AECOM FINAL

Countryside Properties (UK) Limited

Submitted by
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London Road, Rayleigh Essex Flood Risk Assessment Addendum

May 2015

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Table of Contents

1 Introduction

1.1 Background

AECOM (formally URS Infrastructure & Environment UK Ltd) was commissioned by Countryside Properties (UK) Ltd to complete a Flood Risk Assessment (FRA) to accompany a planning application for the proposed development of Land off London Road, Rayleigh, Essex ("the Application Site"). A planning application was originally submitted to Rochford District Council (ref 14/00627/OUT) in August 2014, and the FRA submitted in connection with that application was subsequently updated in September 2014, and submitted to the Council in November 2014.

Prior to the determination of the planning application to Committee, the Environment Agency and Essex County Council (as Lead Local Flood Authority (LLFA)) were consulted on the FRA.

The Environment Agency response dated 3rd November 2014 (Ref AE/2014/118306/01-L01) outlined no objection to the FRA but identified certain conditions that would need to be appended to any planning approval. The Environment Agency response is included within Appendix A of this addendum.

Essex County Council responded outlined their support of the recommended policy in the Environment Agency response dated 3rd November 2014. The response from Essex County Council is included within Appendix A of this addendum.

The planning application was taken to Committee on the 29th January 2015. The Committee refused permission on a number of grounds, one of which was flood risk, specifically Reason for Refusal 2 of the Decision Notice states:

> *"The submitted Flood Risk Assessment is inadequate as it lacks information relating to and fails to take account of recent flooding events that have taken place downstream in Church Road, Rawreth. The assessment also does not properly take account of the impact of the removal of a section of culvert. Appropriate arrangements for the maintenance of sustainable urban drainage features have not been demonstrated. It has not therefore been demonstrated that the proposed development would adequately address the risk of flooding from and to the proposed development."*

In addition to the above reasons for objection, it is understood that concern was also raised by some Councillors over the extent of the tidal flood risk at the Application Site and the tidal influence on the flood risk at the proposed development and the resultant impact on surface water drainage.

This addendum to the FRA has been prepared to provide clarification on the issues which resulted in the application being refused. In addition, further updates to the FRA have been included.

2 Clarification

2.1 Flood Zone Definition

The FRA made reference to the Environment Agency Flood Zone mapping[1]. Under NPPF requirements, this mapping is used to determine the fluvial and tidal flood risk as part of the FRA. The flood map used to detail the flood risk at the Application Site is based on hydraulic modelling completed as part of the 2007 South Essex Flood Risk Study. At the time of the completing the FRA this was the most up-to-date assessment of fluvial flood risk in the area.

As outlined in the FRA (Paragraph 4.3.1), the Application Site is predominately located within Flood Zone 1, with some areas in Flood Zones 2 and 3. The definition of Flood Zones are as follows:

- Flood Zone 1: Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 : land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
- Flood Zone 3: land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

At the Application Site, the flood risk is from fluvial sources only. This will be discussed further in Section 2.2.

Following the completion of the FRA, Countryside Properties (UK) Ltd. appointed AECOM to undertake detailed modelling and mapping of the flood extents associated with the Rawreth Brook as it passes through the Application Site. The updated modelling was commissioned to refine the flood extent across the Application Site in order to inform the layout and design of an access bridge. A summary of the modelling completed is discussed further in Section 3.1.

2.2 Tidal Influence on Flood Risk

Paragraph 4.3.5 of the FRA outlined that the fluvial modelling completed in 2007 as part of the South Essex Flood Risk Study accounted for the tidal influence of the River Crouch on flood risk from the Rawreth Brook.

The Environment Agency confirmed this by supplying mapping detailing the exact extent of the Flood Zone, influenced by tidal waters (Figure 4-1 within the FRA). This showed the tidal extent on the Rawreth Brook to extend as far upstream as Church Road, approximately 2km downstream from the Application Site.

Paragraph 4.2.3 of the FRA outlined that although the tidal extent does not reach the Application Site, there is likely to be an effect on the discharge of fluvial water within the Rawreth Brook as a result of tide locking.

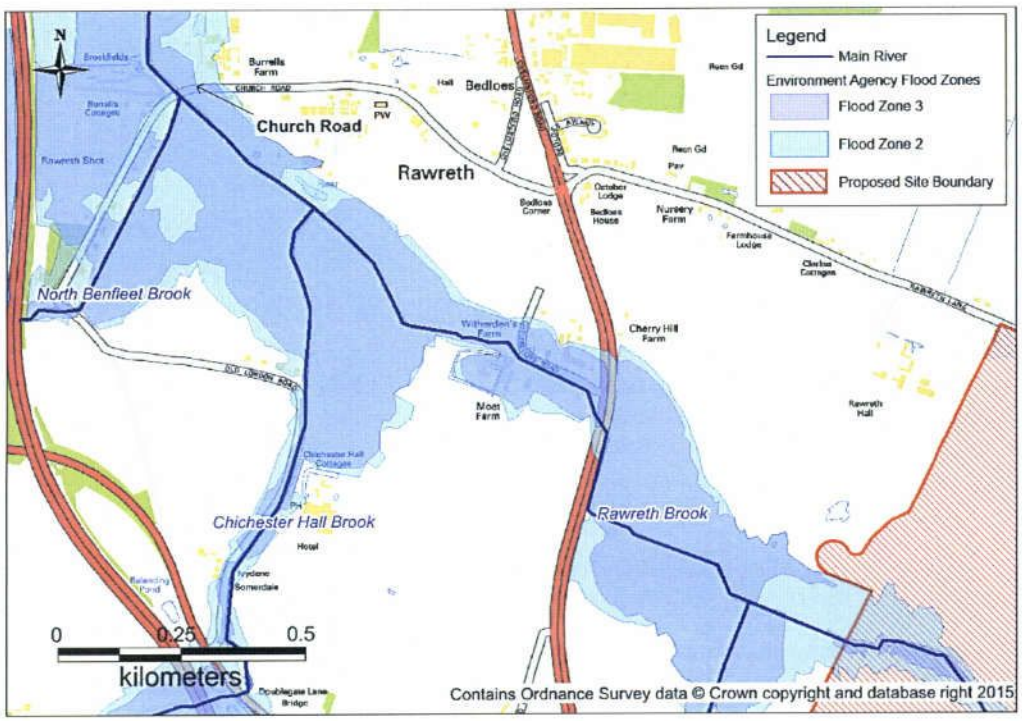
The hydraulic modelling undertaken by AECOM has examined the influence of the tidal downstream boundary on the flood risk across the Application Site. The original 2007 model and the updated AECOM model utilised a downstream boundary that simulates the tidal cycle of the River Crouch over a 48 hour cycle. In order to examine the influence this boundary has on the flood risk at the Application Site, the tidal variation was removed and replaced with a static water level (equivalent to low tide). This resulted in a negligible difference in flood depths within the river channel and across the flood plain at the Application Site. This demonstrated that the Application Site is not affected by the tidal downstream conditions. The Environment Agency (correspondence dated 13th April 2015, Ref: AE/2014/118172/02-L01) has acknowledged that the analysis completed as part of the fluvial modelling, to determine the tide locking at the Application Site, demonstrates there to be minimal influence on flood depths across the Application Site.

[1] Environment Agency Flood Maps. Available online at: http://apps.environment-agency.gov.uk/wiyby/37837.aspx [Accessed 15/05/2015]

2.3 Historic Flooding at Church Road

The Council's reason for refusal states that the FRA did not take account of flooding events at Church Road, Rawreth. Church Road is located approximately 2km downstream of the Application Site. The location of Church Road in relation to the Application Site is shown in Figure 1 below. The Chichester Hall Brook joins the Rawreth Brook 0.7km upstream of Church Road. The North Benfleet Brook joins the Rawreth Brook at the inflow of the culvert beneath Church Road. The Environment Agency Flood Maps indicate Church Road and the surrounding area to largely be within Flood Zone 3 (land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year).

Figure 1: Location of Church Road in relation to the Proposed Development



Church Road is at an elevation of 5m AOD, approximately 5m lower than the Application Site (at 10m AOD). Although a significant distance downstream of the proposed development, there is potential for surface water runoff to be routed towards Church Road, via the Rawreth Brook. If left unmitigated, there is the potential that the flood risk at Church Road would be increased.

