Flood Risk Assessment Development at Barkby Road, Queniborough

Written on behalf of David Wilson Homes

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Flood Risk Assessment

Land at Barkby Road, Queniborough

Job No. : DWH / BRQ / FRA 1

By:
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Unit 17, Lakeside Business Park, Walkmill Lane, Cannock, WS11 0XE

Date: November 2017

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Executive Summary

Executive Summary

Residential and Commercial Engineering Ltd have been requested to carry out a flood risk assessment with regards to the proposed planning application for the construction of 136 dwellings on a greenfield site, off Barkby Road, Queniborough.

This Report discusses the risk of flooding to the site and potential consequences. It then assesses the development proposals and the impact of flooding on these. Future ground levels and drainage proposals are also considered as part of the assessment.

Methodology - A detailed assessment including the preparation of preliminary drainage calculations and reviewing the surface water drainage hierarchy was carried out to ensure compliance with relevant guidance and to ensure a minimal risk of flooding, whilst providing a drainage strategy to inform any following detailed engineering designs. The methodology of this report (including outflow rates & SUDS strategies) should be adhered to during any subsequent detailed engineering designs.

Conclusions –

The assessment shows that the proposed development can be accommodated in its proposed location with a no further risk of flooding to the development site and no increase in risk of flooding to adjacent properties whilst maintaining the existing greenfield flow rates from the proposed site to the downstream network.

Planning Permission should therefore not be withheld on flood risk grounds.

Section 1: Planning Guidance Notes 25

a) With the publication of the 'National Planning Policy Framework' (NPPF) in March 2012 it became a requirement that all affected planning applications be accompanied by a site-specific flood risk assessment.

The Technical Guidance to the National Planning Policy Framework (NPPF-TG) provides additional guidance to ensure the effective implementation of the planning policy as set out in the NPPF and retains key elements of Planning Policy Statement 25: Development and Flood Risk.

The NPPF-TG requires a site-specific flood risk assessment (FRA) to assess the risk to a development site and demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed now, and taking climate change into account.

The NPPF-TG requires that climate change is taken into account in assessing the flood risk for developments. Table 5 of the NPPF-TG provides sensitivity ranges which may provide an appropriate precautionary response to the uncertainty about climate change impacts on rainfall intensities and river flows. The table (adapted to demonstrate effects on rivers) is shown below:

Table 1: Recommended national precautionary sensitivity ranges for peak rainfall intensities in small and urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

The design horizon of the proposed development is beyond 2085 and therefore in accordance with the above table, peak rainfall intensity has, where applicable, been increased by 40% to represent anticipated climate change.

b) Planning Policy Statement 25 (PPS25) issued in December 2006 replaces PPG25 guidance notes issued by the Office of the Deputy Prime Minister in July 2001 which is now cancelled. PPS25 introduced the sequential test and risk based approach to flood risk of developments on priorities based on flood zones as outlined in PPS25. The Flood Risk Assessment follows the relevant sections of the guidelines of PPS25.

c) Environment Agency & other supporting governing bodies provide guidance notes in order to produce flood risk assessments which consist of the following documents –

NPPF & NPPF-TG
CIRIA 522 (SUDS Design manual for England and Wales)
CIRIA 523 (SUDS Best practice manual)
CIRIA 753 (The SUDS manual)
CIRIA 624 (Flood Risk Assessment toolkit)
PPS25 – Planning Policy Statement 25 – Development and Flood Risk
IoH24 – Flood estimation for small catchments
Modified Rational Method & Rational Method
Local Land Drainage Team – Drainage Requirements

The guidance notes have been reflected throughout this report in order to assess and provide a suitable Sustainable Urban Drainage Design System (SUDS) where possible.

Section 2: Site Description

Existing

The existing site comprises of a greenfield area with no associated positively drained buildings, approximately 5.8Ha in area. This existing site is bordered by the following;

North – To the North of the proposed development there are rear gardens of existing residential properties.

East – To the East of the development is an existing road called Barkby Road which then is followed by further greenfield areas.

South – The South of the development is bounded by existing hedges with arable fields beyond.

West – To the West of the site there in an existing industrial park.

It should be noted as a general note the majority of the site is bound by existing hedge rows.

Proposed

The proposed development is 136 dwellings consisting of houses along with associated parking, garden areas and amenity space on the existing site.

Section 3: The Environment Agency & Leicestershire CC

a) The Environment Agency is a statutory consultee for all planning applications and will provide comments and recommendations to planning authorities for any development over 1 ha or within a floodplain.
b) The Environment Agency has issued Local Authorities with indicative Flood Plain maps as a guide to the extent of the existing flood plains. In this study we have found, by retrieving the Environments Agency's Web Site, that the site lies within an area that is considered as low risk, falling within the EA category of 0.1% (1 in 1000) or less, as referred to in PPS 25. This takes into account the effect of any flood defences that may be in the area.
c) The EA would be looking for SUDS to be considered at all times during the site designs, therefore please refer to sub-section "D" of section 5 to review the final SUDS requirements to be incorporated within the final engineering designs.
d) It is also noted that Leicestershire County Council (LCC) Local Drainage Officers require all developments within the borough to reflect greenfield run-off rates along with the introduction of Sustainable drainage techniques. This is reflected within section 5 of this report.

Section 4: Source of Potential Flooding

Consideration of each type of potential flooding has been made in the following table:-

Fluvial Flooding (Rivers and Sea)	**Flood Risk Rating**	Low
The Environment Agency (EA) Fluvial Flood Map shows the site to be within Flood Zone 1. Zone 1indicates an Annual Exceedance Probability (AEP) of not greater than 0.1% (Probability 1 in 1000 year) flood risk – Low Probability. Residential developments are classified as "more vulnerable" developments in the current National Planning Policy Framework (NPPF). Developments of this "more vulnerable" nature are considered appropriate in Flood Zone 1. As the site is situated within EA Flood Zone 1 and there is no history of flooding at the site, it is considered all access and egress routes to the site are safe.		
Groundwater Flooding	**Flood Risk Rating**	Low
There is currently no records indicating that the site is susceptible to groundwater flooding Based on the above it is considered that the risk of flooding from groundwater is low.		
Pluvial Flooding (Surface Water)	**Flood Risk Rating**	Low
The current surface water flooding follows the existing topography. The surface water flows along the Southern boundary of the site and doesn't affect the site. Based on the above it is considered that the risk of flooding from surface water is low.		
Sewer Flooding	**Flood Risk Rating**	Low
At present STW have not issued a developer enquiry response and therefore it is not known as of current if the proposed outfall sewers have suffered from flooding. Based on the above it is considered that the potential risk of flooding from existing and proposed sewers is low.		
Flooding from Other Sources	**Flood Risk Rating**	Low
Based on a review of the EA flood maps and the Ordnance Survey mapping of the area around the site it is considered that the site is not at significant risk of flooding from artificial sources such as reservoirs and canals.		

Section 5: Development Drainage

Throughout the section we identify and assess the proposed drainage methods to be used, together with an assessment of the potential storage requirements to be accommodated within the proposed design. Therefore we address the elements as follows:-

5a) Existing Impermeable Run-Off rates & supporting calculations

5b) Surface Water Drainage Hierarchy

5c) Proposed Impermeable Run-Off rates & supporting calculations

5d) Storage required & how each SUDS element selected will be accommodated within the final engineering design.

5e) SUDS-sequential test and methods selected for the proposed site

5a – Existing Impermeable Run-Off rates & supporting Calculations.

The following paragraph gives a detailed breakdown of the calculations used to determine the existing run-off for the development site, as follows:-

In Appendix E there is a copy of the existing topographical survey information for the development site. The overall site area of 5.82 ha, which is greenfield, thus this FRA has been undertaken on this basis.

The proposed site has been limited to a discharge rate of 5 l/s. This is due to the proposed existing sewer connection being to a 150mm diameter storm sewer. Although a developer enquiry is still awaited, due to the size of the pipe it is believed that 5 l/s is an acceptable outfall rate. It should be noted that assessments were completed to review what the proposed runoff rate should be set at and the result with the worst case scenario was the Micro Drainage ICP SUDS model using the site's impermeable area (Based on a 60% impermeability and allowing for 10% urban creep) the estimation for the site specific Qbar greenfield runoff rate was 16.80 l/s. As discussed above due to the existing pipe size this runoff rate is seen to be too high and has therefore been disregarded. Based on the above figures we are proposing a 70% betterment on the worst case scenario outfall rate and an 83% betterment on standard greenfield calculation (5 l/s per hectare). ((5 / 16.80 x 100 = 70%) - (5 / 29.1 x 100 = 83%))

This approach has been used in order to reduce the risk of impact that the proposed development puts on the existing surface water sewers and thus reducing the possibility of flooding against the existing flows for the greenfield site.

Therefore, in conclusion the existing run-off rate to be utilised is 5.0 l/s which would attenuated the 1 in 100 year storm event plus 40%. This run-off rate has been calculated using the proposed impermeable area and factoring in a 10% urban creep.

STW sewer capacity checks –

A full STW developer enquiry response has not yet been received. Once this is received the response should be considered against this report.

5b – Surface Water Drainage Hierarchy.

Surface water management should be a consideration on any site in order to ensure that surface water is managed in accordance with the NPPF and PPG, the use of Sustainable drainage systems is a requirement on all developments. Sustainable drainage systems are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible. They provide opportunities to:

- reduce the causes and impacts of flooding;
- remove pollutants from urban run-off at source;
- combine water management with green space with benefits for amenity, recreation and wildlife.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;

At the time of completing this report no ground investigation information was available for analysis therefore it cannot be confirmed if soakaways are viable on the proposed site However initial information available from the British Geological Survey identifies that the likely ground conditions will be silty clays overlying mudstone, therefore soakaways are unlikely to provide a via drainage solution. This FRA has be progressed on this basis.

An assessment of the vicinity of the site identifies that the nearest open watercourse is approximately 25 metres away from the site, going against the topography of the site. Meaning a gravity solution is not practical. In addition to gain connection to this open watercourse multiple areas of third party land would need to be crossed including Barkby Road which acts as the primary access road for the existing residential cul-de-sacs to the North of the proposed development. Based on the above information (topography & third party land) a connection into an open watercourse is not seen as a viable option.

An assessment of the site was also completed to assess whether local land drainage ditches were a suitable outfall. When assessing the site topography along with the EA Maps for surface water flooding it is apparent that there significant surface water flooding just of the boundary of the site. It is considered that it is likely that some form of shallow ditches follow the hedge lines running along the site boundaries and that surface water run-off from the site currently discharge into these shallow ditches. As

the EA mapping shows significant surface water flooding near the south-west corner of the site, this seems to indicate, along with general topography of the area, that surface water run-off from the surrounding area is directed towards this area and that flooding occurs because the land drainage network (i.e. ditches) are non-continuous and thus not able to convey flows away from the area in question.
Based on this assessment it is considered that there is not a viable land drainage outfall which could be utilised as an outfall for the proposed site.

Due to the constraints of the site it is proposed that the foul and storm sewers should both discharge via a gravity sewer option into the existing sewers location North West of the proposed site. Due to the site being bound directly by a public highway it is thought a direct connection can be made to both the storm and foul sewers. A connection to the existing sewers is subject to the developer enquiry from the Severn Trent Water. Capacity checks/sewer modelling may be required and this should be assessed during a detailed design. During the detailed design it should be ensured that the proposed outfall point is in public highway and can therefore be connected to without and third party consent. It should be noted due to the storm connection thought to be a 150 diameter pipe the outfall has been restricted to 5 l/s to avoid capacity issues. It is thought when a developer enquiry response is available that this will be requested however this is to be confirmed upon the receipt of the developer enquiry.

5c – Proposed Impermeable Run-Off rates & supporting Calculations.

