | 126.71 | 125.11 |
| 6852 | 127.15 | 126.14 |
| 5850 | 127.48 | 126.29 |
| 6950 | 127.07 | 125.99 |
| 7950 | 126.74 | 125.57 |
| 5751 | 126.95 | 125.59 |
| 5650 | 126.18 | 124.4 |
| 5701 | 126.34 | 124.87 |
| 5602 | 125.89 | 125.17 |
| 5601 | 125.76 | 124.93 |
| 6706 | 125.98 | 124.47 |
| 6705 | 125.65 | 124.35 |
| 671A | | |
| 6707 | 125.88 | 123.86 |
| 6702 | 126.16 | 124.22 |
| 6750 | 126.2 | 124.82 |
| 7650 | 125.44 | 122.61 |
| 7603 | 125.59 | 123.7 |
| 7750 | 125.84 | 123.05 |
| 7751 | 126.19 | 123.38 |
| 7604 | 125.72 | 123.74 |
| 8502 | 124.25 | 122.53 |

# CDWS/CDWS Standard/2013_2508117

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 6553 | | |
| 6551 | | |
| 7501 | 124.17 | 122.78 |
| 7502 | 124.22 | 122.85 |
| 7503 | 124.38 | 123.06 |
| 7553 | 124.68 | 123.37 |
| 7550 | 124.28 | 121.25 |
| 5654 | | |

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 6550 | | |
| 7554 | 124.16 | 121.45 |
| 7551 | 124.19 | 121.38 |
| 7552 | 124.38 | 122.81 |
| 6552 | | |
| 7504 | 124.77 | 123.35 |
| 5501 | | |
| 6652 | | |

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

# CDWS/CDWS Standard/2013_2508117




| | |
|---|---|
| **Scale:** | 1:1791 |
| **Width:** | 500m |
| **Printed By:** | mabdul |
| **Print Date:** | 26/06/2013 |
| **Map Centre:** | 445250,238750 |
| **Grid Reference:** | SP4538NW |

**Comments:**

# CDWS/CDWS Standard/2013_2508117

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 3708 | | |
| 4853 | | |
| 3802 | | |
| 4855 | | |
| 3801 | | |
| 4802 | 128.63 | 127.91 |
| 4801 | 128.51 | 127.82 |
| 4951 | 128.56 | 127.8 |
| 4901 | 128.48 | 127.53 |
| 3706 | | |
| 3714 | | |
| 3601 | | |
| 4704 | | |
| 4651 | 126.81 | 125.5 |
| 4604 | 126.86 | 126.16 |
| 4603 | 126.56 | 126.11 |
| 471I | | |
| 471K | | |
| 4602 | 126.61 | 125.96 |
| 4701 | 126.74 | 125.71 |
| 3702 | | |
| 3710 | | |
| 3602 | | |
| 3704 | | |

| REFERENCE | COVER LEVEL | INVERT LEVEL |
|---|---|---|
| 3701 | | |
| 4854 | | |
| 3804 | | |
| 4852 | | |
| 3803 | | |
| 4850 | 128.62 | 127.97 |
| 4902 | 128.52 | 127.75 |
| 4950 | 128.5 | 127.4 |
| 3713 | | |
| 3705 | | |
| 3707 | | |
| 4703 | | |
| 4652 | | |
| 471G | | |
| 471H | | |
| 4650 | 126.56 | 124.25 |
| 471J | | |
| 471L | | |
| 4601 | 126.56 | 125.54 |
| 3709 | | |
| 3703 | | |
| 3603 | | |
| 3711 | | |
| 3712 | | |

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# Sewer Key - Commercial Drainage and Water Enquiry

## Public Sewer Types (Operated & Maintained by Thames Water)

**Foul:** A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

**Surface Water:** A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

**Combined:** A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

## Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

## Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

## End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

## Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

**Areas**

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

## Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

**Notes:**

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0845 070 9148.