The FRA however outlined that the surface water runoff from the proposed development would be mitigated. This will be achieved through the development of a surface water drainage network, utilising Sustainable Drainage Systems (SuDS). The network would manage surface water runoff up to and including the 1% Annual Exceedance Probability (AEP) (1 in 100 year) plus 30% Climate Change event.

Section 5.3 of the FRA states that as the site is currently undeveloped greenfield land, the surface water runoff rates and volumes from the proposed development would need to equal the present day greenfield runoff rate. As part of the proposed

development, the surface water drainage network is being designed to restrict the runoff to greenfield runoff rates for events up to the 3.3% AEP (1 in 30 year) rainfall event, meaning that runoff resulting from rainfall events of greater extremity (greater than a 3.3% AEP (1 in 30 year)), would be managed by the surface water network at the site.

Therefore, as the result of the drainage strategy for the proposed development, there would be a betterment in flood risk to the areas downstream of the site during extreme rainfall events (3.3% AEP (1 in 30 year) or greater). This is discussed further in section 3.3 and 3.4 of this addendum.

2.4 Culvert Removal

Paragraph 5.2.10 of the FRA outlined an 'opportunity for development' relating to the potential removal of the culvert beneath the second field crossing at the confluence of the tributary of the Rawreth Brook (NGR 578801,192416).

This was never considered to be part of the proposed development nor was it necessary to mitigate the impact of the proposed development, but was outlined in the FRA due to the potential benefits such a measure could achieve.

Subsequent to the FRA it has been identified that the field crossing will be required by the landowner for access to the western extents of the fields that are not being developed. As such the culvert will remain in place and will not be modified as part of the proposed development.

3 Updates

3.1 Fluvial Flood Risk Modelling

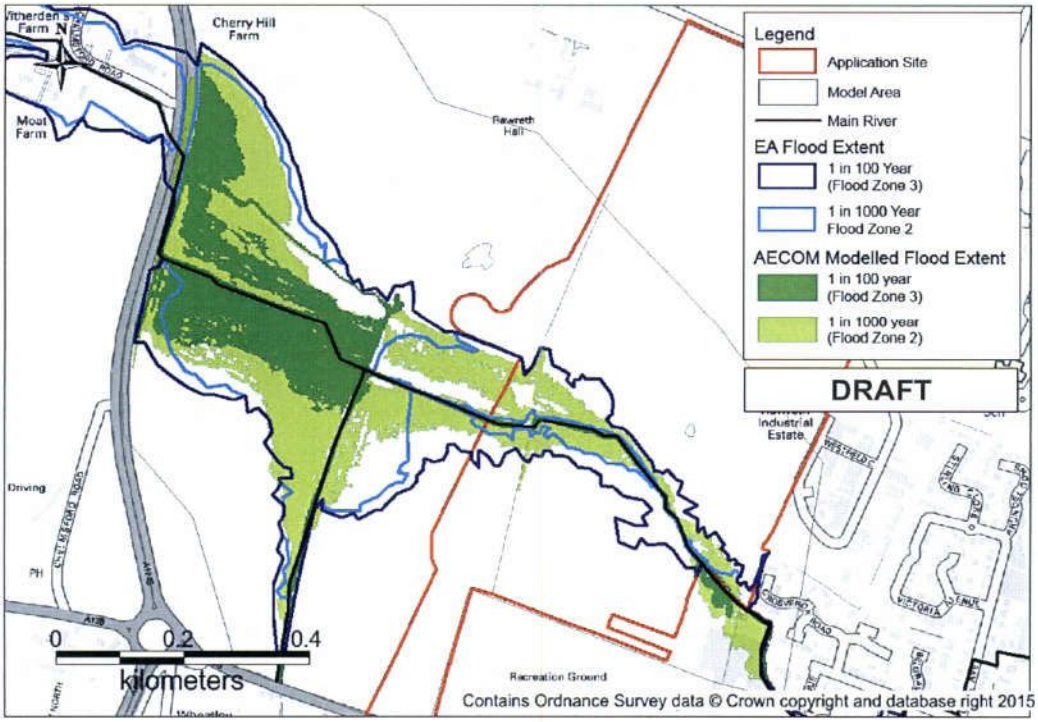
Detailed hydraulic modelling has been completed to improve confidence in Flood Zones used to inform the design of the proposed access road across the Application Site. The model is currently being review by the Environment Agency.

The existing flood extents for the Rawreth Brook were derived from one – dimensional (1D) hydraulic modelling completed in 2007 as part of the South Essex Flood Risk Study.

The updated hydraulic modelling being completed by AECOM builds on the 2007 model by incorporating a two-dimensional (2D) element to represent the floodplain of the Rawreth Brook across the Application Site.

The draft results of the updated modelling show the flood extent across the Application Site has been reduced. This demonstrates that the original 1D model overestimated flooding across the Application Site. Figure 2 outlines the draft model results for the 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year) flood extents against the Environment Agency Flood Zone extents. The flood extents of the revised modeling are mapped only within the 2D model domain area.

Figure 2: Draft AECOM model results against existing Environment Agency Flood Zones



At the Application Site, the draft results of the updated modelling demonstrate that the Rawreth Brook remains in bank for the lower return period flood events (10% AEP (1 in 10 year) and 5% AEP (1 in 20 year)). Flooding occurred during the 10% AEP (1 in 10 year) event downstream of the Application Site at the confluence of the Rawreth Brook main river tributary. This results in flooding of the land to the west of the field crossing, downstream of the Application Site.

During more extreme flood events (1% AEP (1 in 100 year) or greater), the hydraulic modelling shows flood waters to pond upstream of the A1245 embankment, where the Rawreth Brook goes into culvert. The culvert beneath the A1245 embankment throttles flow, causing water to back up channel and flood the western area of the Application Site.

For the 1% AEP (1 in 100 year) + CC and the 0.1% AEP (1 in 1000 year) events flood waters exceed much of the river channel downstream of the confluence of the main river tributary and in some localised instances upstream of this as the Rawreth Brook passes through the Application Site. However, the proposed residential development areas remain outside of the 1% AEP (1 in 100 year) + CC and the 0.1% AEP (1 in 1000 year) flood extents.

As mention previously in Section 2.2 of this addendum, the modelling has determined there to be a negligible influence on flood risk at the Application Site as a result of the tidal downstream boundary.

3.2 Existing Field Drains

Site investigations and historic records show that there is an extensive field drainage system across the agricultural land which forms the Application Site. The field drainage network consists of a shallow herringbone network of perforated pipes that cover the northern area of agricultural land. The drainage network discharges through several outfalls into the Rawreth Brook.

As the soil type across the Application Site is clay rich (see section 2.4.4 of the FRA), it will have a low permeability and as a result, is poorly draining. Rainfall will therefore infiltrate into the ground slowly. The purpose of the land drains is to increase the rate at which water is removed from the soil, reducing the extent of waterlogging and rendering the soil more suitable for agricultural purposes. Prior to the installation of the land drains, rainfall would have infiltrated through the soil into Rawreth Brook, but this would have occurred at a slower rate when compared to the artificially drained land.

Observations made during a site walkover in October 2014 demonstrated that following a period of rainfall, the field drains discharge into the Rawreth Brook at full bore i.e. each of the pipes was discharging water from the fields at full capacity. Met Office[2] records indicate that October 2014 was largely unsettled with higher than average rainfall, and it is during prolonged periods of rainfall that the ground is more likely to be waterlogged, and a large amount of water will be artificially removed by the land drains.

During short duration, high intensity rainfall (typically associated with summer rainfall events), the rate at which rain falls on the surface will exceed the rate at which it is able to drain into the soil. This will result in rainfall runoff off the land as overland flow.

It should be noted that the greenfield runoff rates calculated within Section 3.4 of this addendum does not consider the presence of the field drainage. It is therefore possible that the greenfield runoff calculations have underestimated the volume of runoff from the site. Under the development proposals, a large extent of the land drainage network would be removed, which will provide a reduction in the runoff rates from the Application Site. This would essentially restore the runoff rates closer to the calculated greenfield rate. The proposed surface water drainage strategy, in combination with the removal of part of the land drainage network will result in a considerable reduction in the rate of runoff currently leaving the site.