The following paragraph gives a detailed breakdown of the calculations used to determine the proposed run-off for the development site, as follows:-

This report has been based on the site being approximately 60% impermeable, the total proposed impermeable area of the development totals 24,800m² (2.48ha). In addition, and in accordance with Leicestershire CC guidance, an allowance should be made for urban creep in order that minor future increases in impermeable area (such as conservatories etc) can be taken into account within the design. The principles for setting the value of urban creep is based on the table below:-

Table 2:

Residential development density, Dwellings per hectare	Change allowance % of impermeable area
25	10
30	8
35	6
45	4
50	2
Flats & apartments	0

Based on the above, and the development of 136 residential units, a 10% allowance for urban creep should be incorporated within the design. Due to the layout being a sketch this report has been designed to allow for a 10% urban creep factor to cover and minor design amendments. The total proposed impermeable area of the

development totals 2.728ha (including a 10% allowance for urban creep) which will therefore accommodate any minor layout changes during the planning process.

Therefore, based upon the above criteria, for the proposed site needs to be restricted to equivalent greenfield run-off as calculated in section 5a, namely 5.0 l/s.

To recap on the criteria, the proposed site should be throttled to achieve a maximum flow rate of **5.0 l/s** against the 1 in 30 year storm events and should be designed to not flood on a 1 in 100 year storm + 40% increased to accommodate climate change.

Based on the above calculations quoted within Section 5a, the proposed site would increase flows (if uncontrolled) against the required runoff rates. However, in accordance with LCC & EA guidelines, the site would require SUDS and drainage controls to ensure this maximum flow rate is achieved to return flows back to the calculated Greenfield runoff rates and to also assist with water quality discharge from the proposed site.

Finally, it is noted that within any detailed designs, the designer should ensure that the proposed site would not flood any property against a 1 in 100 year storm + 40% increase in flows to accommodate for climate change.

5d - Storage required & how each SUDS element selected will be accommodated within the final engineering design.

Based on the above calculations, Using the run-off rate of 5.0 l/s against a 1 in 100year + 40% for climate change flow rate event and the proposed impermeable area of 2.728 ha and running a quick storage estimate programme in MicroDrainage, this would equate to the site requiring a between **2136m³** to **2838m³** of storage. The input data and results of these calculations can be seen within Appendix D (Microdrainage Calculations). This calculation together with the drainage strategy plan (Appendix A) therefore proves "that it will be feasible to balance surface water run-off to the greenfield run-off rate (or better) for all events up to and including the 1 in 100 year storm, including 40% for climate change, and set out how this will be achieved".

Finally, in order to prove that the potential volume could be accommodated within the proposed layout, please refer to Appendix A (the Drainage Concept Plan), which indicates where each SUDS element has been considered and could be used, along with consideration to any potential reducing factors to the proposed impermeable areas or storage potentials.

5e – SUDS – Sequential Test & Methods Selected for the Proposed Site.

Under the NPPF it is a requirement to locate development proposals in an area of lowest risk. As such, various types of development have been classified as to their vulnerability, and tables 2 and 3 of the NPPF-TG set out the type of development that is acceptable

within each of the risk zones. Proposed residential use is categorised as "More Vulnerable" in accordance with tables 2 and 3, and acceptable in Flood Zone 1 without any restrictions. Due care is however to be given to ensure that the proposals do not result in an increase in flood risk to surrounding properties.

As all the residential development lies within the area of Flood Zone 1 an Exception Test is not required for the site.

Also with regards to Sustainable drainage it is proposed to introduce a number of methods within the drainage scheme to utilise several methods of Sustainable Drainage. These will include ponds (where possible), along with associated and considered landscaping introduced into the proposed scheme.

The following table should be reflected as & where possible within the detailed engineering design, to ensure all SUDS options are carefully considered. This table is formulated against the proposed site, while giving specific consideration to the weighting for each potential SUDS trains that can be employed for use for the proposed site, through the use of microdrainage. It highlights and lists with specific regards to order of weighing each potential SUDS element to select within the detailed designs. It is also noted that although no ground investigation information has been supplied when assessing the site on the British Geological Survey web-site identifies that the site is likely to be underlain by clay. Due to the British Geological Survey date being the current data available it is thought that porosity techniques would be unsuitable for the proposed site. Therefore these elements should be considered as a water purification method rather than a final discharge point.

	Quick Rank View	Hydrological	Land Use	Site Features	Total	Community and Environment	Economics and Maintenance
Infiltration Trench / Soakaway	(1, 10, 9)	21 (2nd)	30 (2nd)	20 (1st)	71 (1st)	15 (10th)	13 (9th)
Pervious Pavements	(2, 6, 6)	23 (1st)	27 (3rd)	20 (1st)	70 (2nd)	16 (6th)	14 (6th)
Infiltration Basin	(3, 13, 9)	21 (2nd)	25 (9th)	20 (1st)	66 (3rd)	12 (13th)	13 (9th)
Online / Offline Storage	(3, 5, 6)	13 (11th)	33 (1st)	20 (1st)	66 (3rd)	17 (5th)	14 (6th)
Grassed Swales	(5, 6, 6)	18 (4th)	26 (8th)	20 (1st)	64 (5th)	16 (6th)	14 (6th)
Bioretention Area	(6, 2, 12)	16 (7th)	27 (3rd)	20 (1st)	63 (6th)	19 (2nd)	11 (12th)
Filter Drains	(7, 10, 11)	15 (9th)	25 (9th)	20 (1st)	60 (7th)	15 (10th)	12 (11th)
Wet Ponds	(8, 2, 1)	17 (6th)	27 (3rd)	12 (11th)	56 (8th)	19 (2nd)	17 (1st)
Filtration Techniques	(9, 6, 13)	11 (12th)	24 (11th)	20 (1st)	55 (9th)	16 (6th)	9 (13th)
Grassed Filter Strip	(10, 4, 2)	11 (12th)	23 (12th)	20 (1st)	54 (10th)	18 (4th)	16 (2nd)
Dry Detention	(10, 12, 2)	15 (9th)	27 (3rd)	12 (11th)	54 (10th)	13 (12th)	16 (2nd)
Stormwater Wetlands	(12, 1, 5)	16 (7th)	27 (3rd)	10 (13th)	53 (12th)	20 (1st)	15 (5th)
Green Roofs	(12, 6, 2)	18 (4th)	15 (13th)	20 (1st)	53 (12th)	16 (6th)	16 (2nd)

Therefore, to summarise, it is expected (as highlighted on the plan within Appendix A), that an online pond would be used incorporating a low flow channel, stone pitching & aquatic planting which would form the SUDS elements of the proposed drainage scheme for the development. The detailed drainage designer must ensure a minimum of two treatment trains are used within the proposed drainage scheme.

It is noted the final detailed engineering design should be submitted and approved by LCC land drainage team (LLFA), to ensure the final proposals are in line with this Flood Risk Assessment.

Section 6: Flood Risk

National Planning Policy Framework
As stated in section 1, NPPF replaced the Planning Policy Statement 25 guidance notes produced by the Communities & Local Government.

The guidelines use the sequential test and the risk based approach to flood risk and development. Therefore the below two tables indicate the Flood Risk & Risk of Flooding elements. Again as the residential development is only situated within the area of Flood Zone 1, this is what has been used against the selection criteria –

Flood Risk –

Flood Risk Vulnerability Classification					
Flood Zones	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	✗	✗	✗	✓
✓ Development is appropriate			✗ Development should not be permitted		

Risk of Flooding –

Sources of Flooding	**Potential**			**Comments**
	High	Medium	Low	
Fluvial (Rivers)			✓	The whole site is located within Flood Zone 1 (Low probability).
Tidal / Coastal			✓	The site is located within the central regions of the country; therefore there is no risk of tidal flooding
Pluvial (Drainage Systems)			✓	Low probability as the drainage will be designed to accommodate a 1 in 100year storm event + 40% for climate change without flooding properties
Surface Run-off			✓	Area of impermeable material mitigated through use of appropriately sized drainage systems
Ponding			✓	Proposed site levels will prevent and avoid any potential ponding issue
Groundwater			✓	No apparent groundwater flood risk. No existing/proposed basements

It is also noted from the flood maps available that the proposed residential development site lies within Flood Zone 1 and therefore falls within the Low Risk of Flooding.

Section 7: Flood Zone of the Proposed Development & Protection Measures

Based on the result of this flood risk assessment the site falls within Flood Zone 1 in accordance with NPPF sequential Characterisation of Flood Risk Zones for the area which is proposed to have residential build upon it. This means that the site is characterised as little or No Risk with the annual probability of a river nearby flooding less than 0.1% (1 in 1000 year possibility or less).

There is a low risk from other flood sources therefore no mitigation will be required, above that provided by the proposed suitably designed attenuated system, incorporating SUDS options where feasible and controlling flows to green field runoff.

Based on the above no constraints should be imposed for the proposed development based on this criterion.

Section 8: Dry Escape Route

As can be seen in Appendix G, the flood zone map the proposed residential site is not within the area of flood. Therefore the proposed access points (vehicular & pedestrian links) would provide the dry escape route should one so be, as can be accurately reflected from the mapping attached in the EA responses within the appendices. Therefore the proposed site could easily provide a dry escape route should one ever be required.

It is considered that the measures described above provide adequate protection against flooding.

Section 9: Assessment of Development Site

During the planning processes an assessment to why the proposed site should be developed is required, in order to support the planning application. Therefore the following items assisted in supporting the proposed development and consequently provided the reasoning to pursue the development of the proposed site:-

1) The proposed building area of the proposed site lies outside a flood zone, or within the 1 in 1000 year flood line, therefore should not be constrained for any attached issues.

2) Flows from the proposed site would be controlled to equivalent greenfield runoff rates.

3) SUDS would be introduced, where possible, within the final engineering design for the proposed site, which would further reduce flows from the proposed site in normal conditions and would assist in ensuring flows pass through a minimum of two treatment trains to assist in the water purification & quality process.

Section 10: Conclusions

As the proposed residential proposals lies outside any existing flood zones, the site would not be constrained.

Also the surrounding area of the proposed site contains residential properties which are set at similar levels, to that of the proposed site. Therefore it is not viewed that the site would prove to have any flooding issues.

Based on the calculations given the proposals would ensure that there is no impact upon the current drainage across the site and within the surrounding area – in line with standard LCC runoff rate requirements. Also, climate change & urban creep has been considered within the calculations.

Runoff rates will be restricted to 5.0 l/s due to the existing connection thought to be a 150mm diameter pipe. This has been proposed in order to prevent flooding issues. 5 l/s is a 83% betterment on proposed greenfield rates (5 l/s per hectare).

A minimum of two SUDS treatment trains will be introduced into the proposed drainage scheme, which will assist in returning the storm drainage flows back into the natural ground porosity (where achievable), and also assist in purification of the storm water.

Depending on the final location of the potential storage outlined in section 5, maintenance will be undertaken by management companies by agreement or other adopting authority. Arrangements and terms are to be finalised at the detail design stage, by the developer.

Based on the calculations & discussions within this report, the proposals would ensure that there is no impact upon the current drainage systems of flood areas across & nearby to the site and within the surrounding area.

