vectos.

Vectos
5th Floor
4 Colston Avenue
Bristol
BS1 4ST

0117 203 5240

vectos.co.uk

4 February 2022

Sarah Green
Environment Agency
Thames Sustainable Places Team
Environment Agency
Red Kite House
Wallingford
OX10 8BD

Ref: L01/205550D/NB

Dear Sarah

NW Bicester – Response to Environment Agency Comments

Thank you for your letter dated 24 January 2022 (ref WA/2021/129106/03-L01), which was prepared following a review of the:

- Hydraulic modelling submitted to the Environment Agency on 11th November 2021.
- Flood Modelling Report, Firethorn Developments Limited, Land at North West Bicester, Vectos, October 2021
- Flood Risk Assessment and Surface Water Drainage Strategy, Firethorn Developments Limited, Land at North West Bicester, Vectos, Issue 3, April 2021 (Appendix 13.1 of the Environmental Statement)

In your letter you confirm that the Environment Agency maintain an objection to the application because a review of the hydraulic model and associated hydrology has highlighted several issues that need addressing before the results can be accepted.

We have reviewed the Environment Agency model review response for both the hydrological and hydraulic analysis. We have populated a response to each comment where necessary in the spreadsheets provided.

You will note that the comments relating to the hydrological analysis have not resulted in the need to revise the flows incorporated into the hydraulic model. Some minor changes have been made to the hydraulic model to address the Environment Agency comments. The revised hydraulic model (rev 27) has therefore been created and has been uploaded onto the Environment Agency data portal, for all design storm events. Appendix A includes a series of flood maps which have been prepared for the key design simulations associated with the revised hydraulic model (rev 27).

Given the minor changes, it was not considered necessary to re-run the original sensitivity analysis.

It is not the purpose of this letter to outline what changes were made to the hydrological and hydraulic analysis, as this is populated in the spreadsheets. Instead, it is the purpose of this letter to address the more general queries outlined in the Environment Agency letter dated 24 January 2022.

Finished Floor Levels

The Environment Agency letter dated 24 January 2022 states:

"In addition, the FRA advises that finished floor levels of all properties are set at least 150mm above existing ground level. While this should be sufficient if no development is proposed within areas of flood risk, we would advise as a precaution against any unpredicted flooding, finished floor levels of properties should be at least 300mm above the appropriate climate change flood level."

No development is proposed within areas of flood risk. However, it is still accepted that finished floor levels of properties should be at least 300mm above the appropriate climate change flood level. This may be appropriate for properties in the more low-lying parts of the site but given that the developments parcels have been set back from the floodplain and that ground levels rise steeply, it is anticipated that existing ground levels will already be sufficiently elevated. Nevertheless, this will be checked and will inform the proposed finished floor levels for the Reserved Matters application.

Greenfield Runoff Rates

The Environment Agency letter dated 24 January 2022 states:

"We also note that the hydraulic modelling undertaken employs flood flow estimates which equate to approximately 1.3l/s/ha during a 1% annual probability event and 0.4l/s/ha in a 50% annual probability event. This is what we would expect of such a permeable catchment. However, the allowable discharge from the proposed attenuation ponds is detailed to be significantly higher at 2l/s/ha for all events; including the 50% event. The implication being that post development flows will be greater than existing for all flood events up to and including the 1% event, including an appropriate allowance for climate change. There seems to be a disconnect between the methods used to determine appropriate site runoff and the flood flow estimates used in the hydraulic modelling. The FRA argues that detailed site investigations show that the site is more impermeable than implied by the data sets normally used to estimate runoff. However, this logic has not been carried through when the flood estimates for the hydraulic models have been derived. We are concerned that either the flood estimates used in the hydraulic model underestimate flood flows or that the allowable discharge from the proposed attenuation ponds is too high. We consider this should be brought to the attention of the Lead Local Flood Authority in their capacity of commenting on the surface water drainage proposals."

Based on the ground conditions encountered, the QBAR greenfield runoff rate (which is approximately equivalent to a 50% annual probability event), was estimated to be 1.63 l/s/ha for the site.

The OCC Local Standards states "*limit discharge rates for rainfall events up to and including the 1 in 100 year event (including climate change allowances) to the agreed QBAR rate (or 2 l/s/ha whichever is greater)*". A rate of 2 l/s/ha was therefore adopted.

We have now undertaken further consultation with the LLFA on the matter, who has confirmed that we have followed the OCC Local Standards to achieve a greenfield run-off rate with appropriate application of soil type. The greenfield runoff rates were agreed with the LLFA as part of a pre-app exercise and they approved the surface water drainage strategy, as part of the FRA.