[2] Met Office UK Climate, available online at http://www.metoffice.gov.uk/climate [Accessed 18/05/2015]

3.3 Planning Requirements for Surface Water Management

Amendments to national SuDS policy

Within the FRA, reference is made to the National Planning Policy Framework (NPPF) Technical Guidance. The Technical Guidance has since been replaced by the Planning Policy Guidance: Flood Risk and Coastal Change (PPG).

Following a consultation by Defra on the delivery of SuDS[3] in 2014, the Department for Communities and Local Government (DCLG) issued a written statement[4] outlining the Government's response regarding the future of SuDS. This was followed by a consultation exercise carried out in December 2014[5] by DCLG on the proposal to make LLFAs statutory consultees for planning applications with regards to surface water management. The Government published its formal response in March 2015[6]. The PPG has subsequently been amended (March 2015) to reflect the new approach to implementation of SuDS in development.

Rather than implement Schedule 3 of the Flood and Water Management Act 2010, as written, which would establish a new SuDS Approval Body (SAB) that would sit outside the existing planning system, amendments to planning policy ensure SuDS are delivered through the planning system. Local Planning Authorities (LPAs) can now give increased weight to the provision and maintenance of SuDS, alongside other material considerations, during the determination of a planning application.

The National SuDS Standards[7] (NS), published in March 2015, set the non-statutory technical standards for SuDS. The NS provide guidance on implementation of SuDS outlining requirements for the design, construction, maintenance and operation.

Developers must adhere to national policy outlined in the NPPF and PPG and consult the National SuDS Standards guidance when developing proposed SuDS options. The PPG outlines that the NS provide guidance for the design of SuDS schemes, however it is stated that:

> *"compliance with the technical standards is unlikely to be reasonably practicable if more expensive than complying with building regulations - provided that where there is a risk of flooding the development will be safe and flood risk is not increased elsewhere. Similarly, a particular discharge route would not normally be reasonable practicable when an alternative would cost less to design and construct."*

The Planning Practice Guidance: Flood Risk and Coastal Change

The PPG outlines policy for LPAs on determining planning applications including SuDS options. With regards to the requirement for SuDS the PPG states that:

> *"New development should only be considered appropriate in areas at risk of flooding if priority has been given to the use of sustainable drainage systems. Additionally, and more widely, when considering major development, as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015, sustainable drainage systems should be provided unless demonstrated to be inappropriate."* (Ref ID 7-079-20150415)
>
> *"Generally, the aim should be to discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:*
>
> - *into the ground (infiltration);*
> - *to a surface water body;*

[3] Defra / DCLG (September 2014) Delivering Sustainable Drainage Systems: Consultation
[4] Department for Communities and Local Government (Dec 2014) House of Commons Written Statement (HCWS161) Sustainable Drainage Systems.
[5] DCLG (December 2014) Consultation on Further changes to statutory consultee arrangements for the planning application process
[6] DCLG (March 2015) Further changes to statutory consultee arrangements for the planning application process: Government response to consultation.
[7] DEFRA (Sustainable Drainage Systems (March 2015) Non-statutory technical standards for sustainable drainage systems

- *to a surface water sewer, highway drain, or another drainage system;*
- *to a combined sewer.*

Particular types of sustainable drainage systems may not be practicable in all locations." (Ref ID 7-080-20150323)

LPAs are responsible for determining whether the proposed SuDS solution for a site is appropriate and practicable. In making this decision, LPAs should consult relevant flood risk management bodies, particularly the LLFA.

Should SuDS be proposed for a development, the developer should outline, to the satisfaction of the LPA, arrangements for ongoing maintenance of the SuDS for the lifetime of the development (see Section 3.5 below in respect of management). The developer must also satisfy the LPA that the proposed minimum standards of operation are appropriate (see section 3.4 below for operational design specifications).

3.4 Surface Water Management Strategy

The surface water drainage strategy proposes to drain the surface water from the future development into the Rawreth Brook, via permeable paving, a series of swales and attenuation ponds.

The FRA outlines in paragraph 5.3.12 that due to the geology of the Application Site (predominately impermeable clay), it is not possible to discharge surface water via infiltration SuDS. Soakage tests completed in October 2013 by RSA Geotechnics Ltd[8] outline that no notable soakage was recorded at the site. Therefore in line with the Building Regulations Part H and PPG, surface water will be discharged to the Rawreth Brook.

Based on a total developed are of 20.1 hectares, the current Greenfield runoff rates from the site using the nationally recognised IH124 Method are calculated as:-

- 3.3% AEP (1 in 30 year) storm 7.9 litres per second per hectare (158.5 litres per second for the whole site).
- 1% AEP (1 in 100 year) storm 11.1 litres per second per hectare (223.1 litres per second for the whole site).

The swales and attenuation ponds have been sized to ensure that flows from the proposed development into the Rawreth Brook do not exceed the greenfield runoff rates for all events up to an including the 1% AEP (1 in 100 year) plus climate change.

The proposed development and drainage strategy assumes pond volumes based on:-

- Runoff from the development parcels for a 1% AEP (1 in 100 year) storm + 30% allowance for climate change
- Discharge rate into Rawreth Brook equivalent to 3.3% AEP (1 in 30 year) storm green field runoff.

An initial layout for the Phase 1 housing development has been produced and has been used to prepare an initial drainage layout incorporating SuDS. This has been modelled using MicroDrainge WinDes software. Using the results for this model, and assumptions for the densities of the remainder of the proposed development, we have determined the likely volume of surface water attenuation within the ponds required for the overall Application Site.

Total volumes for storage within the ponds for a 1% AEP (1 in 100 year) storm + 30% climate change and based on discharge into Rawreth Brook at 3.3% AEP (1 in 30 year) storm green field runoff is likely to be 7140 m^3. Appendix B details the calculations completed as part of the outline drainage strategy and the WinDes MicroDrainge outputs.

[8] RSA Geotechnics Ltd (December 2013) Ground Investigation Report Number 13692SI

The discharge rate to the Rawreth Brook will be restricted to the 3.3% AEP (1 in 30 year) greenfield runoff rate (7.9 litres per second per hectare). This provides a 30% reduction to the 1% AEP (1 in 100 year) greenfield runoff rate normally specified so improving the current position based on the agricultural use of the Application Site.

Additional attenuation and storage has been provided through the incorporation of onsite swales and permeable paving. These features will function to reduce the flow rates from the proposed development and provide a preliminary level of water treatment. Calculation of the pond storage requirement has not taken the storage potential from these features into account; therefore provide a conservative estimate of storage requirement.

The detailed drainage strategy will be developed as part of the detail planning application. This will cover the conditions outlined by the Environment Agency in their response to the FRA (Ref AE/2014/118306/01-L01). The Environment Agency and other statutory bodies will be consulted during the design process.

3.5 Maintenance of SuDS

SuDS features will be maintained to the general requirements and frequencies indicated in the SuDS Manual.

The management of the public open spaces, including swales, infiltration drains and associated inlet/outlet structures will be undertaken by a management company to be set up by the developer, save any SuDS features that may instead be transferred and managed by a statutory water undertaker or a management company.

Maintenance of swales and filter strips is relatively straightforward and typically there is only a small amount of extra work required over and above that required for any open space. More intensive work such as silt and/or vegetation removal is only required intermittently, but should be planned to be sympathetic to the requirements of wildlife. Swales and filter strips are designed so that special machinery is not required to undertake maintenance. Grass cutting should not be carried out when the swale or filter strip is wet.

The management of road gullies and their associated outlets will be maintained by the Highway Authority.

Piped Networks and Attenuation Ponds will be either adopted and maintained by Anglian Water Services under a Section 104 Agreement, or transferred to the management company.

Maintenance of ponds is relatively straightforward and typically there is only a small amount of extra work required for a SuDS pond or wetland. More intensive work such as silt and/or vegetation removal is only required intermittently, but should be planned to be sympathetic to the requirements of wildlife in a pond. The best time to carry out more intensive work is between September and November when the impact on wildlife is minimised (e.g. no newt breeding or young, ground nesting birds are not breeding, impact on water voles is less).

Intensive silt and vegetation removal should only be carried out to limited areas at any one time (25% to 30% of the pond area on one occasion each year) to minimise the impact on biodiversity.