End of Report

Appendix A – Proposed Drainage Strategy Plan

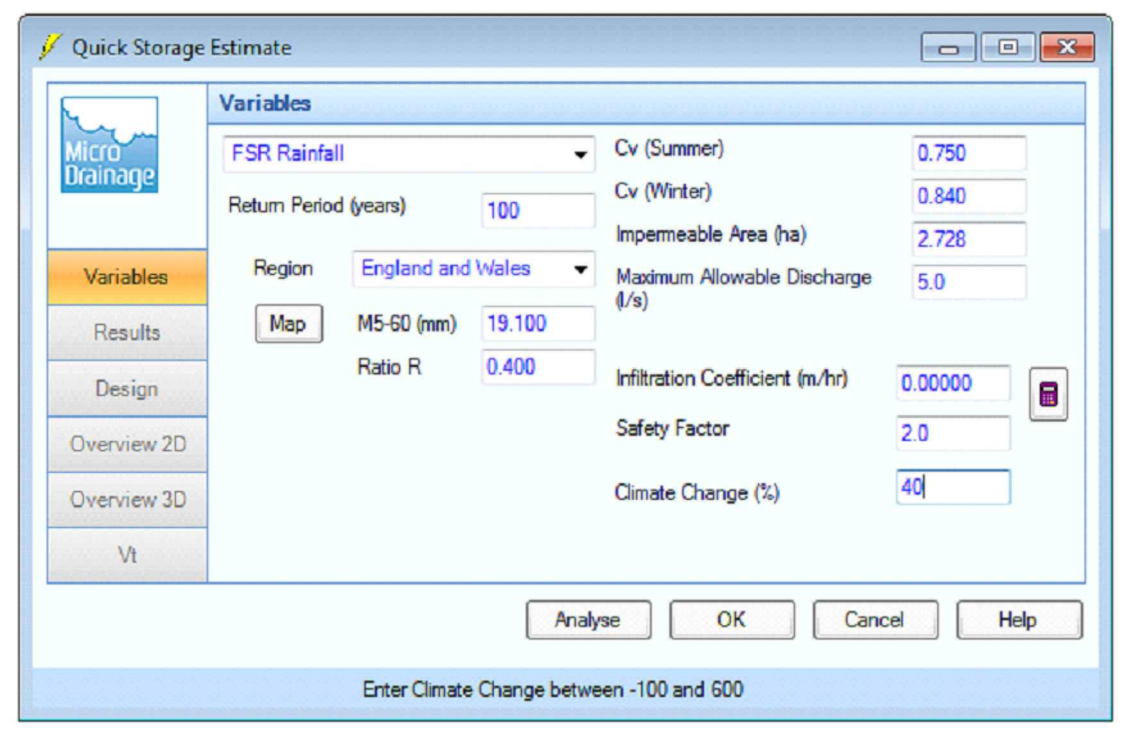
1 IN 100 YR EVENT (+40% CLIMATE CHANGE)

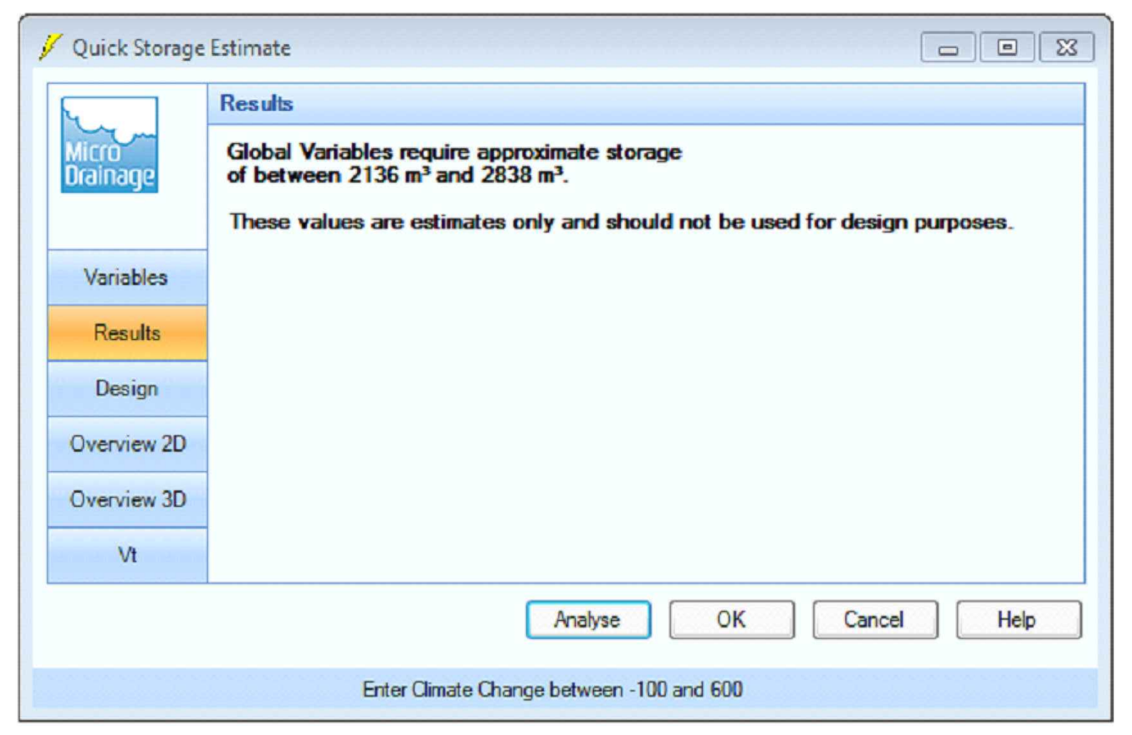
PROPOSED SUDS FEATURES

DRY POND INCORPORATING:

- LOW FLOW SWALE CHANNEL
- STONE PITCHING
- AQUATIC PLANTING

MINIMUM OF TWO TREATMENT TRAINS TO BE CONTAINED WITHIN PROPOSED POND





GENERAL SITE INFORMATION

APPROXIMATE SITE AREA = 5.8 Ha,

IMPERMEABLE AREA = 2.728 Ha (ALLOWING FOR 10% URBAN CREEP).

136 HABITABLE DWELLINGS (SUBJECT TO RECEIPT OF A DETAILED LAYOUT & DETAILED ENGINEERING DESIGN.

THE FRA CONFIRMS THAT THE SITE IS WHOLLY LOCATED IN FLOOD ZONE 1 WITH A LESS THAN 1 IN 100 ANNUAL PROBABILITY OF FLUVIAL FLOODING.

THE DRAINAGE STRATEGY IS BASED ON THE ASSUMPTION THAT INFILTRATION IS NOT FEASIBLE. THE FRA INITIALLY CONFIRMS THAT BGS RECORDS INDICATE SILTY CLAYS OVERLYING MUDSTONE THEREFORE SOAKAWAYS ARE UNLIKELY TO BE VIABLE, HOWEVER A DETAILED SITE INVESTIGATION REPORT AND WRITTEN CONFIRMATION FROM GROUND CONSULTANT IS REQUIRED TO CONFIRM THIS.

ALL DRAINAGE PROPOSALS SUBJECT TO RECEIPT OF AN UPDATED DEVELOPER ENQUIRY RESPONSE FROM SEVERN TRENT WATER AND CLARIFICATION THAT THE PROPOSED STORM OUTFALL LOCATION AND FOUL OUTFALL LOCATION (SUBJECT TO STW SEWER MODELLING EXERCISE) IS ACCEPTABLE (TO BE CONFIRMED BY STWA).

DETERMINE DISCHARGE FROM SITE

AN FRA HAS BEEN UNDERTAKEN FOR THE DEVELOPMENT; PREPARED BY RESIDENTIAL AND COMMERCIAL ENGINEERING REF. DWH/BRQ/FRA1

ACCORDING TO THE FRA THE SURFACE WATER WILL BE RESTRICTED TO **5 l/s.** THIS FIGURE IS A REDUCTION IN THE GREENFIELD RUN-OFF ESTIMATION USING IH24 METHODS BY 70%. THIS IS DUE TO THE EXISTING STORM SEWER BEING 150mm WITH REDUCED CAPACITY. THIS IS SUBJECT TO SEVERN TRENT WATER APPROVAL AND A POTENTIAL SEWER MODELLING EXERCISE.

ACCORDINGLY, THIS DRAINAGE PROPOSALS HAS BEEN BASED ON THE ABOVE DESIGN CRITERIA, WITH THE PROPOSED OUTFALL BEING ONTO THE EXISTING SEWER AS ILLUSTRATED.

DETERMINE STORAGE VOLUMES

1 IN 100 YR EVENT (+40% CLIMATE CHANGE)

QUICK WINDES CALCULATION BASED ON AN IMPERMEABLE AREA OF 2.728HA AND A LIMITED DISCHARGE RATE OF 5.0 L/S...

QUICK STORAGE ESTIMATE = **2136M³ - 2838M³** (INCLUSIVE OF 1 IN 30 YR VOLUME)

ABOVE CALCULATION INDICATES APPROX **2459M³** STORAGE REQUIRED TO BALANCED FLOWS RESULTING FROM A 1 IN 100 (+40% CC) YEAR EVENT.

THIS COULD BE ACCOMMODATED THROUGH THE INSTALLATION OF AN ONLINE BALANCING POND AS ILLUSTRATED. AS AN ONLINE FEATURE, AND IN ORDER TO ENSURE THAT SEVERN TRENT WATER WILL ADOPT THE SEWERAGE BOTH UPSTREAM AND DOWNSTREAM OF THE PONDS, BYPASS NETWORKS WILL BE REQUIRED.

THE ABOVE IS HOWEVER SUBJECT TO DETAILED DESIGN INC. MODELLING & AGREEMENT WITH STWA, LLFA & EA.

IT SHOULD ALSO BE CONFIRMED BY THE DEVELOPER THAT ANY OFFSITE EASEMENT REQUIRED IN ORDER TO CONSTRUCT THE PROPOSED OUTFALL SEWER IS AGREED WITH THE LAND OWNER (IN ORDER A S104 AGREEMENT CAN BE COMPLETED AND NO ADOPTION ISSUES FOR DRAINAGE OR HIGHWAYS ARE ENCOUNTERED).

PLEASE NOTE THE ABOVE IS CRITICAL TO THE PROPOSED SCHEME & IT IS THE DEVELOPERS RESPONSIBLY TO ENSURE THIS ELEMENT IS SATISFIED, IN ORDER THAT THE PROPOSED SITE CAN BE DEVELOPED.

FOUL DISCHARGE FROM SITE

NO OF PLOTS (136) * 4000 = 6.3 L/S *(PEAK DISCHARGE)*

ALL FOUL WATER PIPES 150Ø UNLESS OTHERWISE SPECIFIED.

FOUL INVERT LEVELS INDICATED ONLY AND ARE SUBJECT TO A DEVELOPER ENQUIRY RESPONSE AND SURVEY LEVEL INFORMATION.

AT THE TIME OF PRODUCING THIS DRAWING, THE DESIGNER WAS UNABLE TO ATTAIN ANY EXISTING SEWER RECORD INFORMATION PRIMARILY FOR THE FOUL NETWORK.

ALL DETAILS ARE SUBJECT TO FURTHER REVIEW & POTENTIAL REDESIGN WORKS, FOLLOWING PROVISION OF ANY SITE SPECIFIC FOUL WATER DRAINAGE STRATEGY, UPDATED MODELING REPORT OR ANY OTHER STRATEGIC DESIGN PLANS AND DOCUMENTS.

CONCEPT DESIGN ONLY.
SUBJECT TO FURTHER REVIEW AND CONSIDERATION.
DRAWING PRODUCED FOR INITIAL DISCUSSION PURPOSES ONLY

PRELIMINARY

THIS DRAWING ILLUSTRATES A SKETCH PROPOSAL ONLY AND AS SUCH IS SUBJECT TO DETAILED SITE INVESTIGATION INCLUDING GROUND CONDITIONS/CONTAMINANTS, DRAINAGE, DESIGN AND PLANNING/DENSITY NEGOTIATIONS. THE LAYOUT MAYBE BASED UPON AN ENLARGEMENT OF AN OS SHEET OR OTHER SMALL SCALE PLANS AND ITS ACCURACY WILL NEED TO BE VERIFIED BY SURVEY. FULL RISK ANALYSIS UNDER CDM REGULATIONS HAS NOT BEEN UNDERTAKEN.