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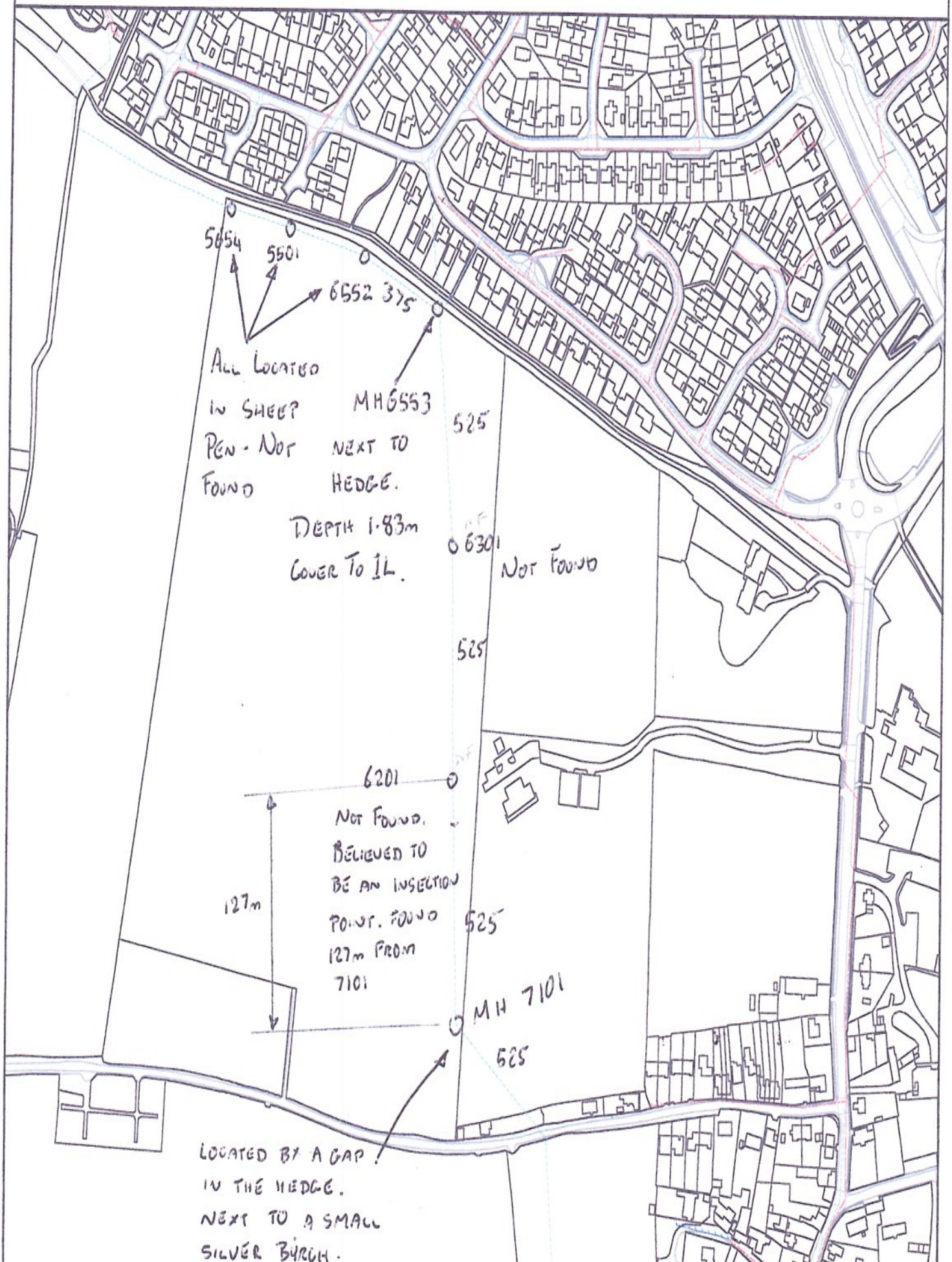
Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

# CDWS/CDWS Standard/2013_2508117



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