The management of any non-private areas of permeable paving (e.g. shared parking courts) will be undertaken by a management company to be set up by the developer.

Maintenance of the permeable paving will be required to maintain the infiltration rate of the paving. This will include:-

- Regular inspections of the surface to assess the condition of the joints (6 monthly);
- periodic cleaning of the surface to remove debris from the surface (Annually);
- periodic vacuuming of the surface to remove accumulations of silt/debris in the joints (every 2- 5 years depending on usage); and,
- repair of rutted sections, cracked or broken blocks (based on 6 monthly inspections).

4 Summary

The clarifications provided in this addendum have been presented following refusal of the previous planning application, partly on the grounds of flood risk.

The following clarifications to the previous FRA have been provided in light of the reasons for planning application refusal:

- Paragraph 6.1.4 - The modelled flood levels for the Rawreth Brook should be used to ensure that finished floor levels are set to 300 mm above the 100 year plus allowance for climate change flood level. The revised fluvial modelling, once agreed with the Environment Agency, will be used to determine the range in flood levels across the Application Site.

- Paragraph 6.1.5 – The Application Site is currently greenfield land, in accordance with NPPF requirements, surface water runoff from the Application Site will need to be restricted to the 1% AEP (1 in 100 year) greenfield runoff rate. As outlined in the drainage strategy in Section 3.4, 30% betterment will be provided to this, as the surface water runoff rate will be restricted to the 3.3% AEP (1 in 30 year) greenfield runoff rate.

- Paragraph 6.1.6 – As surface water runoff will be restricted to the 3.3% AEP (1 in 30 year) greenfield runoff rate, attenuation storage of 7140 m^3 will be provided through the provision of three attention ponds across the Application Site.

- Paragraph 6.1.7 - The discharge of surface water via infiltration measures is not suitable due to impermeable clay bedrock geology. Soakage tests carried out across the site confirmed that no discernable soakage was observed. Surface water will therefore need to be managed onsite through appropriate storage and attenuation systems, designed to accommodate the necessary storage prior to being discharged to the Rawreth Brook (providing discharge consent is granted).

The following points discussed in the FRA remain valid:

- Paragraph 6.1.2 - The assessment of flood risk to the development concludes that there is a low risk of flooding from tidal, sewer, groundwater and artificial sources. There is a high risk of flooding from surface water sources and a high to low risk of flooding for parts of the Application Site, from fluvial sources.

- Paragraph 6.1.3 - The proposed development is classified as more vulnerable. The residential, school and healthcare components of the proposed development will be constructed entirely within Flood Zone 1 away from the areas of high fluvial flood risk. This satisfies the sequential approach to development as outlined in the NPPF.

- Paragraph 6.1.8 - The assessment of the flood risk from the proposed development concludes that with appropriately designed and managed surface water management measures (providing sufficient attenuation and storage) and appropriate bridge construction, it is considered that there is no increased flood risk to the surrounding area as a result of the proposed development.

This additional statement also responds to the previous reason for refusal by:

- Explaining that risk of downstream flooding (at Church Road) will be reduced as a result of the proposed development, not increased;

- Clarifying that there will be no culvert removal; and

- Providing a strategy for the future management and maintenance of the on-site drainage system.

Appendix A.
FRA Consultation

Environment Agency

Ms Katie Rodgers
Rochford District Council
Planning Department
3-19 South Street
Rochford
Essex
SS4 1BW

Our ref: AE/2014/118306/01-L01
Your ref: 14/00627/OUT

Date: 03 November 2014

Dear Ms Rodgers

OUTLINE PLANNING APPLICATION (WITH ALL MATTERS RESERVED APART FROM ACCESS) FOR THE ERECTION OF RESIDENTIAL DEVELOPMENT WITH ASSOCIATED OPEN SPACE, LANDSCAPING, PARKING, SERVICING, UTILITIES, FOOTPATH AND CYCLE LINKS, DRAINAGE AND INFRASTRUCTURE WORKS, AND PRIMARY SCHOOL. PROVISION OF NON-RESIDENTIAL FLOORSPACE TO PART OF SITE, USES INCLUDING ANY OF THE FOLLOWING: USE CLASS A1(RETAIL), A3(FOOD AND DRINK), A4(DRINKING ESTABLISHMENTS), C2(RESIDENTIAL INSTITUTIONS), D1A(HEALTH OR MEDICAL CENTRE) OR D1B(CRÈCHE, DAY NURSERY OR DAY CENTRE). LAND NORTH OF LONDON ROAD AND SOUTH OF RAWRETH LANE AND WEST OF RAWRETH INDUSTRIAL ESTATE, RAWRETH LANE, RAYLEIGH, ESSEX.

Thank you for your consultation received on 5 September 2014 and the submission of a updated Flood Risk Assessment on 6 October 2014. We have inspected the application, as submitted, and have no objection provided the flood risk conditions below are appended to any planning permission granted. Our detailed comments are provided below, together with advice on foul water and sustainability:

Flood Risk

The site falls partially within Flood Zone 1, 2 and 3a, and exceeds a hectare in area. Flood Zone 2 is classed as medium probability risk land having between a 1 in 100 and 1 in 1,000 annual probability of sea flooding. Flood zone 3a is classed as high probability risk land assessed as having a 1 in 100 year or greater annual probability of flooding. This is defined in Table 1: Flood Zones of the Planning Practice Guidance.

The proposed development consists of residential units, non-residential floor space, a school, and a health centre. Section 3.3.3 of the submitted Flood Risk Assessment

(FRA) by URS, referenced 47065807, Rev. 6, and dated September 2014, states that the land within Flood Zone 2 and 3 will be set aside for public open space and all residential development will be located entirely within Flood Zone 1. However, it should be noted that the access road and bridge will be within Flood Zone 2, although levels will be set above the 1 in 100 year event inclusive of climate change.

The proposed scale of development within Flood Zone 1 may present risk of flooding on-site and/or off-site if surface water run-off is not effectively managed. Therefore an FRA has been submitted in support of this application, as required by the National Planning Policy Framework (NPPF).

The Floods and Water Management Act 2010 and NPPF require developers to include sustainable drainage (SuDS), where practicable, in new developments. Whilst not all SuDS options will be appropriate for all development sites, a sustainable drainage approach should be possible on almost every development site. Surface water arising from a developed site should as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development in accordance with the Planning Practice Guidance, Flood Risk and Coastal Change, Reference ID: 7-051-20140306.

Having reviewed the FRA submitted we are satisfied that it provides sufficient detail to fully assess the flood risks arising from the proposed development. The proposed development will only meet the NPPF policy to not increase flood risk elsewhere if the following planning conditions are included.

We also provide advice for further consideration in Technical Appendix 1 to this letter, which will help inform your decision on whether the development can be made sustainable.

Condition
Development shall not begin until a surface water drainage scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydrogeological context of the development, has been submitted to and approved in writing by the local planning authority. The scheme shall be implemented before the development is completed in accordance with the approved details. The scheme shall:

- Provide calculations to demonstrate that the proposed surface water management scheme has been adequately sized to accommodate the critical duration 1 in 100 year rainfall event including allowances for climate change without causing nuisance or damage. The management strategy should consider both storage and conveyance of surface water.

- Provide plans and drawings showing the locations and dimensions of all aspects of the proposed surface water management scheme. The submitted plans should demonstrate that the proposed drainage layout will perform as intended based on the topography of the site and the location of the proposed surface water management features. In addition, full design details, including cross sections of any proposed infiltration or attenuation features will be required.

- Provide sufficient information to demonstrate that people and property will be kept safe from flooding, with consideration given to overland flow routing where required.

- Fully investigate the feasibility of infiltration SuDS as a preference and provide evidence to establish if the principles of any infiltration based surface water drainage strategy are achievable on site, based on the ground conditions, such as infiltration or soakaway tests which adhere to BRE365 guidance.

- Incorporate the SUDS "Management Train" and ensure all features are designed in accordance with CIRIA (C697) The SUDS Manual so ecological; water quality and aesthetic benefits can be achieved in addition to the flood risk management benefits. In addition, the maintenance requirements for the SUDS element of the proposed surface water drainage system should be formulated as per the recommendations within the CIRIA SUDS Manual (C697).