GENERAL NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS GIVEN IN METRES ABOVE ORDNANCE DATUM (m AOD).
3. ALL OTHER DIMENSIONS IN MILLIMETRES, UNLESS OTHERWISE STATED.
4. ALL SLAB LEVELS ARE +/- 475mm AND ARE SUBJECT TO DETAILED ENGINEERING DESIGN.
5. ALL DRAINAGE SHOW IS INDICATIVE AND SUBJECT TO DETAILED ENGINEERING DESIGN.
6. ATTENUATION POND SIZED FOR STORM RUNOFF FROM DEVELOPMENT AREAS BASED UPON LAYOUT PROVIDED.
7. ALL FOUL SEWERS 150mmØ UNLESS OTHERWISE STATED.
8. MINIMUM CARRIAGEWAY GRADIENT 1:80.
9. ALLOWANCES FOR RETAINING FEATURES (INCLUDING RETAINING WALLS, EXPOSED BRICKWORK, TANKING ETC) MADE AT THIS STAGE SUBJECT TO REVIEW FOLLOWING RECEIPT OF A DETAILED LAYOUT. SLAB LEVELS INDICATED REFLECT PROPOSED LEVEL DIFFERENCES AT THIS STAGE OF THE PRELIMINARY DESIGN.
10. DRAINAGE STRATEGY BASED ON FEASIBILITY SKETCH LAYOUT SCHEME 3 DRG. NO. QUEN-SK2

ALL SEWERAGE OUTFALLS TO BE CHECKED AND CONFIRMED BY THE DEVELOPER AND/OR CONTRACTOR ONSITE, TO ENSURE PROPOSED OUTFALL LEVELS ARE ACHIEVABLE, PRIOR TO ANY CONSTRUCTION BEEN UNDERTAKEN ONSITE.

SHOULD ANY LEVELS DIFFER, THEN THE ENGINEER IS TO BE ADVISED IMMEDIATELY FOR FURTHER ADVICE, PRIOR TO ANY FURTHER CONSTRUCTION BEEN CONTINUED.

A FULL RADAR SURVEY IS ADVISED PRIOR TO CONSTRUCTION.

SHOULD ANY UNKNOWN SERVICES BE FOUND DURING CONSTRUCTION (OR SERVICES ARE FOUND TO BE IN LOCATIONS OTHER THAN THOSE INDICATED ON THE SUPPLIED MAPPING FROM EACH RELEVANT SERVICE PROVIDER); THE ENGINEER IS TO BE ADVISED IMMEDIATELY FOR FURTHER ADVICE.

IT IS THE DEVELOPERS &/OR CONTRACTORS RESPONSIBILITY TO ENSURE ALL SAFE WORKING METHODS ARE ADHERED TO (INLINE WITH RELEVANT AUTHORITY REQUIREMENTS FOR HIGHWAYS, DRAINAGE & SERVICES), AND THAT ALL REQUIRED SERVICE DIVERSIONS ARE COMPLETED PRIOR TO CONSTRUCTION WORKS COMMENCING.

Rev	Description	Date	Drawn	Check

Revisions:

DAVID WILSON HOMES
WHERE QUALITY LIVES

RACE
RESIDENTIAL & COMMERCIAL ENGINEERING

Drawing Status:
FOR PLANNING ONLY SUBJECT TO DETAILED DESIGN

Client:
DAVID WILSON HOMES
EAST MIDLANDS

Project:
BARKBY ROAD
QUENIBOROUGH

Title:
DRAINAGE STRATEGY PLAN

Job Number. RACE/DWH/BRQ
Drawing No. ENG_002
Revision. #

Scale: 1:500 @ A0
Date: JAN ' 18
Drawn by: APJ
Checked by: #

Contact us :

Residential & Commercial Engineering Ltd, Unit 17, Lakeside Business Park, Walkmill Lane, Cannock, WS11 0XE.

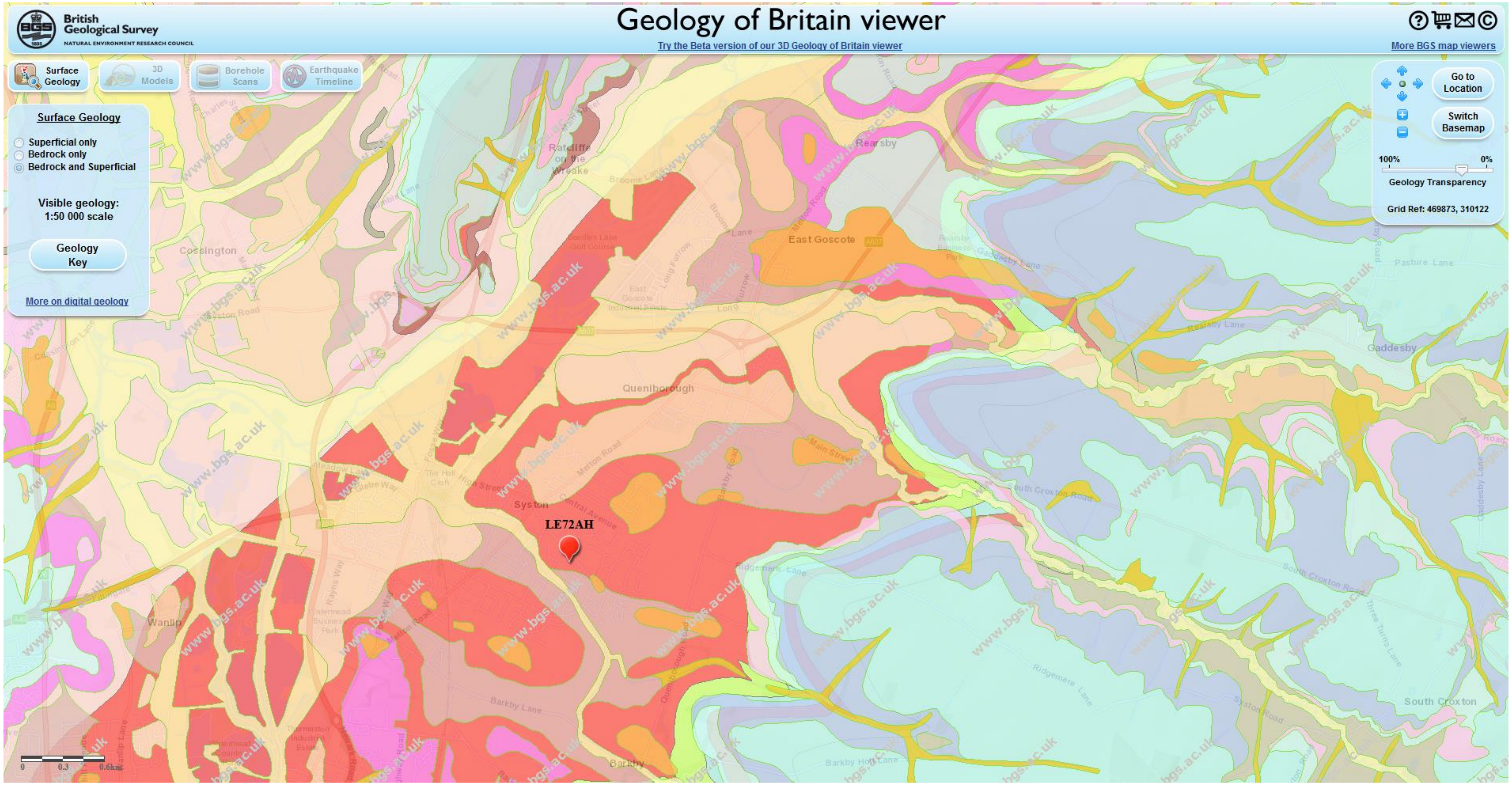
Tel : 01922 411552

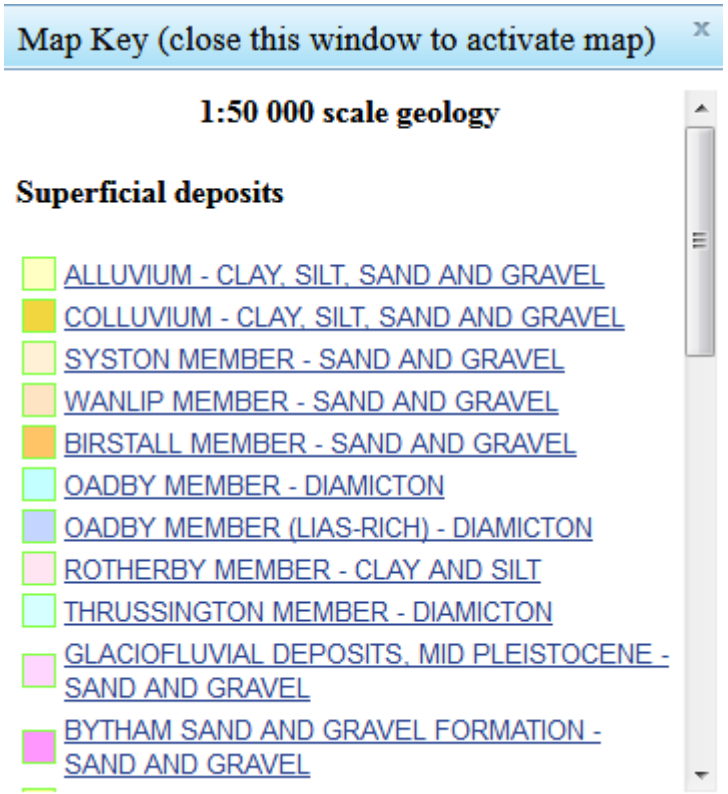
Appendix B – Calculation of site specific Greenfield runoff rate

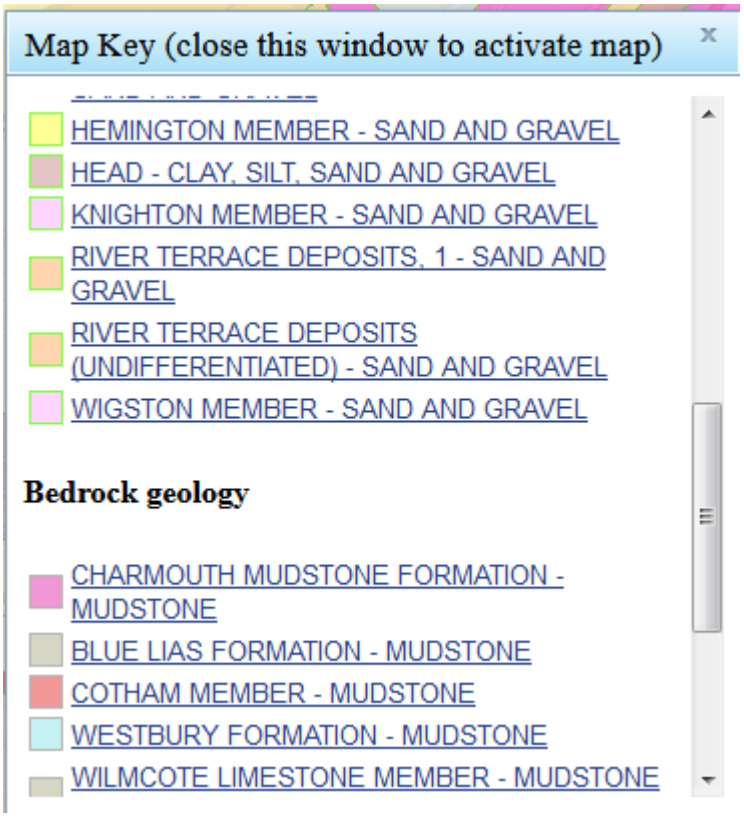
No calculations are required due to the restriction of 5 l/s being used. This has been proposed due to the eisting storm water sewer being a 150mm diameter pipe and therefore in order to avoid potential flooding we have proposed a restricted outfall of 5 l/s.

