clive onions
consulting civil engineer

Ms V M Sweetingham

Oxpens, Wigginton, Oxford, OX15 5LU

Flood Risk Assessment and Drainage Strategy

SEED image

Clive Onions Ltd is complying with Government guidance and continuing to work and support UK business during the Covid-19 crisis and to help enable a speedy return to normal business, when safe to do so. We are working from home and will not visit site, but we are using video conferencing etc to keep in touch and share information.

26th June 2020 V2

This report is based on the instructions given by our client. It is not intended for use by a third party, and no responsibility will be given to any third party.

The consultant has followed accepted procedure in providing the services, but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, the consultant takes no liability for and gives no warranty against actual flooding of any property (client's or third party) or the consequences of flooding in relation to the performance of the services.

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Appendices

Report prepared by Hayley Burke – BSc (Hons)
Report reviewed by Clive Onions – BSc CEng FICE FCIWEM MIStructE MCIHT

Version history

Version	Date	Prepared by	Approved by	Comment
V1	24.06.20	HB	CO	Issued to accompany planning application
V2	26.06.20	LJ	CO	Minor amendments

Issue history

Version	Date	Issued to	Method
V1	24.06.20	SEED Landscape Design Ltd, Seymour-Smith Architects	Email pdf
V2	26.06.20	Ditto	Ditto

1. Introduction

Ms V M Sweetingham is proposing a single dwelling for multi-generational living on a greenfield site to the west of Wigginton.

The site is shown to be in Flood Zone 1, at low risk of fluvial flooding according to the Environment Agency (EA) Flood Map for Planning. According to the EA Surface Water Flooding Map the majority of the site is at very low risk of surface water flooding, but incorporates a large man-made pond which is in a very poor condition.

Clive Onions Limited has been appointed to prepare this Flood Risk Assessment and Drainage Strategy (FRADS) to accompany the planning application.

The site was inspected by the author on 4th December 2019 during a very prolonged wet period, which highlighted the water features and helped inform this report.

This report includes an assessment of the hydrological characteristics in the area and shows that the proposal is safe for its lifetime and does not increase flood risk off site.

This report should be read in conjunction with the full scale drawings submitted by the Design Team, and in particular the landscape drawings, to show an integrated sustainable drainage and landscape design, appropriate for the area and in line with Defra's guidance.

2. Site Location and Setting

The site is located northwest of Oxford, to the west of Wigginton. at postcode OX15 5LU.

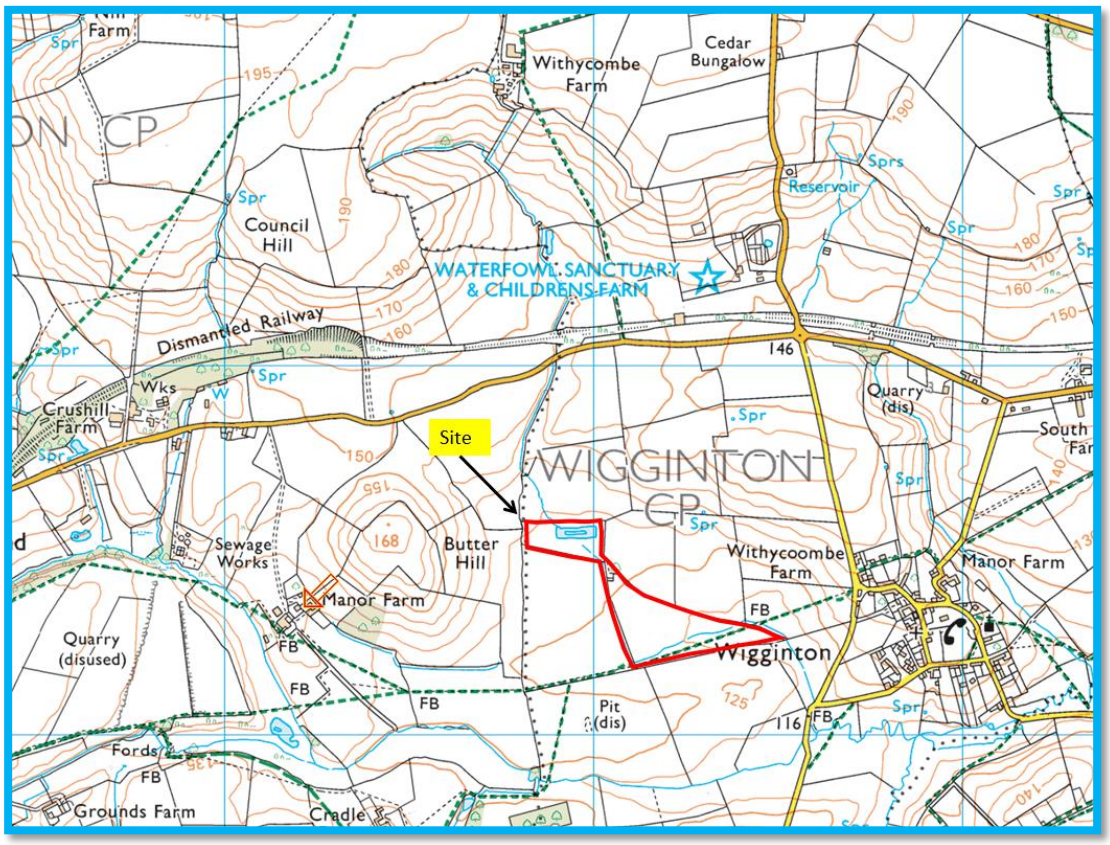


Fig 1 Site location (Streetmap).

The site is in the following setting:

- North of the site is mixed arable and pasture farmland with hedges and trees. The land is in the form of a small valley about 1.5km long with steep sides north of the dismantled railway, containing a minor watercourse.
- East of the site is farmland up to the village of Wigginton, some 200m east of the site.
- South of the site is a minor watercourse within a local valley, which flows eastwards to Wigginton, with rising farmland which quickly falls to another valley.
- West of the site is a watercourse on the boundary, beyond which the land rises to Butter Hill, but the western area generally forms a rural valley with a wastewater treatment works some 900m west of the site.

The site can therefore be described as being located in a rural area west of Wigginton on land which rises to the north and west.

Fig 2 Satellite view of site and surrounding area (Google Earth).

3. Existing Development and Ground Conditions

The site is irregular in shape and is approximately 422m north-south and 426m east-west at the base of the site and 223m east-west in the top section of the site. It has a total approximate area of 7.89ha.