- Ensure that any surface water discharged to the receiving ditch or main river, Rawreth Brook, shall be no greater than existing greenfield runoff rates for a range of equivalent return period events up to and including the 1 in 30 year rainfall event over the lifetime of the development.

- Fully investigate the impacts of tide locking on the site and model a surcharge outfall scenario.

- Provide attenuation storage that will cater for the 1 in 100 year critical storm plus allowance for climate change based on a six hour duration event.

- Provide calculations of the piped network performance in the 1 in 30 year or 1 in 100 year rainfall events, including climate change.

- Include permeable paving in the drainage system where infiltration allows. Modelling should be provided to demonstrate its functionality in the 1 in 100 year event inclusive of climate change.

- Provide details of the future adoption and maintenance of the proposed surface water scheme for the lifetime of the proposed development. The local planning authority should be satisfied that arrangements are in place for the long term maintenance and management of the surface water management scheme.

- Confirm that the receiving watercourse (Rawreth Brook) is in a condition to accept and pass on the flows from the discharge proposed.

Reason
To prevent flooding by ensuring the satisfactory storage and disposal of surface water from the site for the lifetime of the development.

Condition

The development permitted by this planning permission shall be carried out in accordance with the approved Flood Risk Assessment (FRA) undertaken by URS, referenced 47065807, Rev. 6, and dated September 2014, and the following mitigation measures detailed within the FRA:

- Finished ground floor levels of any development within a flood zone should be set no lower than 13.11 meters above Ordnance Datum (AOD); 300mm above the 1 in 100 year event inclusive of climate change.
- Confirmation of the opening up of any culverts across. The impact this will have must be fully investigated and modelled.
- A scheme for compensatory flood storage should be provided where appropriate to the final layout of the development and its access road.

The scheme and mitigation measures shall be fully implemented prior to completion of development and subsequently maintained, in accordance with the timing / phasing arrangements embodied within the scheme or within any other period as may subsequently be agreed, in writing, by the local planning authority.

Reasons
To reduce the risk of flooding to the proposed development and future occupants.
To reduce the risk of flooding from blockages to the existing culvert and or their removal.
To prevent flooding elsewhere by ensuring that compensatory storage of flood water is provided.

Flood Defence Consent

Under the terms of the Water Resources Act 1991, and the Land Drainage and Sea Defence Byelaws for Anglian Region, our prior written consent is required for any proposed works or structures, in, under, over or within 9 metres of the top of the bank of Rawreth Brook, designated a 'main river'.

The flood defence consent will control works in, over, under or adjacent to main rivers (including any culverting).Your consent application must demonstrate that:

- there is no increase in flood risk either upstream or downstream
- access to the main river network and sea/tidal defences for maintenance and improvement is not prejudiced.
- works are carried out in such a way as to avoid unnecessary environmental damage.

Mitigation is likely to be required to control off site flood risk. We will not be able to issue our consent until this has been demonstrated.

Foul Water Disposal

Anglian Water Services should be consulted regarding the available capacity in the foul water infrastructure. If there is not sufficient capacity in the infrastructure then we must be consulted again with alternative methods of disposal.

Sustainability

Climate change is one of the biggest threats to the economy, environment and society. New development should therefore be designed with a view to improving resilience and adapting to the effects of climate change, particularly with regards to already stretched environmental resources and infrastructure such as water supply and treatment, water quality and waste disposal facilities. We also need to limit the contribution of new development to climate change and minimise the consumption of natural resources.

Opportunities should therefore be taken in the planning system, no matter the scale of the development, to contribute to tackling these problems. In particular we recommend the following issues are considered at the determination stage and incorporated into suitable planning conditions:

- Overall sustainability: a pre-assessment under the appropriate Code/BREEAM standard should be submitted with the application. We recommend that design Stage and Post-Construction certificates (issued by the Building Research Establishment or equivalent authorising body) are sought through planning conditions.
- Resource efficiency: a reduction in the use of resources (including water, energy, waste and materials) should be encouraged to a level which is sustainable in the long term. As well as helping the environment, Defra have advised that making simple changes resulting in the more efficient use of resources could save UK businesses around £23bn per year.
- Net gains for nature: opportunities should be taken to ensure the development is conserving and enhancing habitats to improve the biodiversity value of the immediate and surrounding area.
- Sustainable energy use: the development should be designed to minimise energy demand and have decentralised and renewable energy technologies (as appropriate) incorporated, while ensuring that adverse impacts are satisfactorily addressed.

These measures are in line with the objectives of the NPPF as set out in paragraphs 7 and 93-108. Reference should also be made to the Climate Change section of the draft National Planning Practice Guidance, in particular: "Why is it important for planning to consider climate change?" and "Where can I find out more about climate change mitigation and adaptation?"
http://planningguidance.planningportal.gov.uk/blog/guidance/

Additional guidance on considering climate change for this proposal is provided in an appendix at the end of this letter.

We trust this advice is useful.

Yours sincerely

Miss Lizzie Griffiths
Sustainable Places - Planning Advisor

Direct dial 01473 706820
Direct e-mail lizzie.griffiths@environment-agency.gov.uk

cc Phase 2 Planning and Development Ltd
URS

Awarded to Essex, Norfolk and Suffolk Area

Technical Appendix 1 – Flood Risk

Surface Water Drainage Scheme

Section 5.3.4 of the FRA states that the scheme will be developed to accommodate surface water runoff for all rainfall events up to and including the 1 in 100 year design storm inclusive of climate change. The scheme proposes to drain surface water generated by the site via a surface water outfall to Rawreth Brook. Table 5-1 of the FRA outlines the estimated Greenfield run of rate for various events. It is important to note that these figures will be refined at the detailed design stage. In order to achieve the greenfield run off rate, it will be necessary to attenuate surface water on site and restrict the discharge rate to Rawreth Brook.

The outline drainage design drawing, referenced 47065807-DS-02, Rev P4, dated 25 February 2014, details the location of the discharge point. In this drawing, it can be seen that attenuation will be provided by two attenuation basins to the west of the site. A number of swales are also proposed to drain the road. In Appendix E, the FRA has provided some quick storage estimates using the WinDES Micro Drainage software.

Tide Locking

We are aware that tide locking is known to occur downstream of the site at Church Road, Rawreth. A pre-application meeting was held on 8 September 2014, where this was highlighted as an issue and the FRA was amended accordingly in Section 4.2.3. Section 5.3.9 of the FRA highlights the importance of assessing the impact of tide locking upon surface water drainage, on site attenuation and off site. It is possible that the discharge from the site could be restricted by high water levels in the river. Additional capacity will therefore be required to attenuate surface water until water levels in the channel reduce and allow discharge from the site. It is essential that this is investigated fully to establish the risk posed on and off site.

In order to mitigate this risk it was agreed in the meeting that it may be possible to discharge any surface water at the 1 in 30 year storm rate. This would be betterment upon the existing arrangement and allow for the impact of tide locking ensuring that flood risk is not increased elsewhere and on site.

Sustainable drainage

Section 5.3.12 of the FRA states that infiltration SuDS are not suitable at this site, therefore surface water can be discharge to the nearest watercourse. Further consideration should be given to infiltration prior to discharge to watercourse. The development of this site should look to incorporate and give priority to sustainable drainage systems (SuDS) to manage surface water in accordance with paragraph 103 of the National Planning Policy Framework (NPPF) and the Planning Practice Guidance, Flood Risk and Coastal Change, Reference ID: 7-051-20140306.
'Sustainable drainage systems are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems also provide opportunities (in line with other policies in the National Planning Policy Framework) to reduce the causes and impacts of flooding.'

Soakage/infiltration testing should be completed across the site to establish where SuDS may be incorporated into the scheme.

Section 5.3.16 of the FRA suggests the use of permeable paving on roads and parking spaces. Further information should be submitted to illustrate how this will be incorporated into the drainage system, where infiltration allows. Modelling should be provided to demonstrate its functionality in the 1 in 100 year event inclusive of climate change.

Road and bridge design

Section 4.3.10 outlines the proposed access to the site. The access road will pass through the site and across Rawreth Brook. The access route connects to existing roads to the north and south of the site ensuring there is safe access and egress should Rawreth Brook flood. The road and bridge crossing will be located within Flood Zone 2. The road will also be set 300mm above the 1 in 100 year design event inclusive of climate change.