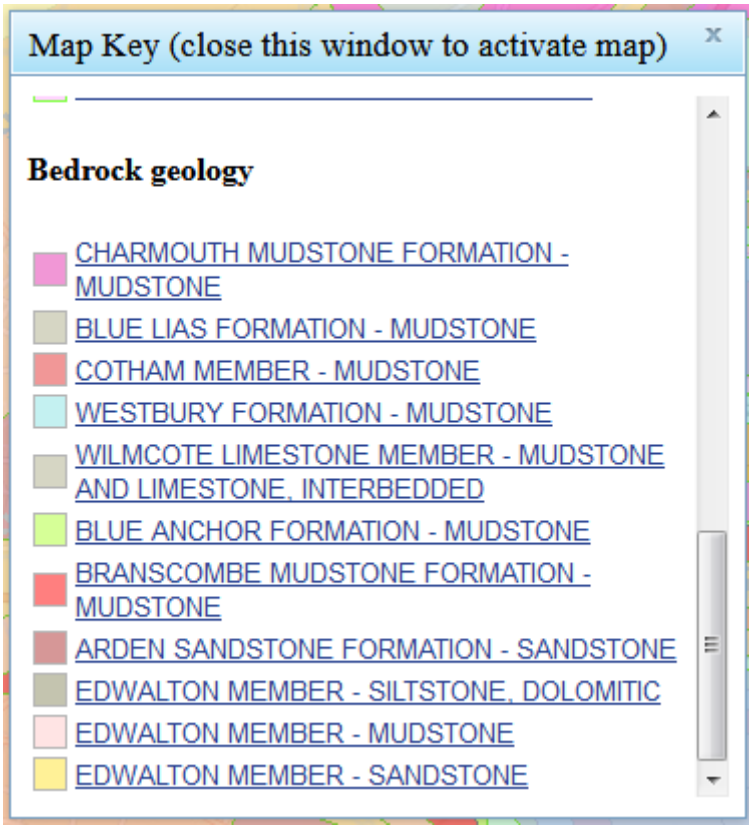
Appendix C – Initial Ground Information & Infiltration Results

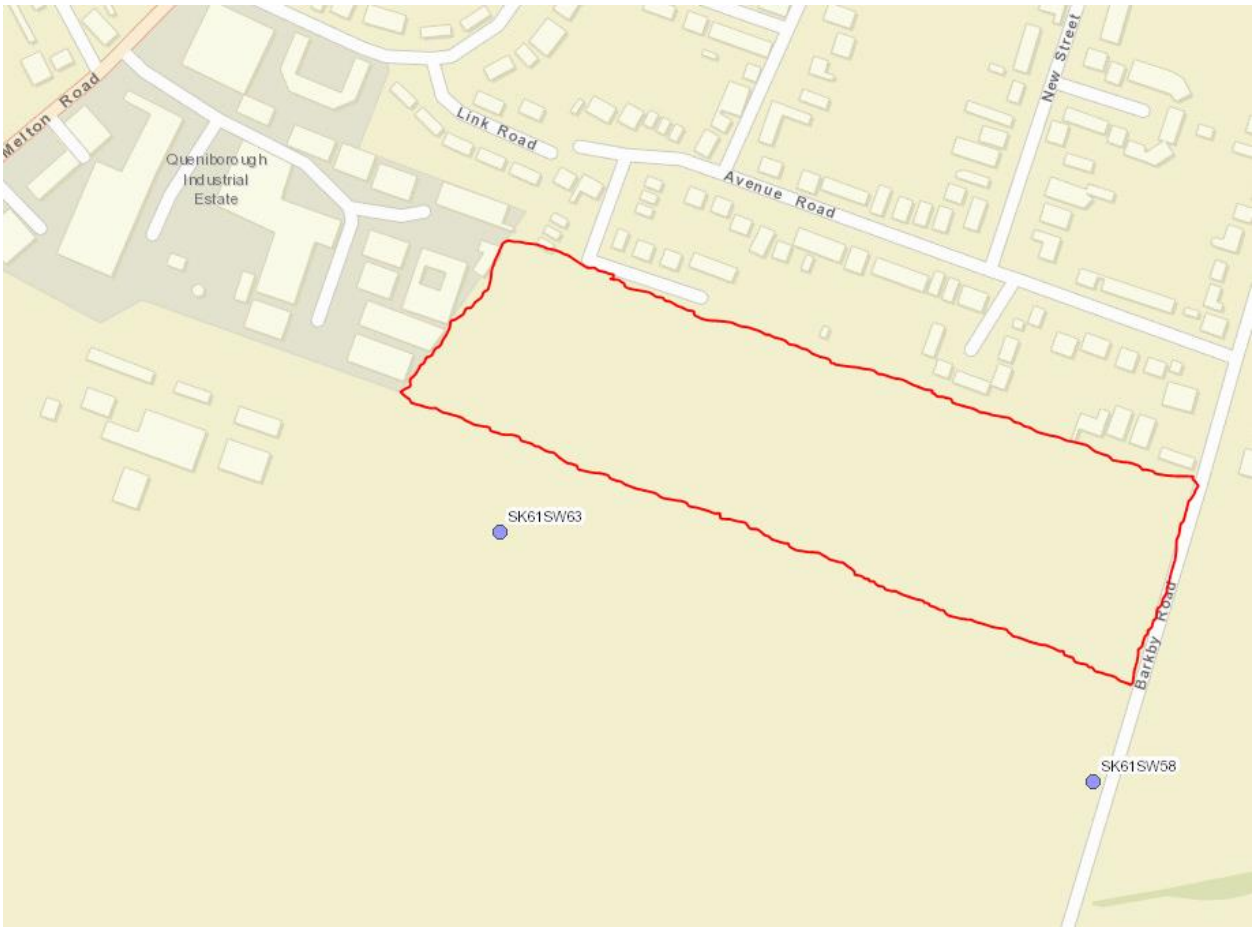
(No information was available at the time of completing this report. This should be assessed when completing the detailed design) – Due to this the Geology of Britain findings have been detailed below.


British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL
Geology of Britain viewer
Try the Beta version of our 3D Geology of Britain viewer
More BGS map viewers
Surface Geology
3D Models
Borehole Scans
Earthquake Timeline
Surface Geology
Superficial only
Bedrock only
Bedrock and Superficial
Visible geology:
1:50 000 scale
Geology Key
More on digital geology
Go to Location
Switch Basemap
100%
0%
Geology Transparency
Grid Ref: 469873, 310122
Rearsby
East Goscote
Cossington
Ratcliffe on the Wreake
Queniborough
Syston
LE72AH
Wanlip
Gaddesby
South Croxton
Barkby
Barkby Lane
0
0.3
0.6km


Map Key (close this window to activate map)
1:50 000 scale geology
Superficial deposits
ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
COLLUVIUM - CLAY, SILT, SAND AND GRAVEL
SYSTON MEMBER - SAND AND GRAVEL
WANLIP MEMBER - SAND AND GRAVEL
BIRSTALL MEMBER - SAND AND GRAVEL
OADBY MEMBER - DIAMICTON
OADBY MEMBER (LIAS-RICH) - DIAMICTON
ROTHERBY MEMBER - CLAY AND SILT
THRUSSINGTON MEMBER - DIAMICTON
GLACIOFLUVIAL DEPOSITS, MID PLEISTOCENE - SAND AND GRAVEL
BYTHAM SAND AND GRAVEL FORMATION - SAND AND GRAVEL


Map Key (close this window to activate map)
HEMINGTON MEMBER - SAND AND GRAVEL
HEAD - CLAY, SILT, SAND AND GRAVEL
KNIGHTON MEMBER - SAND AND GRAVEL
RIVER TERRACE DEPOSITS, 1 - SAND AND GRAVEL
RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - SAND AND GRAVEL
WIGSTON MEMBER - SAND AND GRAVEL
Bedrock geology
CHARMOUTH MUDSTONE FORMATION - MUDSTONE
BLUE LIAS FORMATION - MUDSTONE
COTHAM MEMBER - MUDSTONE
WESTBURY FORMATION - MUDSTONE
WILMCOTE LIMESTONE MEMBER - MUDSTONE


Map Key (close this window to activate map)
Bedrock geology
CHARMOUTH MUDSTONE FORMATION - MUDSTONE
BLUE LIAS FORMATION - MUDSTONE
COTHAM MEMBER - MUDSTONE
WESTBURY FORMATION - MUDSTONE
WILMCOTE LIMESTONE MEMBER - MUDSTONE AND LIMESTONE, INTERBEDDED
BLUE ANCHOR FORMATION - MUDSTONE
BRANSCOMBE MUDSTONE FORMATION - MUDSTONE
ARDEN SANDSTONE FORMATION - SANDSTONE
EDWALTON MEMBER - SILTSTONE, DOLOMITIC
EDWALTON MEMBER - MUDSTONE
EDWALTON MEMBER - SANDSTONE


Melton Road
Queniborough Industrial Estate
Link Road
Avenue Road
New Street
Barkby Road
SK61SW63
SK61SW58

....SK.61.SW/.63....

DEPARTMENT OF THE ENVIRONMENT	RECORD OF BOREHOLE No. 61 SW 19	
CONTRACT PECD 7/1/112 : RESEARCH PROGRAMME TO ASSESS THE POTENTIALLY WORKABLE SAND AND GRAVEL RESOURCES IN THE SOAR VALLEY LEICESTERSHIRE.		Sheet No. 1 of 1
DRILLING CONTRACTOR FOUNDATION ENGINEERING LTD.	COORDINATES 463861E 312137N	DATE 31.8.84
DRILLING METHOD/MACHINE Cable Tool Percussion/Pilcon Wayfarer	GROUND LEVEL 57.5m OD	HOLE DIAMETER 200 mm

SAMPLE DEPTH (m)	PARTICLE SIZE SUMMARY % (mm) BS 5930 : 1981 cobbles > 60	gravel 60 – 2	sand 2 – 0.06	fines < 0.06	BS 882 : 1983 > 40	40 – 5	5 – 0.075	< 0.075	STRATA DESCRIPTION (According to BS 5930 : 1981)	DEPTH & THICKNESS (m)	REDUCED LEVEL (M.O.D.)	SYMBOLIC LOG
									TOPSOIL			
0.90 – 1.10	–	25	41	34	–	16	49	35	Light brown, silty, very clayey, fine to medium SAND	0.90 (0.30)	56.60	
									Very stiff, red brown, sandy, gravelly CLAY	1.20	56.30	
									Very stiff, red brown mottled green grey, very silty CLAY	1.40	56.10	
									END OF BOREHOLE 1.80 m.	1.80	55.70	

REMARKS:-

Dry

Overburden thickness 0.90 m.

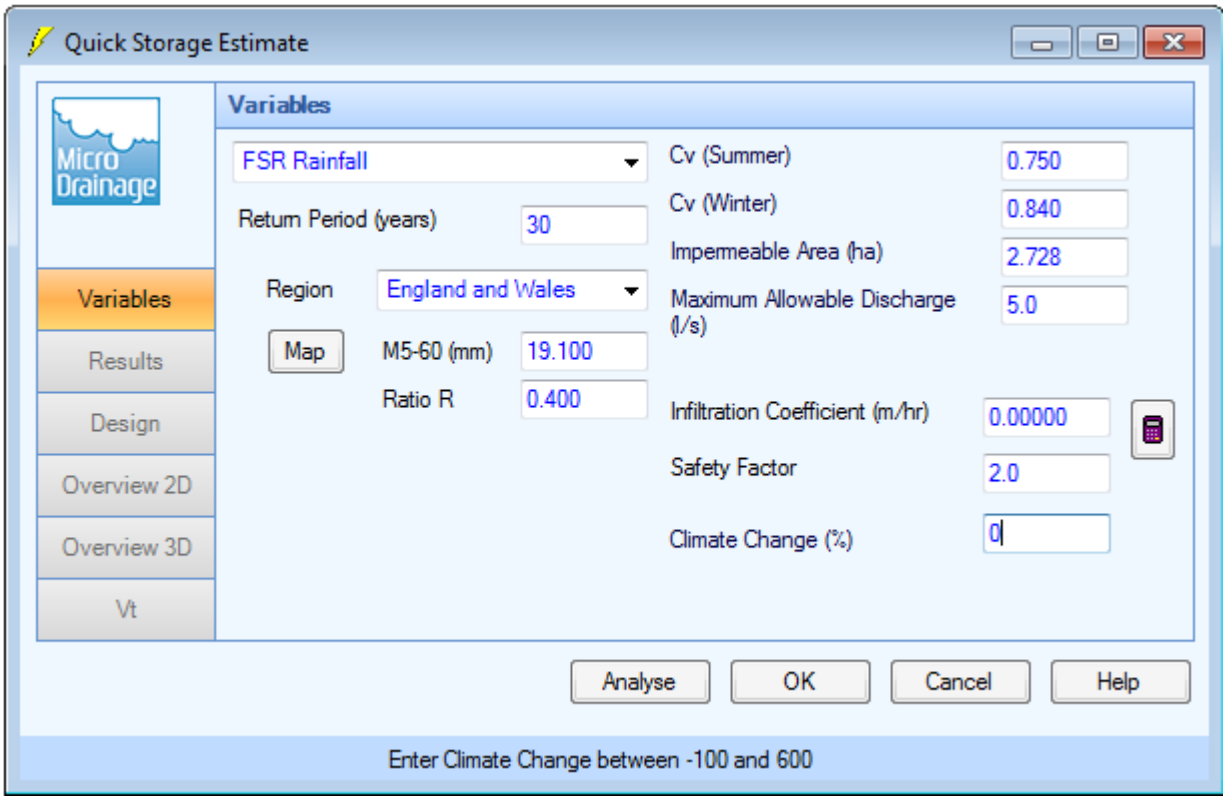
Mineral thickness 0.30 m.