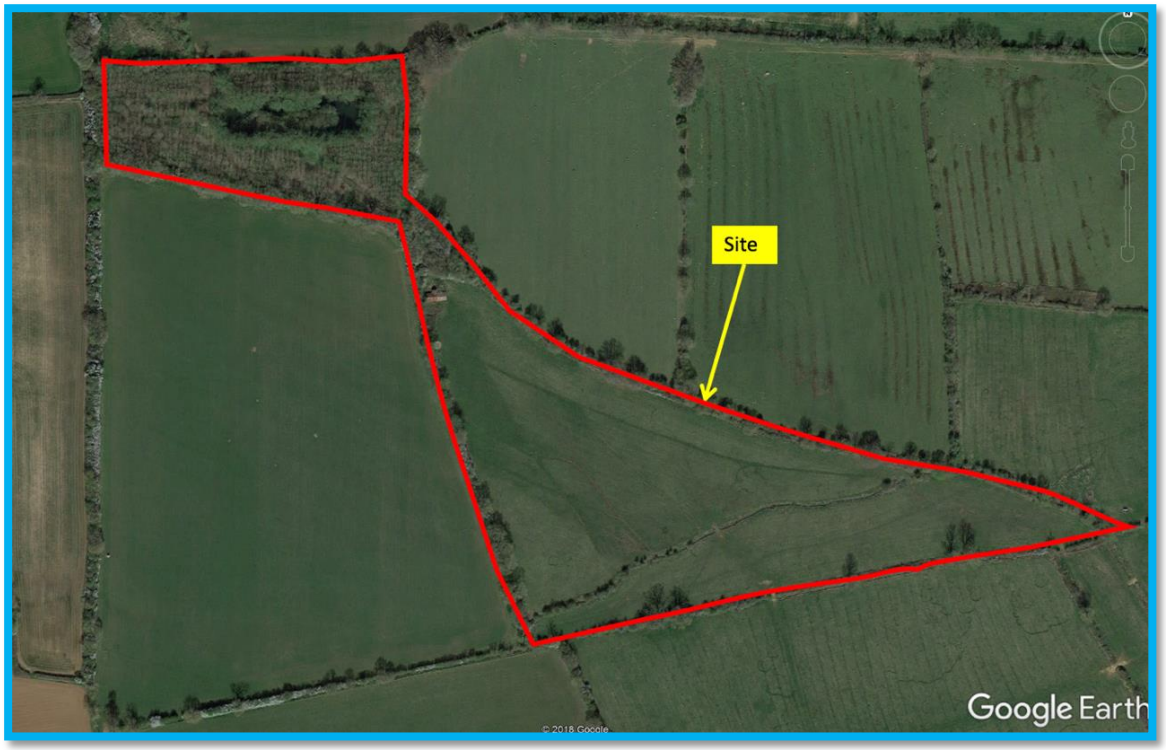


Fig 3 Satellite view of site. Note the plantation in the northwest and the meadow in the southeast, with the watercourse flowing through the meadow (Google Earth).

A detailed topographic survey has been undertaken, related to Ordnance Datum. The site levels vary from 130.39 - 117.8m AOD. The existing pond has an approximate top water level of 128.1m AOD (as measured during the survey, when it was overflowing). The pond includes banks around it to provide an even level along its full perimeter, and has a managed overflow in the northeast side.

The northern section of the site will be referred to as the woodland plantation and the southern section of the site will be referred to as the meadow.

The woodland plantation area tends to fall quite steeply and contains a pond formed by the previous owner about 15 years ago, following which the plantation was started. The pond is in very poor condition and dense with leaves which have deprived the pond of oxygen and caused the very poor water quality.

The pond was formed on the line of the watercourse from the northern valley, which runs diagonally through the plantation site and then through the meadow area, joining with other watercourses on its way to the southeast corner of the site.

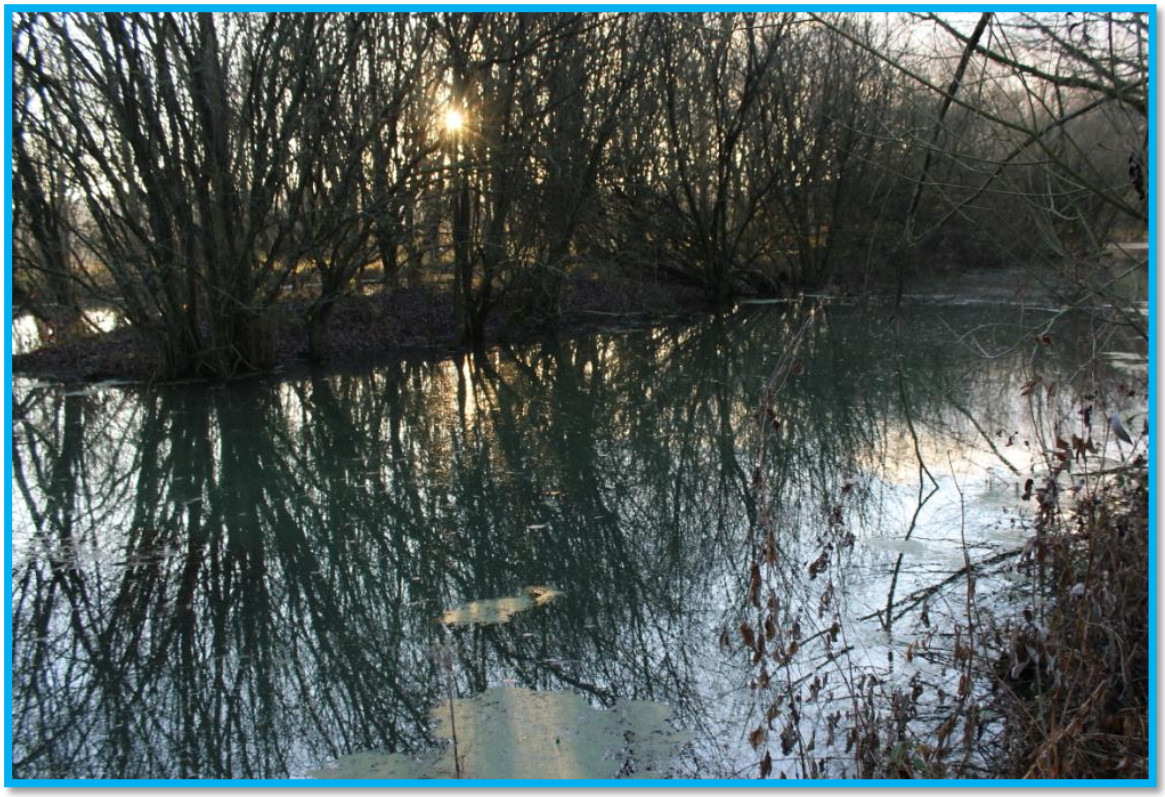


Fig 4 Pond in plantation showing proximity of trees and poor water condition, looking westwards.

The meadow has the appearance of being level, but has a gentle fall to the east as shown by the topographic survey, with the defined watercourse channel as shown on the survey and below.

Fig 5 Well-defined watercourse through meadow area, looking westwards.

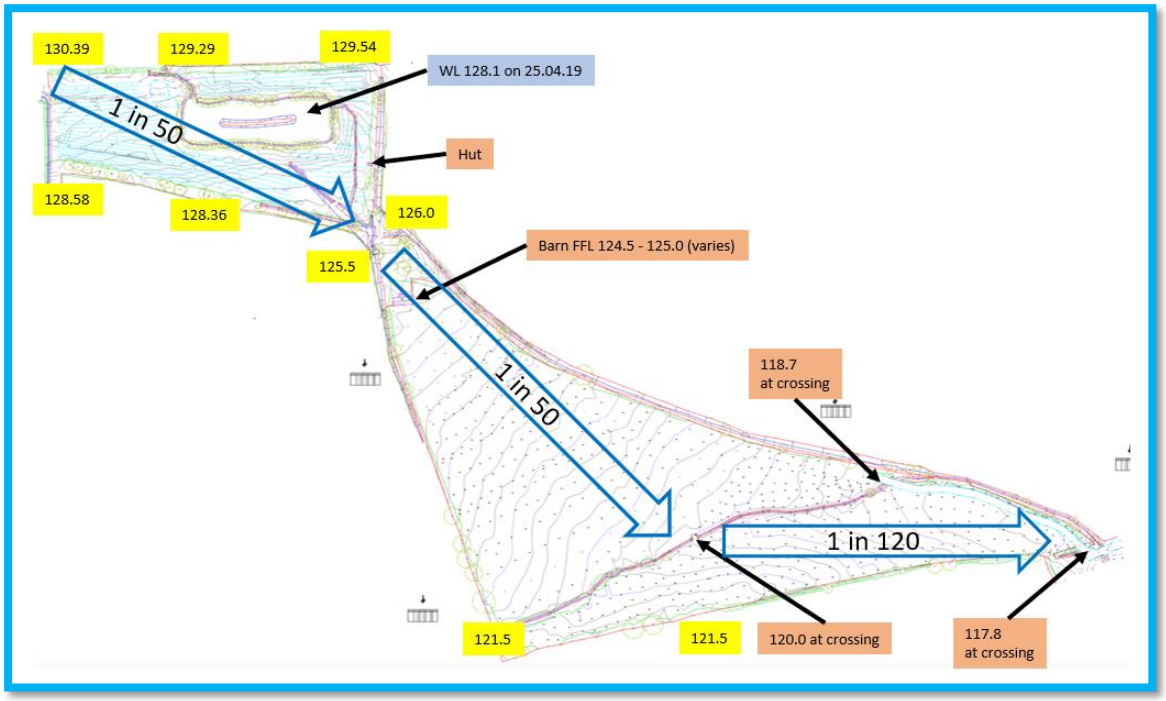


Fig 6 Topographic survey showing contours with key levels annotated. Note all of these levels have been taken outside of the ditches. All levels in m AOD.