Compensatory Storage

Section 5.2 identifies that some of the development will displace floodplain volume. It is therefore suggested that compensatory storage is provided on a level for level volume for volume basis. Section 5.2.4 states that the construction of the bridge and access road within the flood zones will need to be compensated for should land raising be required. Further information should be submitted to clarify exactly how this will be achieved.

Culvert removal

Section 2.1.6 identifies that a section of Rawreth Brook, 60m to the west of the site, is culverted as part of a crossing between fields. The FRA suggests that there is an opportunity to de-culvert the watercourse and undertake river restoration work and increase flood storage capacity. In principle, this is acceptable and will provide betterment. However, the impact this removal could have upon the hydrology of the watercourse is unknown. Potentially the culvert at this location could act as a buffer, holding back water and slowing its progress downstream towards Church Street. Removal of the culverts could speed up the flow of the watercourse. The impact of the removal of the culvert should be investigated further to ensure flood risk is not increased on and off site.

New modelling

Rawreth Brook is currently being re-modelled. The modelled flood level information and flood map provided by the Environment Agency is derived from data from 2007. The update may alter the outlines of the flood zones and the modelled flood levels. This data will provided a more accurate picture of the flood risk at this location. It was understood from the pre-application meeting that this modelling will be considered when confirming the detailed design of the site.

Technical Appendix 2 – Sustainability

We suggest the following points are addressed by the applicant to limit the development's impact on the environment and ensure it is resilient to future climate change.

Water Efficiency

Over the next 20 years demand for water is set to increase substantially yet there is likely to be less water available due to a drier climate and tighter controls on abstraction. To address this new development should be designed to be as water efficient as possible. This will not only reduce water consumption but also reduce energy bills as approximately 24% of domestic energy consumption in the UK goes to heating water (DTI 2002).

Simple solutions such as dual-flush toilets, water-saving taps and showers, water butts and appliances with the highest water efficiency rating should all be included in the development. The use of greywater recycling and rainwater harvesting will achieve a higher efficiency for the development and should be installed wherever possible.

The payback following investment in water saving devices is often higher in commercial units than residential due to the higher frequency of use. Simple measures such as urinal controls or waterless urinals, efficient flush toilets and automatic or sensor taps are therefore very effective. Likewise investment in water recycling schemes is also more viable in business settings. Further advice is available on our website at:
http://www.environment-agency.gov.uk/business/topics/water/32070.aspx.

We also recommend that developers consider using equipment on the Water Technology List, a directory of products which have met an approved water efficiency eligibility criteria. Businesses which invest in these products may also be eligible for tax savings through Enhanced Capital Allowance (ECA).

Any submitted scheme should include detailed information (capacities, consumption rates, etc) on proposed water saving measures. Where rainwater recycling or greywater recycling is proposed, this should be indicated on site plans. Applicants are also advised to refer to the following for further guidance:
www.environment-agency.gov.uk/research/library/publications/33993.aspx
www.waterefficientbuildings.co.uk and
www.waterwise.org.uk

Waste and Resource Management

The applicant is strongly advised to prepare a site waste strategy which takes account of the requirements of the Waste Framework Directive 2008/98/EC transposed into UK law as the Waste (England and Wales) Regulations 2011. Compliance with Article 4, the Waste Hierarchy, is a legal obligation. Any site waste strategy should include aspirations for zero waste to landfill, the need for waste prevention, and recycling targets. The strategy should show that all possible

measures will be taken to reduce construction and demolition waste produced during the course of the construction, and how this will be achieved, such as preventing the over-ordering of materials, reducing damage to materials before use by careful handling and segregating waste on site into separate skips. The strategy should be made available to all staff and contractors so they are aware of what is required. Waste should be designed out during the property design phase to ensure that during the construction and during demolition at the end of life, minimal volumes of waste result. The developer should consider how they will incorporate recycled/recovered materials into the building programme, including the use of secondary and recycled aggregates, and re-use of any on-site demolition waste.

The applicant should consider how the design of the development will incorporate facilities to allow for easy recycling by the residents. Careful thought should be given as to how recycling will be made easy for residents of multi-occupancy buildings and for the provision for recycling on the move. Facilities like these will increase recycling as well as reduce litter.
http://www.wrap.org.uk;
http://www.tcpa.org.uk/pages/towards-zero-waste.html .

Net Gains for Nature

Landscaping proposals should demonstrate that thought has been given to maximising potential ecological enhancement. Paragraph 9 of the NPPF sets out that planning should seek positive improvements and includes an aim to move from a net loss of biodiversity to achieving net gains for nature in line with the Natural Environment White Paper (2011). In determining planning applications Local Authorities are asked to conserve and enhance biodiversity and encourage opportunities to incorporate biodiversity in and around developments (para.118). This presents an opportunity to provide multi-functional benefits - providing open space for residents / workers, sustainable transport links, wildlife/ecological value, climate change resilience, improved water quality and flood risk management.

Green Infrastructure, defined as a network of new and existing multi-functional green space and features, such as ecological corridors or other appropriate planting, should therefore be considered as part of the development. Such measures can provide the range of benefits outlined above, including for example providing shade to the built environment to reduce overheating, and intercepting rainfall and reducing flood risk. But there is evidence that the inclusion of such features can also provide further economic benefits, such as encouraging inward investment, increasing property values and increasing visitor spending in an area. More information on this, and Green Infrastructure in general, is available on the Natural England web pages: http://www.naturalengland.org.uk/ourwork/planningdevelopment/greeninfrastructure/default.aspx

Incorporating green and/or brown roofs and walls can be a particularly effective measure. They provide valuable urban habitats, increased energy efficiency of buildings and attenuation of rain water. Research from the journal '*Environmental Science and Technology*' claims that green walls deliver cleaner air at street level where most people are exposed to the highest pollution. They can also add to an

attractive street scene if designed well – a good example of this is the Transport for London Green Wall near Blackfriars station.

Additional Useful Resources

In April 2012 we took on full responsibility for the governments Climate Ready support service which provides advice and support to businesses, the public sector and other organisations on adapting to climate change. The aim is to ensure businesses and services assess how they will be impacted by a changing climate so that they are both resilient and can thrive in the future. The Climate Ready pages of our website (http://www.environment-agency.gov.uk/research/137557.aspx) provide information including guidance on carrying out impact assessments and evaluating adaptation strategies.

The UK Green Building Council has also published a series of documents to help Local Authorities and developers to understand sustainability issues. These documents are available on their website at: http://www.ukgbc.org/content/advice-planners-and-developers.

The most recently published technical guidance to the Communities and Local Government's 'Code for Sustainable Homes' also provides useful guidance: http://www.planningportal.gov.uk/uploads/code_for_sustainable_homes_techguide.pdf.

FAO Katie Rodgers

Good afternoon,

Thank you for consulting us on the revised Flood Risk Assessment with respect to the below application. Whilst we have no further comments to make, we would support the recommended policy in the Environment Agency response dated 3rd November 2014.

Kind regards,

Kat Goodyear

SuDS Approving Body Manager

Flood and Water Management

Essex County Council

Telephone: 03330 136738 | **Mobile**: 077388 303698

Email: kathryn.goodyear@essex.gov.uk | www.essex.gov.uk

From: Holli Fielden [mailto:Holli.Fielden@Rochford.gov.uk]
Sent: 18 November 2014 10:56
To: Suds
Subject: Re-consultation on a Planning Proposal

Appendix B.
Outline Drainage Calculations

Appendix B.
Outline Drainage Calculations

B.1 Site: Rayleigh – Rawreth Lane

- OS X (Eastings): 578988
- OS Y (Northings): 192534
- Nearest Post Code: SS11 8SS

B.2 Greenfield runoff (IH124 Method):

- Total developed area: 20.1 hectares (excluding ponds)
- Greenfield runoff for a 1 in 30 year storm: 158.5l/s for the Application Site - 7.9 l/s/ha
- Greenfield runoff for a 1 in 100 year storm: 223.1l/s for the Application Site - 11.1 l/s/ha

B.3 Proposed Development:

The Pond volumes and discharge to Rawreth Brook have been sized for a:

- 1 in 100 years storm + 30% climate change,
- Discharge rate equivalent to a 1 in 30 years storm greenfield runoff

A layout for the Phase 1 of the proposed development has been produced and is shown on sketch SK1 -: "Initial Site Layout", dated 18.09.14. This layout has been used to carry out a Windes detail drainage model and determine the volume of attenuation required.