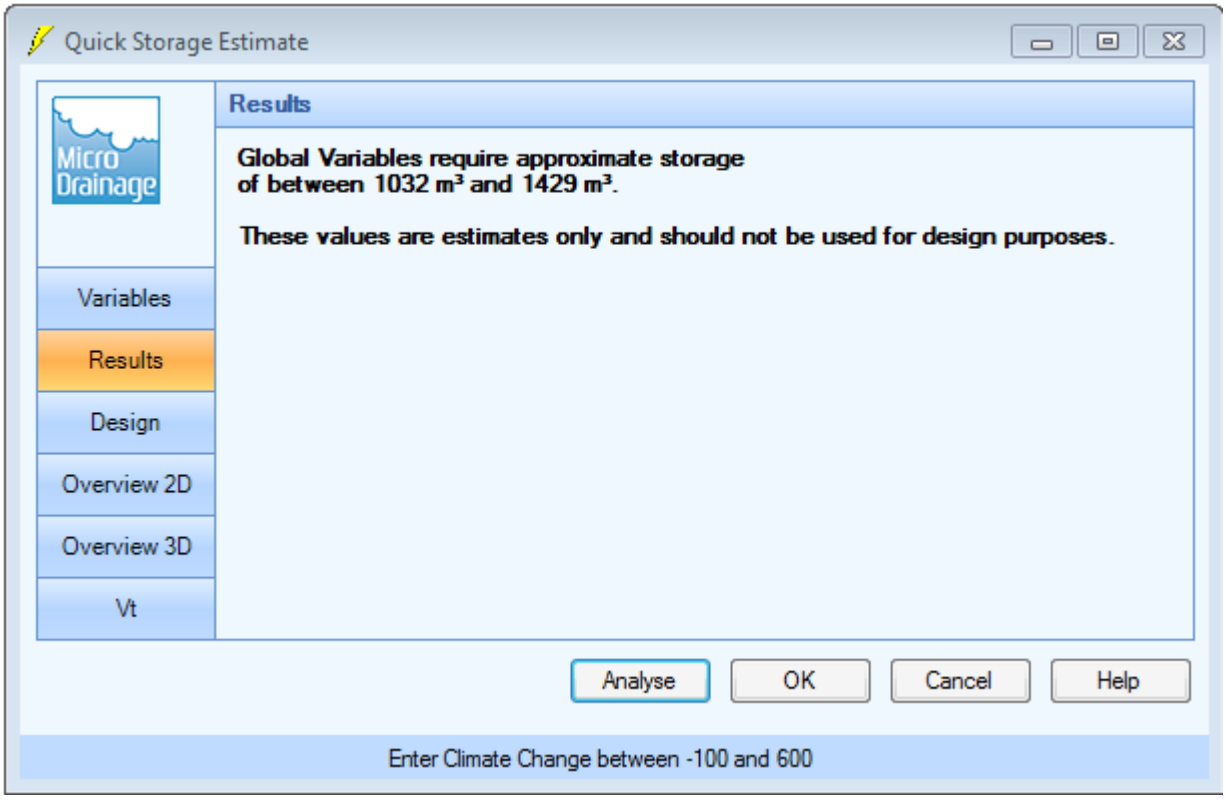
Overburden ratio 3

ENGINEERING GEOLOGY LTD.
in association with
GEOMORPHOLOGICAL SERVICES LTD.

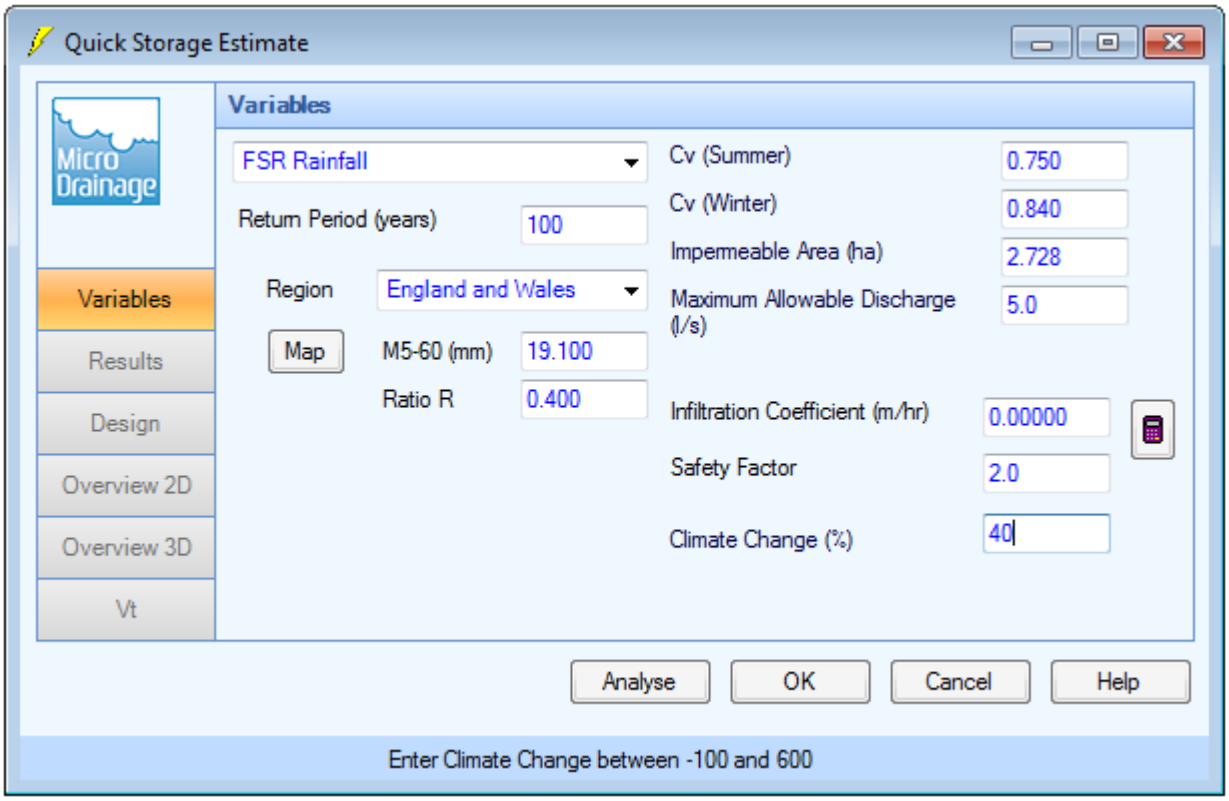
Appendix D – MicroDrainage Calculations

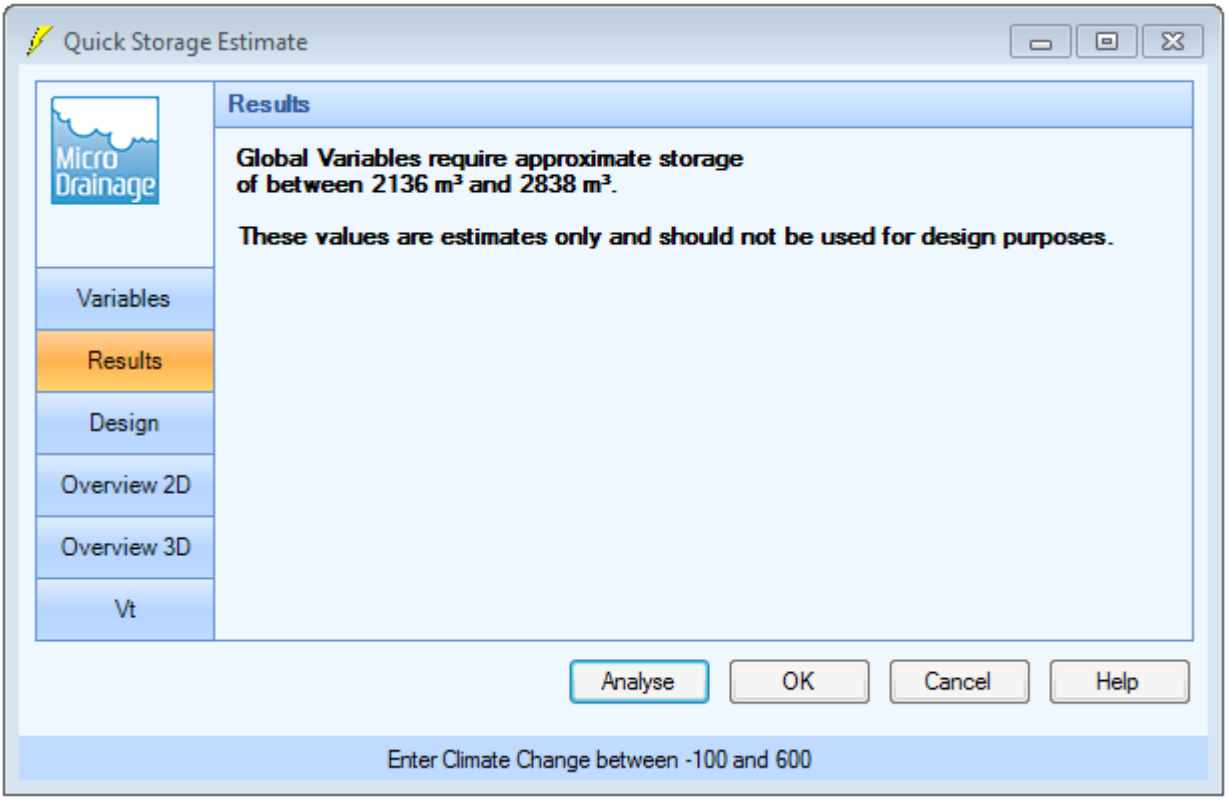
30 Year Evaluation Results (Factoring in 10% for urban creep) –