The site contains a single barn and a small hut as shown on the annotated survey above.

The British Geology Survey shows the superficial geology to be alluvium, consistent with a river valley, and the underlying geology to be Whitby Mudstone Formation. The Cranfield Soilscape Viewer shows the soils to be loamy and clayey with impeded drainage. The many watercourses in the area suggest that groundwater levels would be high during wet periods and traditional soakaways would not be appropriate.

4. Proposed Development

The proposal comprises a single dwelling for multi-generational living with access, parking and high quality landscaping, all located in the northeast of the plantation area, served by a track which will run from the existing track in the southeast of the meadow.

The existing barn will be restored for utility uses and the setting improved with an apron formed with concrete slab with permeable joints over a permeable gravel base.

The access through the meadow will be a formed by traditional rural access formed by two bitumen with gravel strips for vehicle access, minimising the impact on the meadow.

The access within the plantation will be formed with a single 3m wide bitumen and gravel strip. The colour of the gravel will be chosen to suit the location.

The pond will be cleaned out to remove the debris and improve the water quality. The shape will be adjusted as shown on the landscape drawings to integrate with building design and landscaping with shallow slopes for safety. Key to creating much improved water quality in the pond and downstream will be removing the trees around the perimeter to reduce the quantity of leaves entering the pond. The aim with the pond is to create an attractive and biodiverse feature.

The natural water flow characteristics and improved water management features are described later.

The pond top water level will be retained at 128.1m AOD, controlled by an improved overflow arrangement, and the finished landscaping and building floor levels will vary between 128.7 and 129.1m AOD, safely above the top water level.

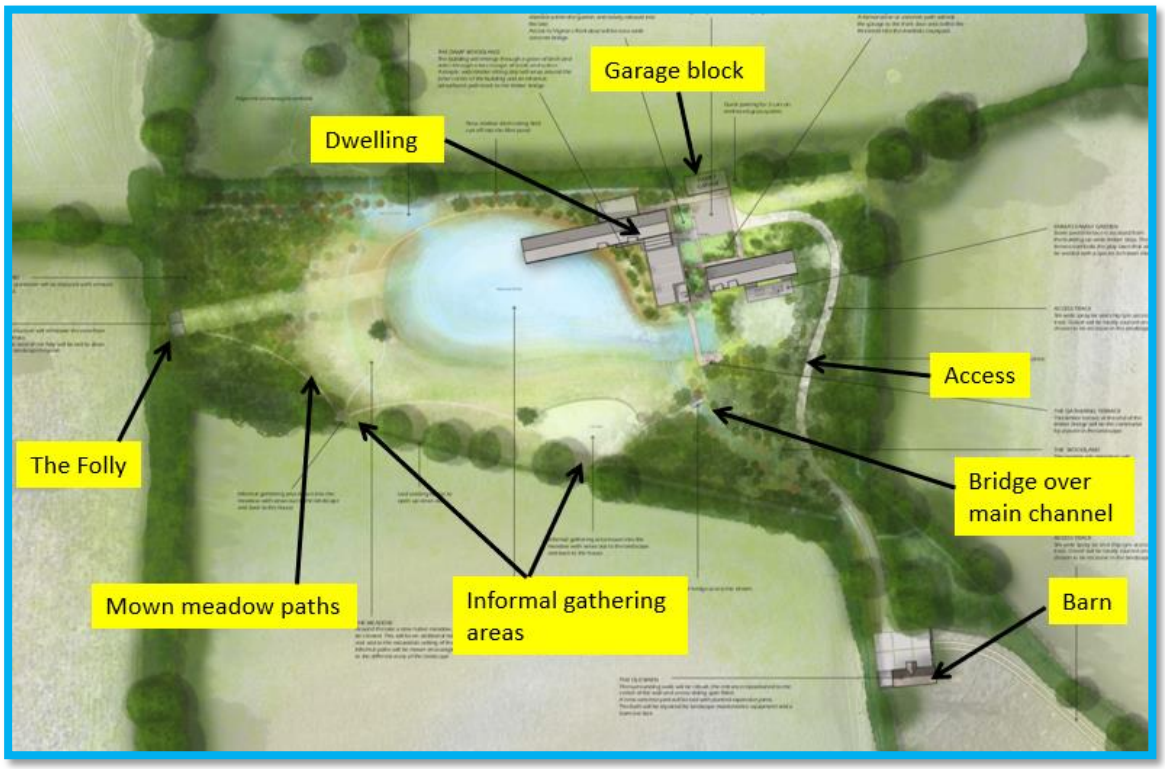


Fig 7 Proposed layout plan highlighting the key features.

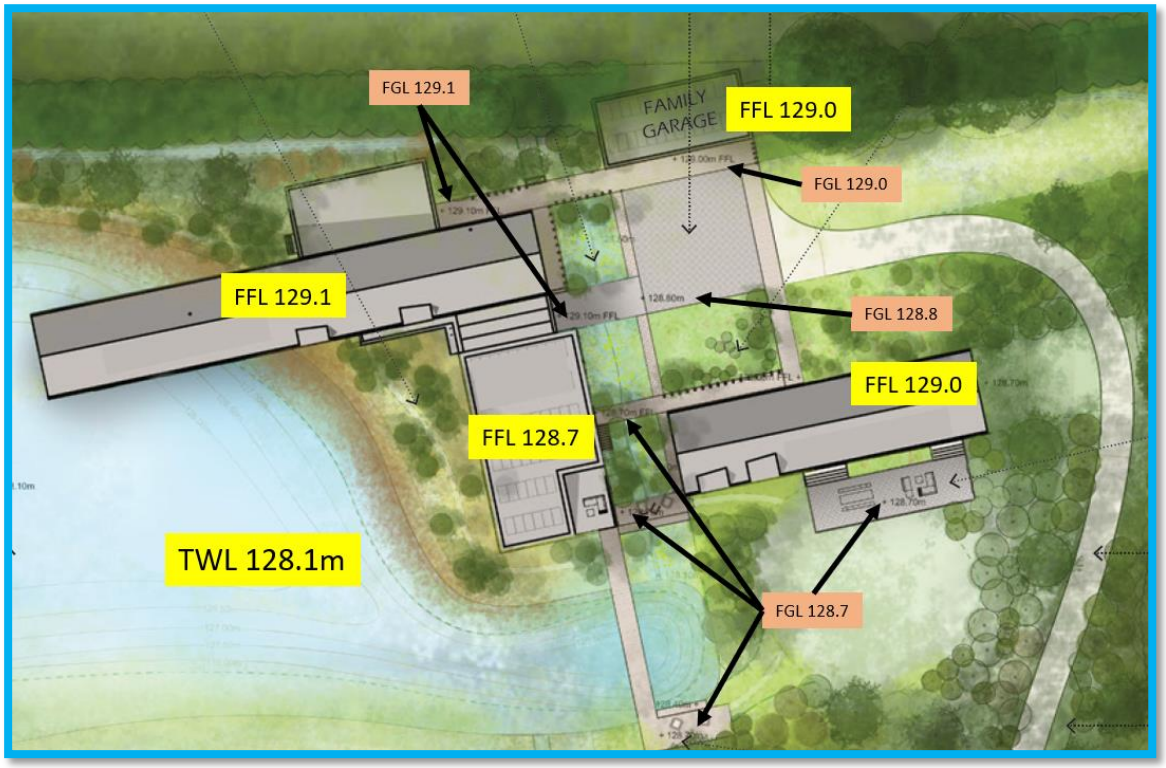


Fig 8 Proposed building layout with key proposed levels, showing the developed area more than 600mm above top water level (TWL).

Fig 9 Oblique view of proposed layout. Note sloping roof of western building over the water.

5. Flood Risk

Fluvial/Tidal Flooding

According to the EA Flood Map for Planning the site is located in Flood Zone 1 at low risk of fluvial flooding.