The volume of attenuation required for rest of the development has been estimated using total the parcels sizes and density factors. Windes has been used to estimate the volume of storage required.

Pond 1: (large pond to west)

- **Northern part of the Application Site (Phase 1 – Blocks A, B &C)**
  Parcels + school: 6.11Ha
  Link road: 1.1 Ha
  Bus route: 0.39ha
  Based on Sketch 1 and Windes, the volume of storage required is approximately **1500m3** (3.3Ha impermeable - **26l/s** for 1/30 year).

- **+3.5Ha parcels**
  Assume density 60%:
  Impermeable area: 3.5 x 60% = 2.1Ha
  Discharge 2.1 x 7.9 = **16.6l/s**
  Volume required for 1 in 100y + 30% CC = **1440m^3** (No SuDS)

Pond 1: Volume: 3000m3, Discharge: 26 + 16.6 = 43l/s

Pond 2:

Parcels: 4.0Ha
Link road: 0.8 Ha
Assume density 60%:
Impermeable area:(4.0 x 60%) + 0.8= 3.2Ha
Discharge: 3.2 x 7.9 = **25.28l/s**
Volume required for 1 in 100y + 30% CC = **2200m^3** (No SuDS)

Pond 2:	**Volume: 2200m3 Discharge: 25.28l/s**

Pond 3: (south of ditch)

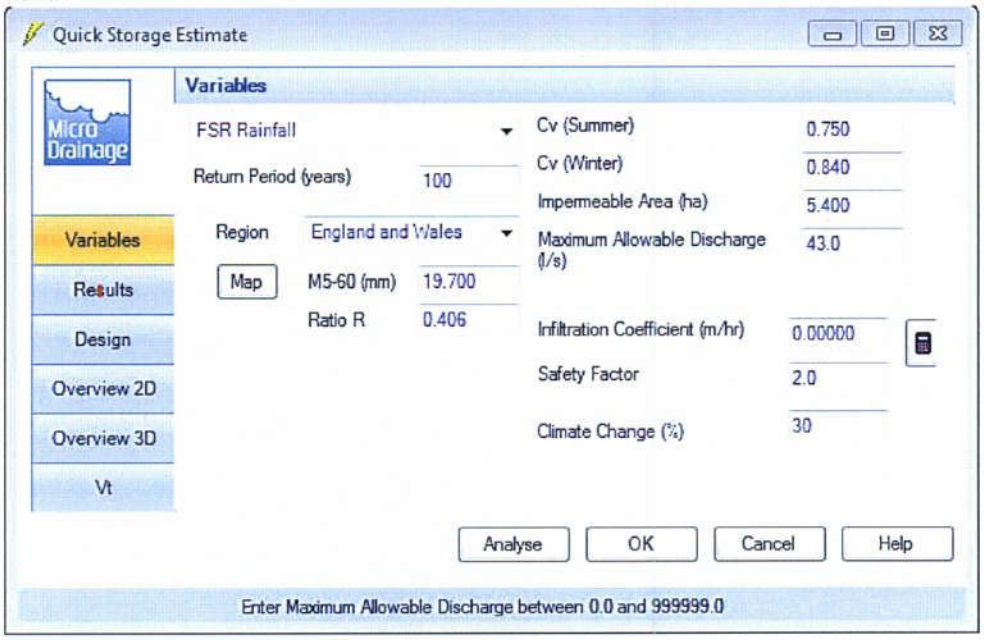
Parcels: 3.34Ha
Link road: 0.97Ha
Assume density 60%:
Impermeable area :(3.34 x 60%) + 0.97= 2.97Ha
Discharge: 2.97 x 7.9 = **23.5l/s**
Volume required for 1 in 100y + 30% CC = **2000m^3** (No SuDS)

Pond 3:	**Volume: 2000m3 Discharge: 23.5l/s**

Total Pond volumes and discharge to Rawreth Brook for 1 in 100 years storm + 30% climate change based on 1 in 30 years storm greenfield runoff:

Ponds: 7140m3 -	**Discharge:**	**92.3l/s**

Pond1


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FSR Rainfall
Return Period (years) 100
Region England and Wales
Map
M5-60 (mm) 19.700
Ratio R 0.406
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 5.400
Maximum Allowable Discharge (l/s) 43.0
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 30
Analyse
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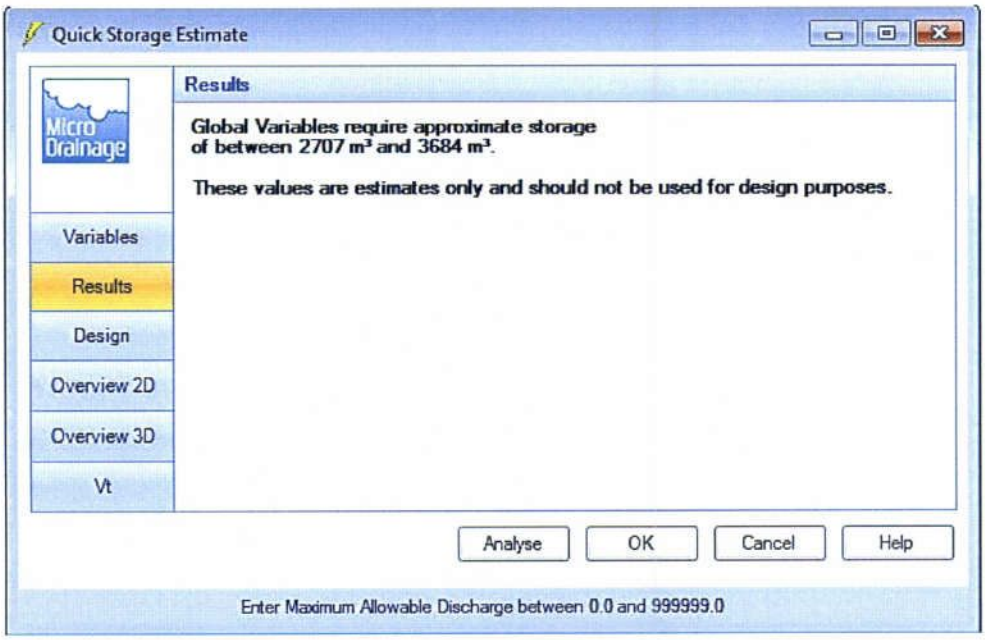
Enter Maximum Allowable Discharge between 0.0 and 999999.0


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage of between 2707 m³ and 3684 m³.
These values are estimates only and should not be used for design purposes.
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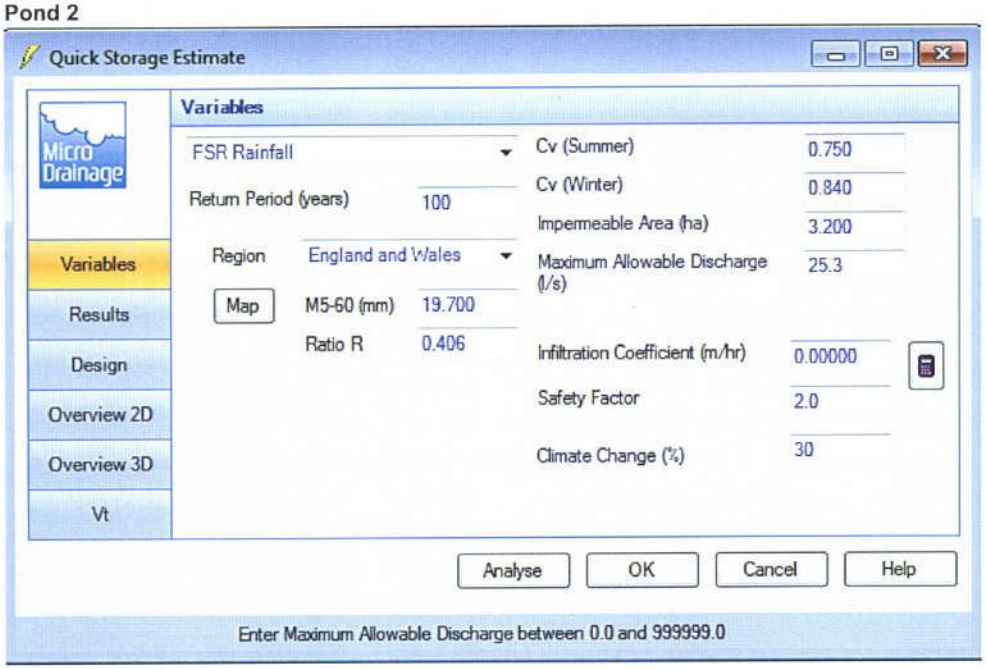
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0