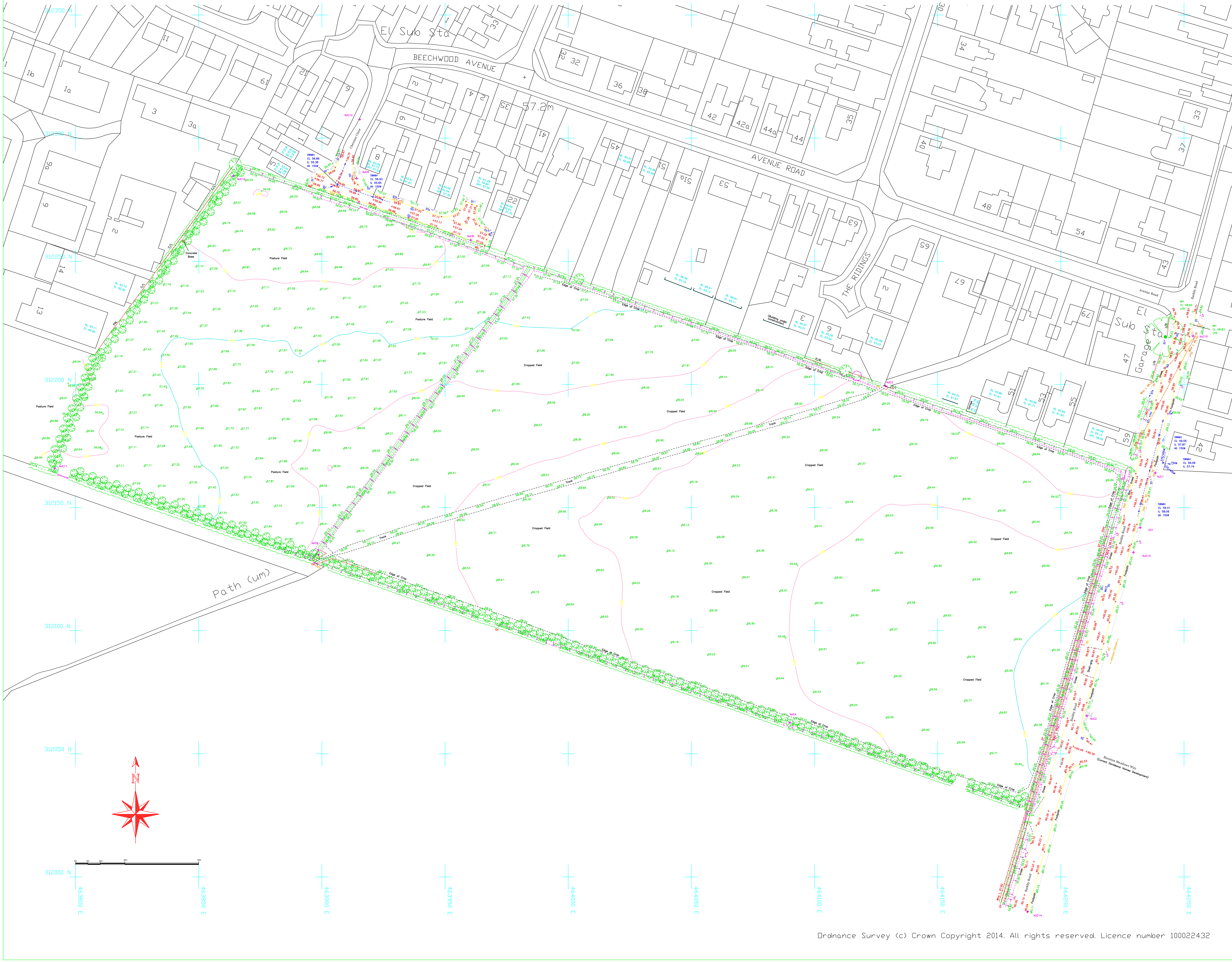


100 Year + 40% for Climate Change (Factoring in 10% for urban creep) Evaluation Results -





Appendix E – Existing Topographical information



Survey Notes

1: This Survey is related OS Grid Base (OSGB36 15).

2: All Levels are related to OS Datum (OSGB36 15).

3: The information Shown on this drawing is surveyed to the accuracy of the base scale shown.

4: Man entry to sewers has not been undertaken. Depths and pipe sizes are measured / estimated from the ground. This should be checked with Local Authority records or on site prior to the commencement of any works.

5: Boundaries shown are physical features and may not represent legally conveyed ownership.

6: Some services or features on the ground may be missing due to parked vehicles and other obstructions.

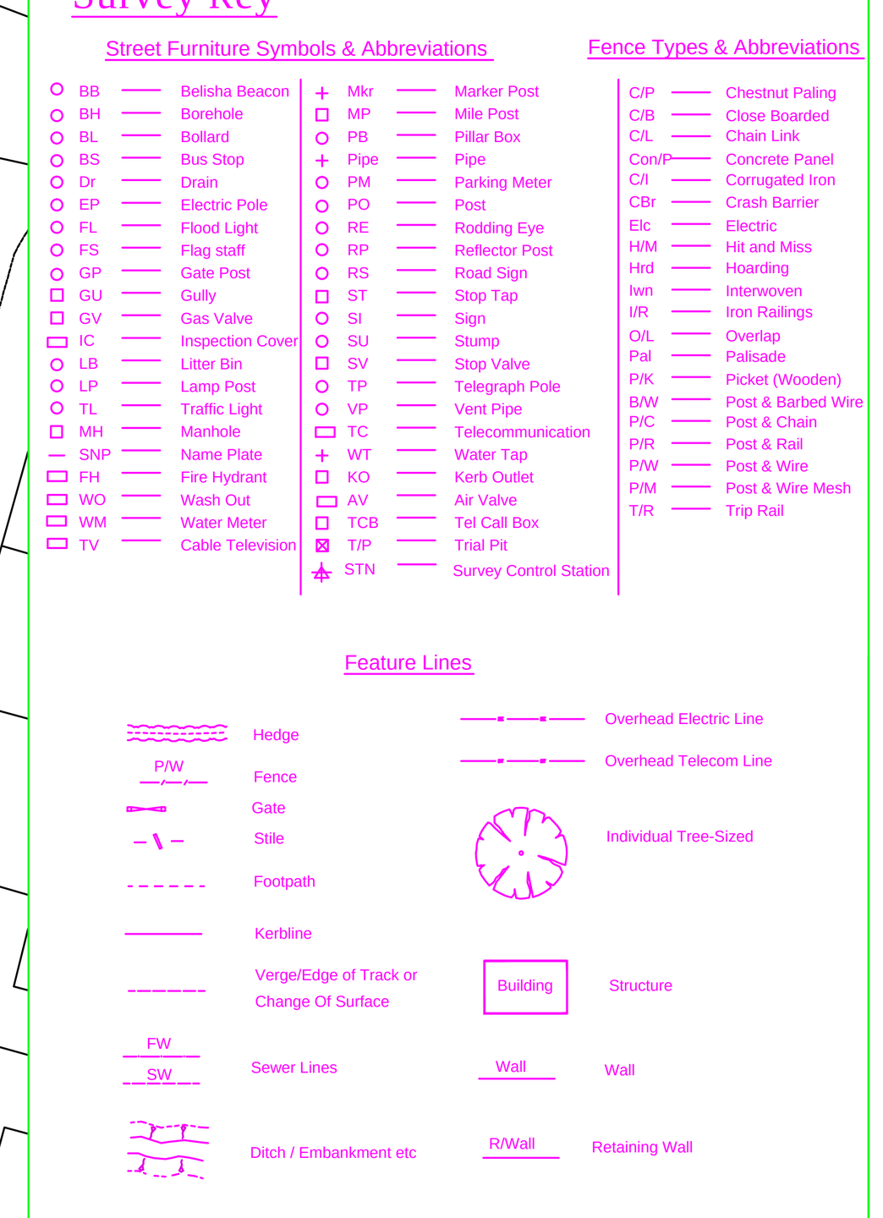
7: Where adjacent buildings have been surveyed remotely all walls may not be shown due to obstructions along lines of sight.

8: This plan should only be used for its original purpose. NJC Surveys LTD accepts no responsibility for this plan if it is supplied to any party other than the original client.

8: Ordnance Survey background data used under licence and should only be used in accordance with the Ordnance Survey guidelines.

Ordnance Survey information provided by David Wilson Homes East Midlands.

Survey Key



SURVEY CONTROL

STN	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
EX1	464232.202	312141.926	59.702	Hilti Nail
NJC1	464238.324	312164.147	59.312	Hilti Nail
NJC2	464210.594	312065.493	60.698	PK Nail
NJC3	464128.833	312199.442	59.316	PK Nail
NJC4	464089.952	312062.708	59.529	Wooden Peg
NJC6	463898.642	312130.867	58.172	Wooden Peg
NJC8	463960.421	312258.688	57.238	PK Nail
NJC9	463914.101	312283.717	56.879	PK Nail
NJC10	463864.113	312284.717	56.646	Wooden Peg
NJC11	463791.574	312166.013	57.233	Wooden Peg
NJC12	463915.353	312307.685	56.689	PK Nail
NJC13	464229.447	312131.854	59.942	Hilti Nail
NJC14	464186.562	311986.030	60.168	PK Nail
NJC15	464253.684	312219.719	58.903	PK Nail

REV	DATE	DESCRIPTION	BY	APP.

njc SURVEYS LTD
The Old Police Station,
South Street,
Ashby de la Zouch,
Leicestershire
LE65 1BS
Telephone ● 01530 414251
Mobile ● 07876 792994
Mail ● nclarke@njcsurveys.co.uk
Web ● www.njcsurveys.co.uk

Topographical Surveys ● Building Surveys ● GPS Surveys ● Setting Out
Dimensional Control ● Monitoring Surveys ● Ground Modelling ● Volumetric Calculations

Client

DAVID WILSON HOMES
WHERE QUALITY LIVES

Project Title

Land off
Barkby Road,
Queniborough

Drawing Title

Topographical Survey

Drawn	Checked	Authorised
LD	NJC	NJC
Date	**Scale**	**Sheet size**
30/11/2017	1/500	A0
Drg. No.		**Revision**
S2117/01		

Appendix F – Site Location plan

Appendix G – EA Flood Mapping Information

FLOOD ZONE 1

Land and property in flood zone 1 have a low probability of flooding

More information about flood zones

1 You don't need to do a flood risk assessment if your development is in flood zone 1 and:

- smaller than one hectare
- is not affected by sources of flooding other than rivers and the sea, for example surface water drains

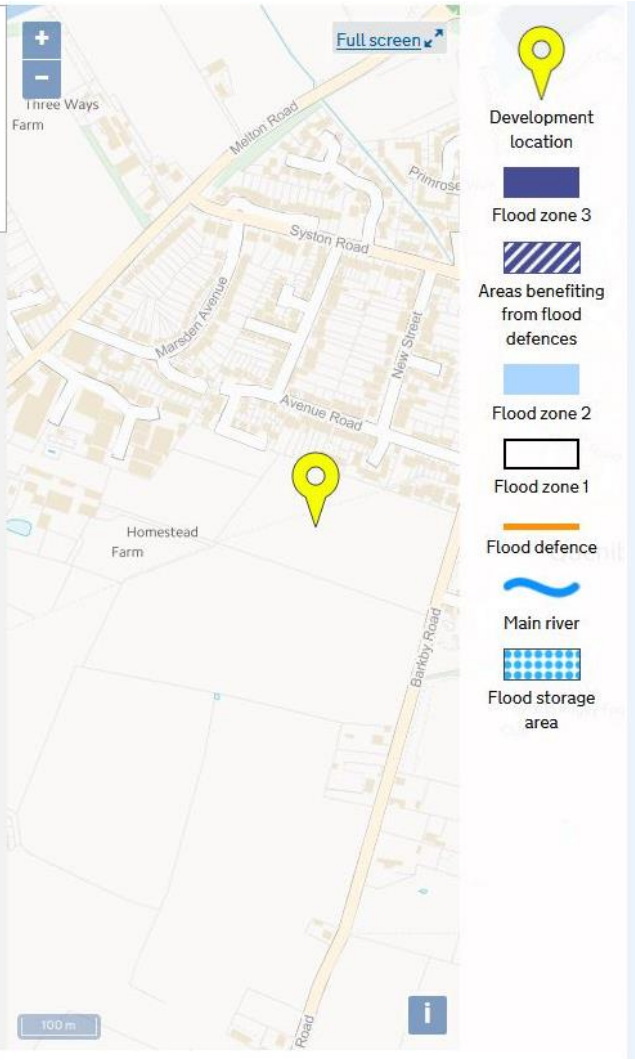
2 If your development is in flood zone 1 and:

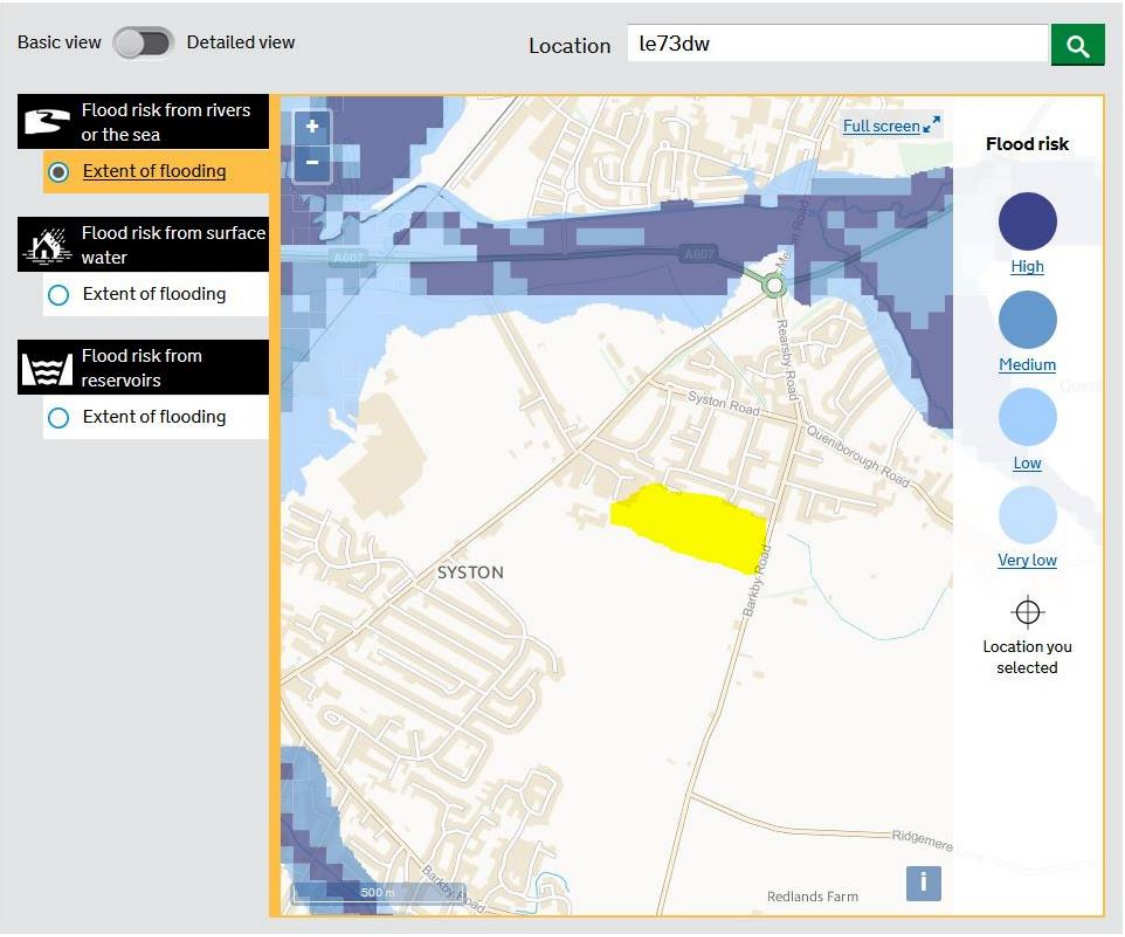
- larger than one hectare
- is affected by sources of flooding other than rivers and the sea, for example surface water drains

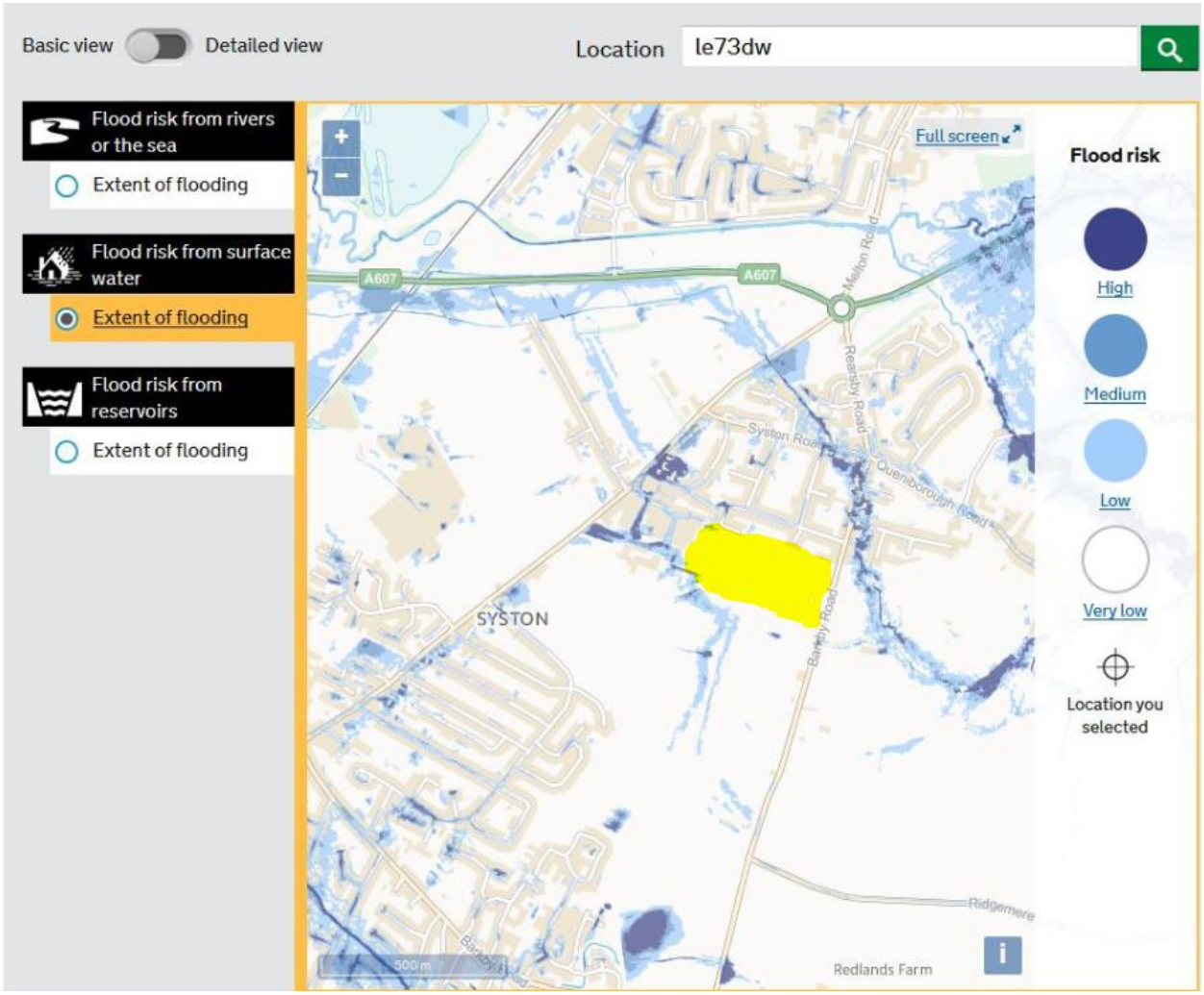
you can learn more about flood risk assessment in flood zone 1

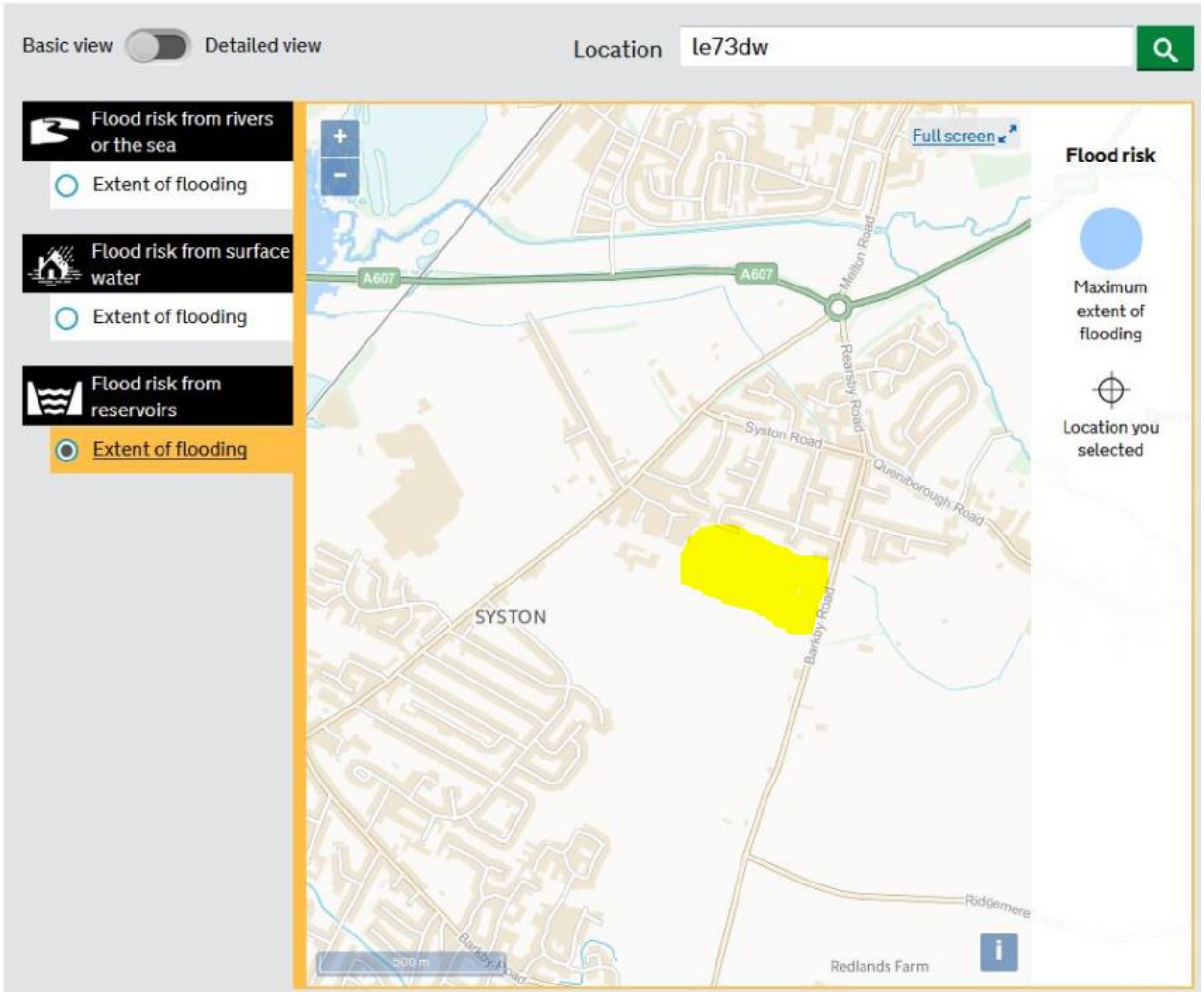
3 You can also read more about flood risk assessments for planning applications

Learn more about the potential sources of flood risk in this area




Basic view
Detailed view
Location
le73dw
Flood risk from rivers or the sea
Extent of flooding
Flood risk from surface water
Extent of flooding
Flood risk from reservoirs
Extent of flooding
Full screen
Flood risk
High
Medium
Low
Very low
Location you selected
SYSTON
Syston Road
Queniborough Road
Barkby Road
Ridgemere
Redlands Farm
A607
500 m


Basic view
Detailed view
Location
le73dw
Flood risk from rivers or the sea
Extent of flooding
Flood risk from surface water
Extent of flooding
Flood risk from reservoirs
Extent of flooding
Full screen
Flood risk
High
Medium
Low
Very low
Location you selected
A607
A607
Melton Road
Reesby Road
Syston Road
Queensborough Road
Barkby Road
SYSTON
Ridgemere
Redlands Farm
500 m


Basic view
Detailed view
Location
le73dw
Flood risk from rivers or the sea
Extent of flooding
Flood risk from surface water
Extent of flooding
Flood risk from reservoirs
Extent of flooding
Full screen
Flood risk
Maximum extent of flooding
Location you selected
A607
A607
Melton Road
Rearsby Road
Syston Road
Queniborough Road
Barkby Road
SYSTON
Ridgemere
Redlands Farm
500 m

Appendix H – Available STW Information – Not yet received

END OF REPORT – PAGE LEFT INTENTIONALLY BLANK