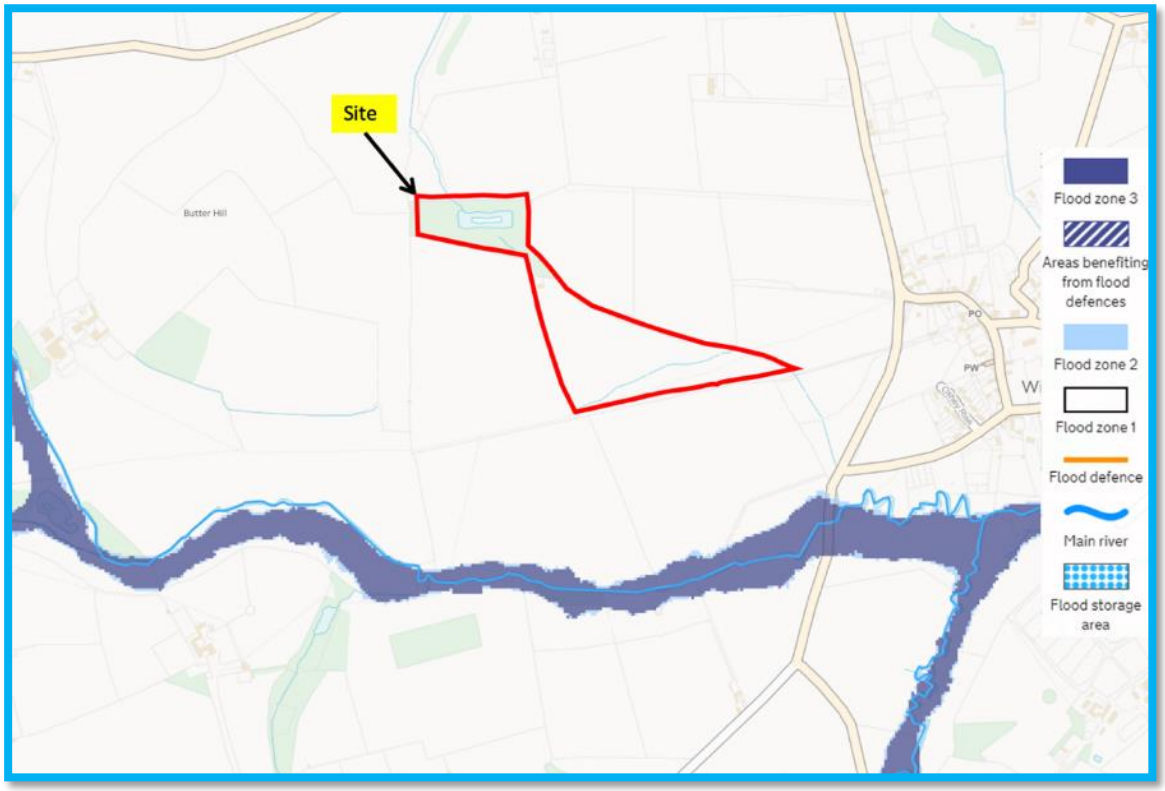


Fig 10 EA Flood Map for Planning.

Surface Water Flooding

The majority of the site is shown to be at very low risk of surface water flooding according to the EA Surface Water Flooding Map.

The plantation area shows a low risk of surface water flowing through the central area of the pond in the plantation.

The map also shows ponding in the southeast of the meadow, but it is noted that the flows are not shown following the watercourse. The site inspection and topographic survey shows a well-defined ditch over 1m deep in this area, which would prevent the ponding as shown.

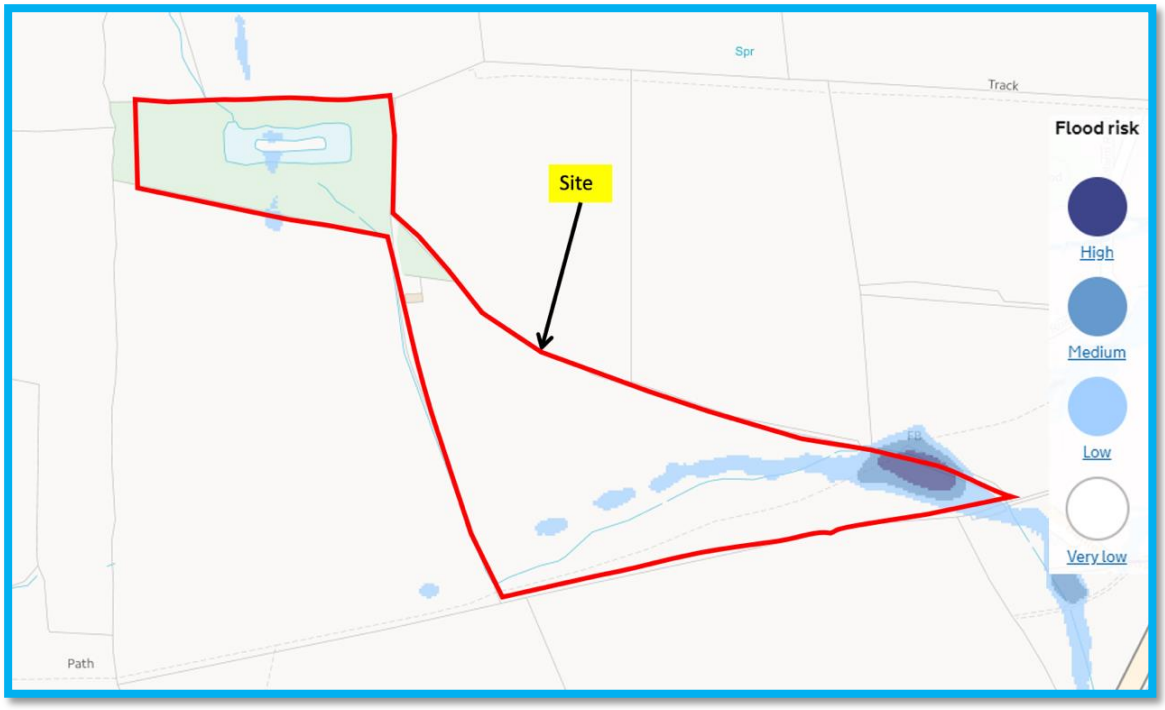


Fig 11 EA Surface Water Flooding Map.

In the Medium Risk Scenario (1 in 100 year) the woodland plantation, where the dwelling is proposed, shows no surface water flooding predicted and the ponding is localised in the southeast of the meadow.

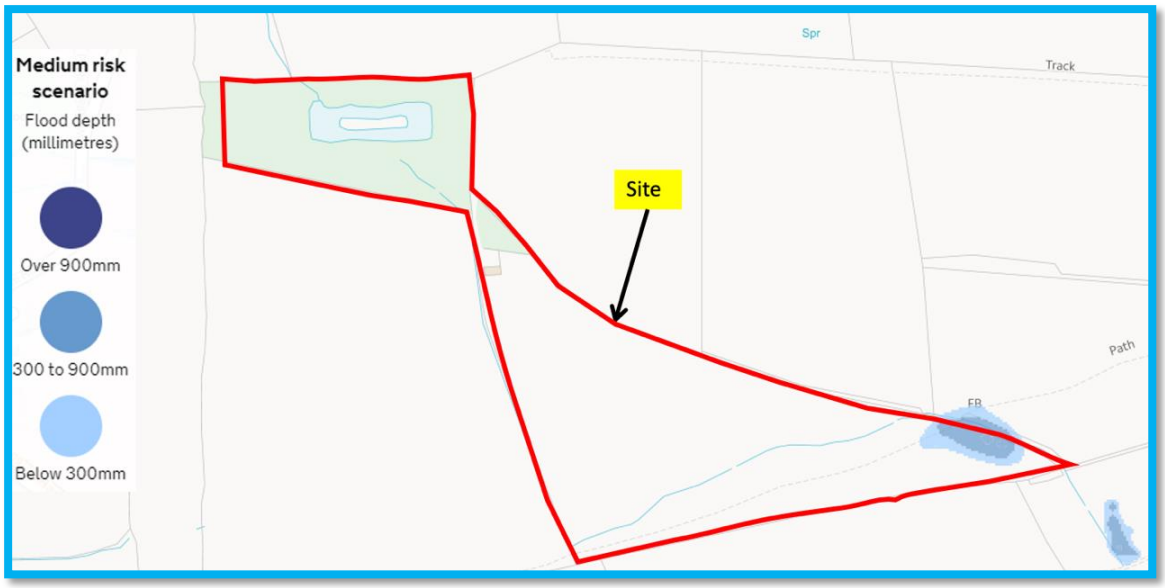


Fig 12 EA Surface Water Flooding Map – Medium Risk Scenario (1 in 100 year).