Pond 2


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FSR Rainfall
Return Period (years) 100
Region England and Wales
Map
M5-60 (mm) 19.700
Ratio R 0.406
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 3.200
Maximum Allowable Discharge (l/s) 25.3
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 30
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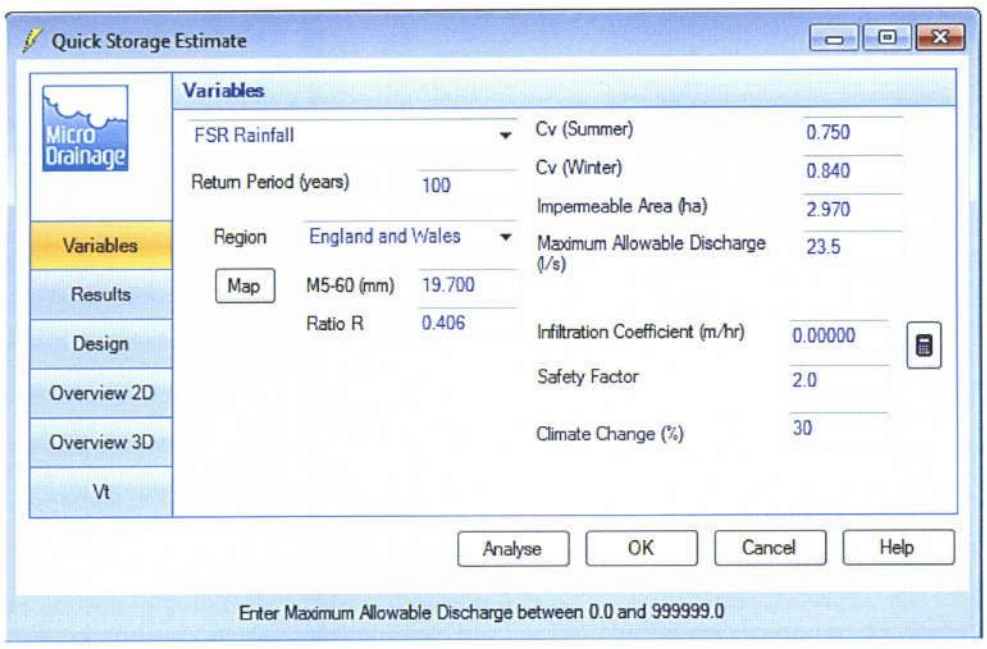
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0


Quick Storage Estimate
Micro Drainage
Variables
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Design
Overview 2D
Overview 3D
Vt
Variables
FSR Rainfall
Return Period (years) 100
Region England and Wales
Map
M5-60 (mm) 19.700
Ratio R 0.406
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 2.970
Maximum Allowable Discharge (l/s) 23.5
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 30
Analyse
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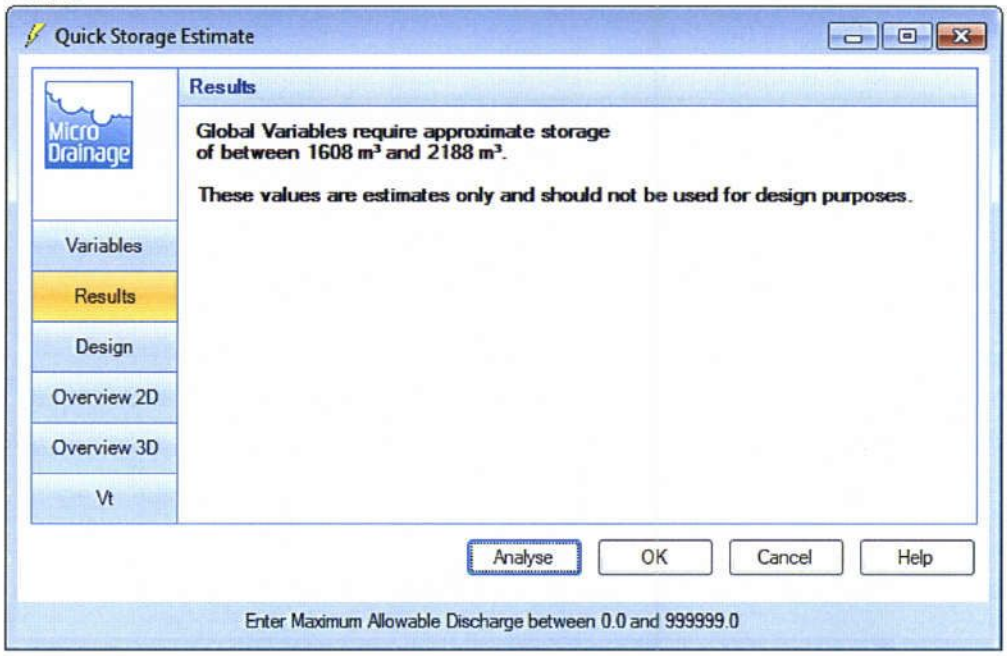
Cancel
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0

Pond 3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Micro Drainage
Results
Global Variables require approximate storage of between 1608 m³ and 2188 m³.
These values are estimates only and should not be used for design purposes.
Variables
Results
Design
Overview 2D
Overview 3D
Vt
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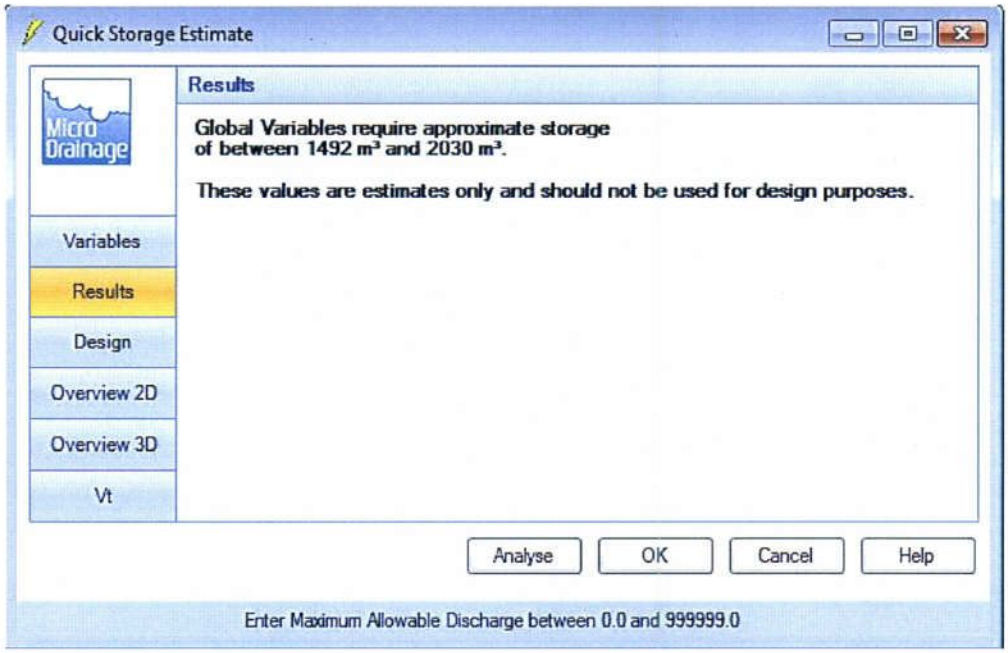
Help
Enter Maximum Allowable Discharge between 0.0 and 999999.0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Micro Drainage
Results
Global Variables require approximate storage of between 1492 m³ and 2030 m³.
These values are estimates only and should not be used for design purposes.
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Enter Maximum Allowable Discharge between 0.0 and 999999.0

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