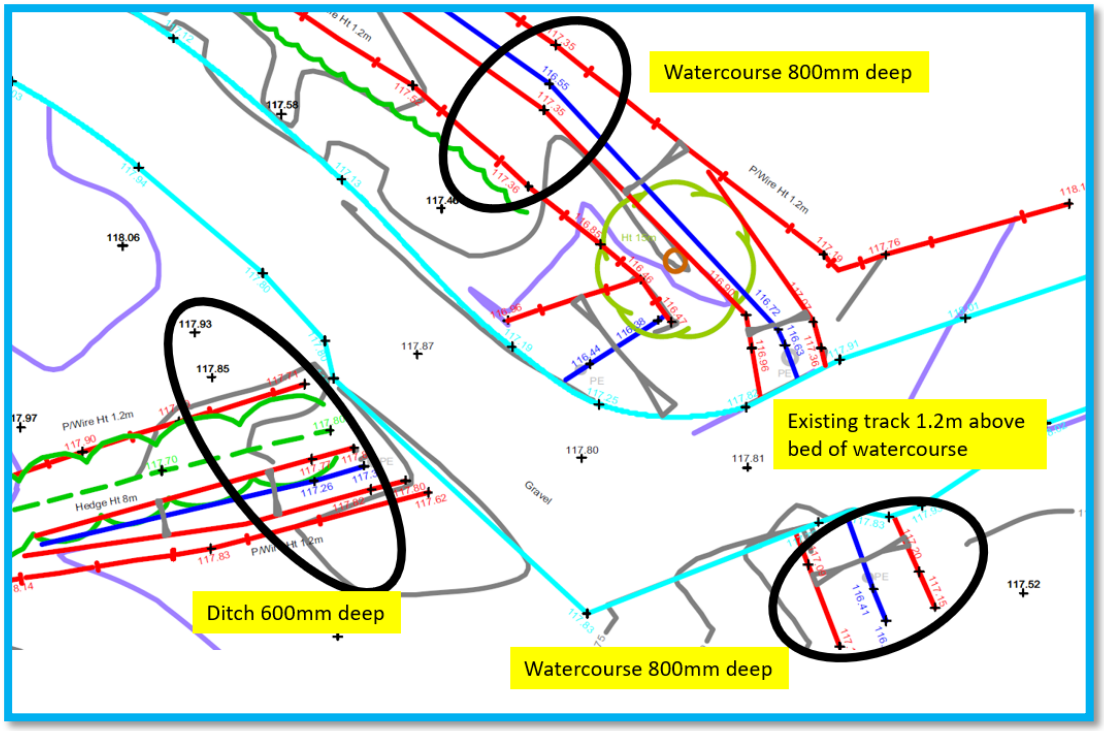


Fig 13 Note the substantial ditches not recorded on surface water flood map – showing that the ponding will not occur.

In the Low Risk Scenario (1 in 1000 year) ponding in the woodland is associated with the existing pond, and the development will not affect this area, nor will the overland surface water affect the buildings.

In summary the site is safe from surface water flooding, and there is shown to be safe dry access even in extreme events.

Fig 14 EA Surface Water Flooding Map – Low Risk Scenario (1 in 1000 year) with site plan superimposed.

6. Existing Hydrology

The existing hydrology has been investigated in the area and there are many minor watercourses draining the higher ground and the surrounding farmland. The area has been investigated to clarify the various historical features and the routes plotted within the Developed Design Document by SEED.

The image below shows the prominent ditches and the field boundary ditches, which drain the area.

The main watercourse through the site is well-defined. It enters the pond in the northwest through a dispersed area, due to the neglect of a pond upstream of the site. The water exists the pond about midway, through a 300mm dia. pipe simply formed in the bank. This location results in potential stale water in the eastern area, exacerbated by the island formed within the pond.

The overflow is in the northeast of the pond and uses a man-made channel to re-join the main watercourse as shown below.

During the site visit in December the ground was very wet due to the prolonged rainfall, and the pond was overflowing. The outlet from the pond was partially blocked and submerged, hence the overflow in operation.

Appendix 1 includes a Flood Estimation Handbook (FEH) assessment of the valley flow, and provides the following estimates:

- 1 in 2 year flow 160 l/s
- 1 in 10 year flow 290 l/s
- 1 in 30 year flow 430 l/s
- 1 in 100 year flow 575 l/s

The 300mm outlet appears to be laid at a very steep slope – maybe at 1 in 20 or steeper. The capacity at this gradient is over 250 l/s. A 500mm dia. pipe at 1 in 50 (the slope of the plantation) would convey 600 l/s, and then ditch is clearly much larger in cross section than a 500mm pipe and would have the conveyance capacity.

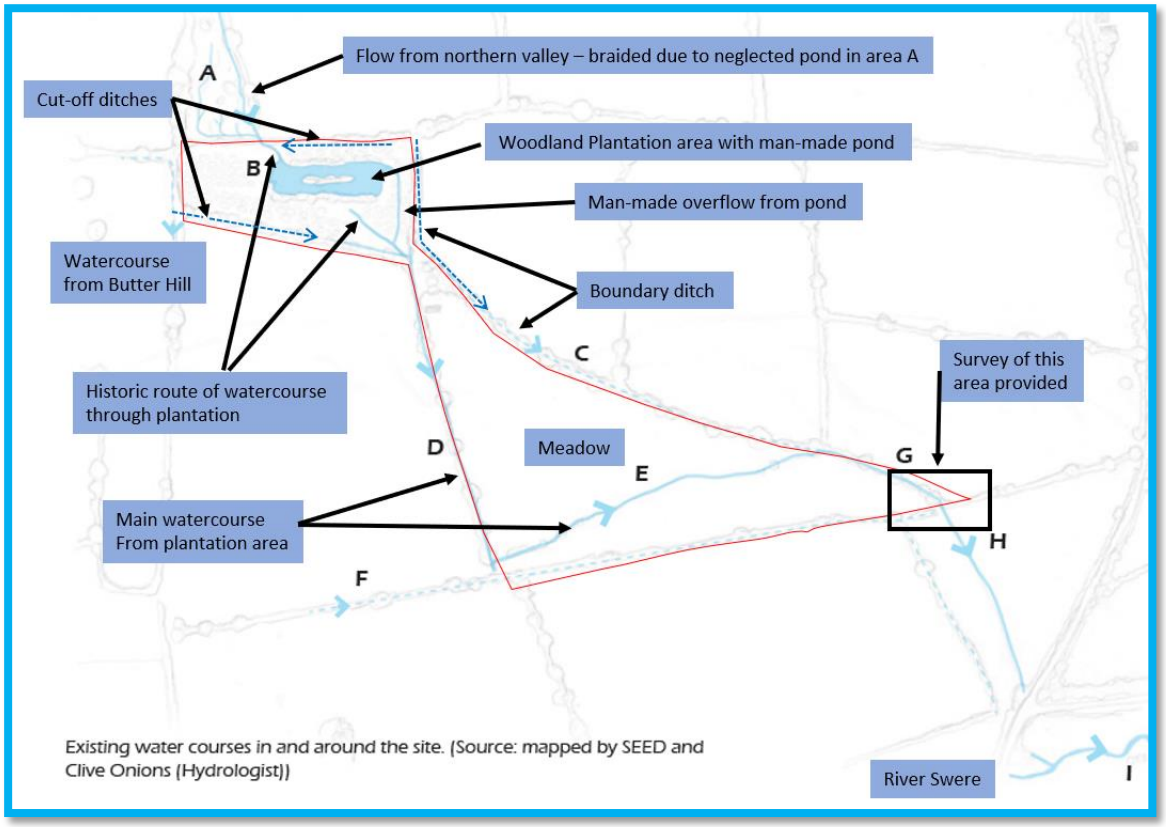


Fig 15 Annotated plan showing watercourses and boundary ditches. Based on SEED plan from their report.

Fig 16 300mm outlet from pond into watercourse indicating inlet blocked (pond was overflowing).

Fig 17 Well-defined outlet channel from pond, approx. 600mm wide bed with sloping banks and 600mm deep (as on survey).

7. Management of Natural Surface Water

Based on the above assessment, it is proposed to introduce improvements in the management of the surface water and water quality conditions in the pond, without changing the routes of the watercourses and ditches.

The following works will be introduced:

- The cut off ditches along the north of the site will be retained and maintained.
- These and the main channel will lead to an inlet area with native water plants, which will operate as a filter/sediment collection area from upstream runoff.
- A traditional stone entry will be formed into the pond to allow easy inspection and maintenance and to convey the design flows (up to 575 l/s).
- On overflow will be formed leading to the southern boundary ditch to manage exceedance events (as occurs at present).
- The pond bed will be cleaned to remove leaves etc and improve water quality.
- The pond shape will be changed to remove the 'still' area and improve flow characteristics through the pond, and hence improve water quality. The island will also be removed.
- The top water level of the pond will be retained at 128.1m AOD.
- A traditional stone outlet will be formed to manage normal flows and high flows, and return these to the historic channel (ie a traditional overflow). It will include a low level drain to allow lowering the pond level by gravity for inspection and maintenance.
- The banks of the pond will be wide for safety and to aid maintenance and robustness, and will have shallow planted slopes.
- The historic watercourse downstream of the pond through the plantation will be retained and maintained.

The above measures will improve the quality of the water entering the pond, improve the water quality in the pond and create details to allow proper safe inspection and maintenance. The landscaping and operational features will be integrated to create a sustainable and attractive design, which will ensure the safe operation of the pond for the lifetime of the development. It will enhance biodiversity.

The watercourse channels in and around the meadow will not be changed. For planting proposals and maintenance of the meadow area see the landscaping information by SEED.

One crossing of the watercourse is proposed to reach the informal gathering areas, and this will be in the form of a bridge to avoid causing a restriction to flow.

The watercourse and ditches are non-main watercourses and consultations will be held with the Lead Local Flood Authority (LLFA) to agree the scope of the Land Drainage Consent application form(s) to cover the changes to the pond and new bridge crossing and any other relevant works.

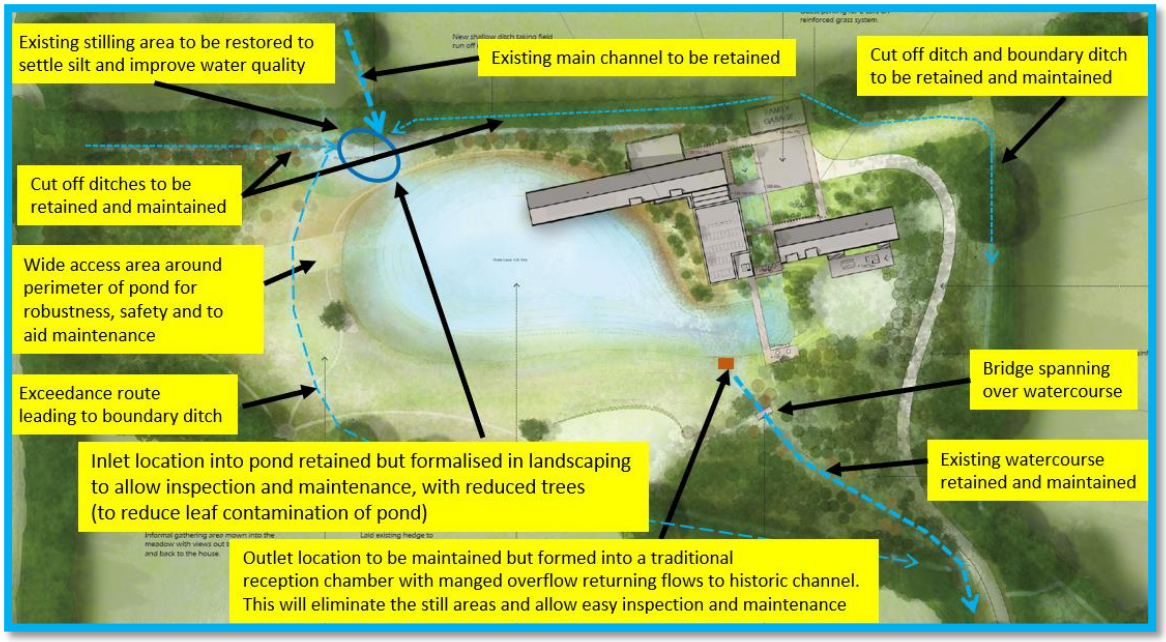


Fig 18 Description of key drainage features managing natural flows.

8. Surface Water Drainage Design

Defra and the SuDS Manual recommend a sustainable approach to managing runoff from impermeable areas, using vegetated permeable and 'soft' solutions where feasible.

The proposal includes features to manage the increased runoff from the impermeable areas using features which are integrated with the landscaping and use the water for the safe enjoyment of the residents.

It is noted that the site is not in a sensitive area with regard to flood risk and an assessment of the route of the River Swere shows that the nearest potential property flooding is some 10km downstream in Deddington. However, the impermeable runoff will be managed to reduce the risk of increasing flood risk downstream.

The management of the impermeable area will be as follows:

Roofs

The impermeable roof areas are as follows:

- West and south roofs 472m^2
- Eastern roof = 229m^2
- Garage roof = 91m^2
- **Total impermeable area = 792m^2**

The design of the attenuation area will be based on a 1 in 100 year event with 40% additional flow to allow for predicted climate change. The outlet flow be restricted to 2 l/s using a vortex flow control device to reduce the risk of blockage.

From Appendix 2 it can be seen that a volume of 39m^3 will be required to provide the required attenuation.

The layout has been designed with a vegetated swale/rill running between the buildings, which is 5.5m wide and 28m long, with a bed level of 128.1m AOD, making the depth 600mm maximum (for safety at the bridges). A stone low flow channel will be formed with a nominal longitudinal fall of about 1 in 250 from north to south, giving an average shallow depth of 545mm. A silt trap and grill/filter will be formed in the rill prior to the flow control device to allow easy inspection and removal of debris, with an exceedance overflow into the pond.

To provide 39m^3 the swale needs to provide 1.4m^3/m, and with a 100mm freeboard (in this sheltered and safe area) the swale will provide the required 1.4m^3/m. It is recommended that the swale is surveyed on completion to ensure that the design volume and freeboard are achieved.

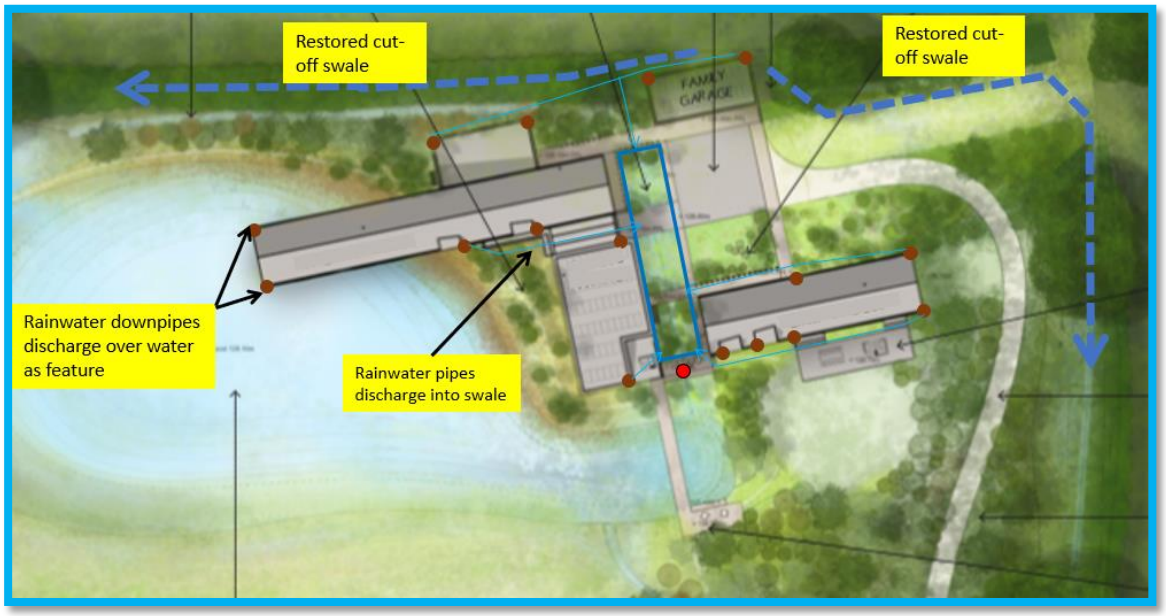


Fig 19 Drainage design showing rainwater pipes, connection and discharges to swale/rill.

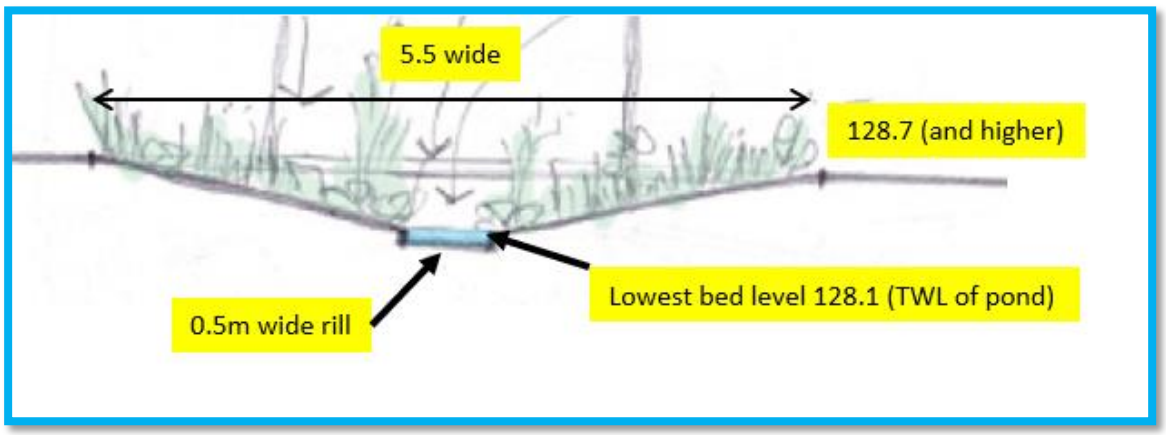


Fig 20 Landscape Architect's section through swale/rill providing low-flow channel at a fall.

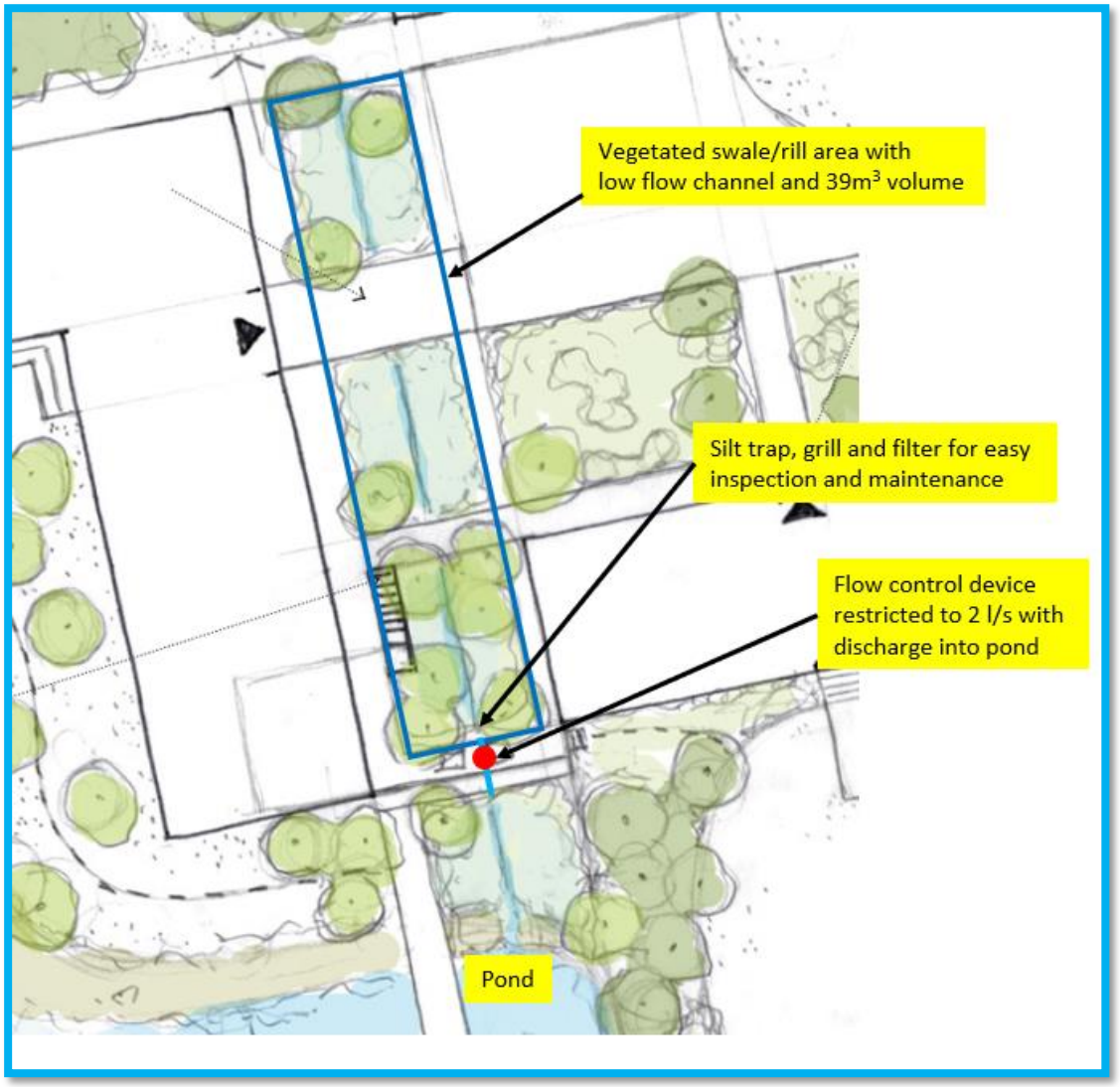


Fig 21 Plan of swale/rill with key features.

Paths - The paths adjacent to the house will be formed in an impermeable surface with an adjacent french drain, with overflow to the swale.

Courtyard and patios - These will be forming in permeable setts or paving.

Vehicle access within plantation (from barn to dwelling) - The bitumen and gravel wearing course 3m wide access will be formed with a permeable granular base and side french drain to distribute the water into the base and encourage infiltration. This is at a satisfactory slope at 1 in 30 for permeable construction, which sets a limit of 1 in 20.

Access across meadow - This will be formed in 750mm wide 'tramlines' with macadam and chip over a permeable base, but with grass up to the edges and between the tramlines.

Barn - The barn, roof and existing drainage will be restored. The new apron will be formed in concrete slabs with permeable gaps over a permeable base.

The Folly - This will be formed with a permeable base.

Paths in plantation - These will be formed in mowed meadow and rainfall will infiltrate naturally.

The rainwater landing on the site is therefore managed by infiltration where feasible, and the runoff from the main roofs is mainly attenuated by the swale/rill, with a small area attenuated in the large pond.

This represents the most sustainable solution for the proposed development.

9. Foul Drainage Design

There is no existing foul drainage on site, and no foul sewers in the vicinity of the site. It is noted that the site is within a Drinking Water Safeguarded Zone.

Foul water from the dwelling will therefore be conveyed to a proprietary package treatment works designed for the flow and located at a suitable point on the site which can be accessed by a tanker, and compliant with Building Regulations (it is likely to be much more than the minimum 7m from the properties allowed in Building Regulations).

The discharge from the treatment works will be less than $5m^3$/day and therefore would not normally require a permit. However, given the safeguarded zone a discharge will be provided which meets the General Binding Rules and has the required consent from the Environment Agency. This might be a discharge to the water course (which does not run seasonally dry) or a partial drainage field, as described in the Binding Rules.

10. Management and Maintenance

The Homeowner will be responsible for maintaining all the landscaping, water features and other infrastructure. They will comply with their Riparian duties with respect to managing the watercourses/ditches.

Silt traps will be installed on all downpipes (apart from the two which discharge into the pond), to allow for easy inspection and clearance.

The pond has an inlet which allows silt inspection and management. The swale/rill will incorporate features at the proprietary inlets to manage silt, and at the outlet.

The flow control device will be readily maintainable as will the pond inlets and outlets.

The landscaping will have a formal inspection in Spring and Autumn and matched against a schedule prepared by the Landscape Designer in consultation with the Drainage Designer.

It is recommended that this schedule and associated programme is prepared on completion of the works to ensure it is appropriate and sufficiently detailed. It should be reviewed after the first and second years, and thereafter every 5 years.

It should include the service contract for the foul water drainage system.

The design and maintenance inspections and associated works will ensure that the whole infrastructure supporting the dwelling is maintained for the lifetime of the project.

11. Conclusions and Recommendations

Ms V M Sweetingham proposes a dwelling on a greenfield site to the west of Wigginton.

The site is in Flood Zone 1, so development is appropriate in terms of flood risk, and the site is at low risk of surface water flooding.

The site of the dwelling (ie the plantation) has been modified in the last 15 years by the previous owners to form a pond and plantation. The watercourse entering the pond is unmanaged, the pond includes still areas and the surrounding trees have caused the pond to become stagnant.

The proposal is to clean out the pond, adjust its shape and improve the management of the watercourses and ditches through maintenance of the existing features. There are no proposals to divert the watercourses or ditches.

The catchment runoff has been considered such that the improved system will safely convey the predicted flows, and the outlet from the pond will reduce the risk of still water in the pond.

The proposal includes very high quality landscaping which has been integrated with the driange design to create a sustainable drainage scheme which meets the highest target of the SuDS hierarchy for this site.

The design has been developed to provide access to the key features and provide easy inspection and safe maintenance. A schedule and programme for the maintenance will be prepared on completion, such that it integrates the hydrological requirements with the landscaping and ecological requirements.

A foul drainage system is proposed which will include a package treatment works in a suitable location, and which will meet the General Binding Rules. A service contract will be entered into such that it continues to operate as intended.

The proposal is therefore based on a site-specific assessment, meets the highest target in the SuDS hierarchy for this site and will be safe for its lifetime, and therefore complies with the guidance in the NPPF and associated Sustainable Drainage guidance.

Appendix 1 **Catchment Flow Calculation Sheet,** with FEH catchment identified below (and the site at the red teardrop).

Project Title	Oxpens		**Site Address**	Wigginton, Oxford	clive onions consulting civil engineer	
Project Number	19227		**Post Code**	OX15 5LU		
FEH Runoff Calculation	using method in SUDS Manual 24.3.2					

$$Q_{med\ cds} = 8.3062\ AREA^{0.8510} \times 0.1536^{(1000/SAAR)} \times FARL^{3.4451} \times 0.0460^{BFIHOST^2}$$

AREA (ha)	128
BFIHOST	0.705
FAARL	1
SAAR	675
QMED (l/s)	159.03

Calculated for 50 hectares and scaled down

Hydrological Region 6/7

Site Location

FEH Point data Eastings 438000 Northings 233500

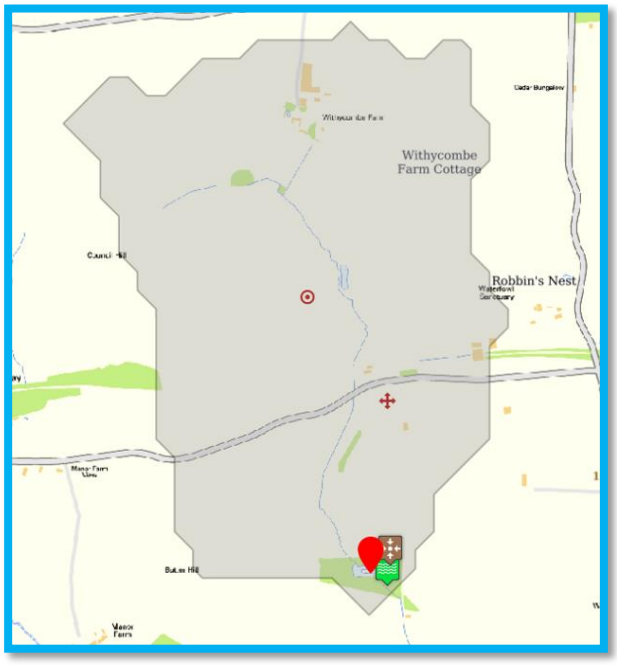
Rainfall depths

	6 hour	12 hour
1 in 2 year	24.3	30.2
1 in 10 year	39.1	44.7
1 in 30 year	49.6	56.2
1 in 100 year	64.0	75.0

Greenfied Runoff Rates

Event	Growth Curve Factor	Flow (l/s)
1 year	0.85	153.6
2 year	0.88	159.0
QBAR	n/a	180.7
10 year	1.62	292.8
30 year	2.4	433.7
100 year	3.19	576.5

Version :	V1	Created :	AB	Checked :	CO	Unit 4b, Winford Business Park,
Comments :	-	Date :	16.07.19	Date :	16.07.19	Windford, Bristol. BS40 8JH.



Appendix 2 Runoff Storage Calculation Sheet

Project Title	Oxpens	**Site Address**	Wigginton, Oxford
Project Number	19227	**Post Code**	OX15 5LU

clive onions
consulting civil engineer

Required Volume Calculation (South)

Assumed outflow	2	l/s
Impermeable Area Draining to System	792	m^2
Climate Change Factor	40	%
Runoff Coefficient	0.95	

						Balance	
Duration (hrs)	100 year depth (mm)	100 year + 40% (mm)	Intensity (mm/h)	Inflow (l/s)	Outflow (l/s)	Flow (l/s)	Storage (m^3)
0.25	25.77	36.1	144.3	30.2	2	28.2	25.35
0.5	33.90	47.5	94.9	19.8	2	17.8	32.11
0.75	38.85	54.4	72.5	15.2	2	13.2	35.52
1	42.35	59.3	59.3	12.4	2	10.4	37.41
2	**50.68**	**71.0**	**35.5**	**7.4**	**2**	**5.4**	**38.98**
3	56.25	78.8	26.3	5.5	2.0	3.5	37.65
4	60.46	84.6	21.2	4.4	2	2.4	34.89
6	66.56	93.2	15.5	3.2	2	1.2	26.91
8	70.87	99.2	12.4	2.6	2	0.6	17.05
10	74.10	103.7	10.4	2.2	2	0.2	6.05
12	76.66	107.3	8.9	1.9	2	-0.1	None
16	80.45	112.6	7.0	1.5	2	-0.5	None
20	83.21	116.5	5.8	1.2	2	-0.8	None
24	85.39	119.5	5.0	1.0	2	-1.0	None
32	88.76	124.3	3.9	0.8	2	-1.2	None
40	91.54	128.2	3.2	0.7	2	-1.3	None
48	93.96	131.5	2.7	0.6	2	-1.4	None
96	105.97	148.4	1.5	0.3	2	-1.7	None

FEH EXPORT DATA

FEH Web Service (2.0.0.0)	VERSION	Version	1.0.0		
	Parameters		FEH 2013		
FEH 2013	Rainfall model=		Design rainfall		
Design rainfall	Calculation type=		For a point		
For a point	Calculation mode=		Point		
Point	Calculation location=		GB	438007	233554

Version :	V1	Created :	HB	Checked :	CO
Comments :	-	Date :	24.06.20	Date :	24.06.20

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