The hydrological analysis has been undertaken based on standard methods and we are under the impression that the Environment Agency are satisfied with this. The greenfield runoff rates reflect methods outlined in the OCC Local Standards.

A clayey topsoil was encountered across the entire site. This is identified in the ground investigation for the site. Extracts of the ground investigation are enclosed in the FRA, but the full documentation (including extensive borehole logs showing the clay topsoil), is available on the planning portal.

Clayey topsoil would result in greenfield runoff rates greater than would be expected based on desktop data alone. However, the ground conditions on site are not necessarily indicative of what is present across the entire catchment, so some disparity is anticipated. In fact, we have looked at the ground investigation for the Exemplar site immediately north, where topsoil is described as sand. See Section 5.1 using the link below for ground investigation:

https://planningregister.cherwell.gov.uk/Document/Download?module=PLA&recordNumber=39912&planId=816647&imageId=1581&isPlan=False&fileName=6958836.PDF

Therefore, we would expect the greenfield runoff rates for the Exemplar site to the north to be much lower.

As previously noted, the hydrological analysis used to define flows in the hydraulic model has been based on standard methods, but it is accepted that the impact of the clayey topsoil on site was not considered. This was because, based on readily available information, these ground conditions are anticipated to be localised and therefore not significant. However, a simple sensitivity test has been undertaken in the hydraulic model with respect to the hydrological flows used to examine any potential uncertainty.

Sensitivity Test

The hydraulic modelling employs catchment flood flow estimates which equate to approximately 1.29 l/s/ha during a 1% annual probability event (i.e. 0.98 m^3/s for the 760 ha catchment). The equivalent greenfield rate estimated in the FRA for the site, based on the ground conditions encountered, is 5.19 l/s/ha. Table 1 presents theoretical flow rates based upon arbitrary extents of clayey topsoil across the catchment.

Table 1 - 1% annual probability event peak flows

% of Catchment with Clayey Topsoil	l/s/ha	m^3/s
0	1.29	0.98
10	1.68	1.28
25	2.27	1.72

The catchment is known to be permeable and because of this, the clayey topsoil is anticipated to be limited to the site and perhaps some of the immediate surrounds.

The site (22.2 ha) makes up almost 3% of the total catchment area (760 ha).

If we were to conservatively say that 10%, or even 25% of the catchment is underlain by a clayey topsoil, a peak flow rate of 1.28 m^3/s and 1.72 m^3/s would apply, respectively. This has increased by a factor of approximately 1.30 and 1.75, respectively.

In the Flood Modelling Report, the event that resulted in the most extensive flooding on site was attributed to the 0.1% annual probability event. The peak flow for this event was estimated to be 1.74 m^3/s. Based on the same approach outlined above, using a factor of 1.30 and 1.75, the 0.1% annual probability event peak flows are identified in Table 2.

Table 2 - 0.1% annual probability event peak flows

% of Catchment with Clayey Topsoil	Factor	m^3/s
0	0	1.74
10	1.30	2.26
25	1.75	3.04

To test the impact of this potential uncertainty and demonstrate the robust nature of the model and parameters applied to the masterplan for the site, we have re-run the 0.1% annual probability event with both a 10% and 25% allowance of clay topsoil.

Whilst it was discovered that the flood extents for the 0.1% annual probability event have increased, this was not significant on site. The resultant flood maps are enclosed in Appendix B.

Discussion

As outlined in the Flood Modelling Report (see paragraph 4.5 to 4.9), the modelling demonstrated that the parameters originally used to inform the masterplan were robust. These parameters included:

1. Interpolated climate change floodplain based on JFLOW data
2. Risk of Flooding from Surface Water map

These layers were overlaid in the masterplanning process and are identified on the constraints and opportunities plan (see Appendix C). Therefore, all development (including SuDS) was steered out of the floodplain.

The very conservative sensitivity test outlined above has not changed this conclusion. The resultant flood extent associated with a theoretical 25% clay topsoil coverage is still smaller than that defined by the two data sources identified above. This is shown in Figure 1 and 2.

Whilst it is accepted that the findings of the ground investigation for the site has introduced a little uncertainty with respect to the hydrological calculations, this has no bearing on the conclusions or purpose of this study. There is no desire to update the Flood Map for Planning and it has been shown that the masterplan is robust and any potential uncertainty will not introduce developed parts of the site into the floodplain.

Figure 1 – Comparison of the 0.1% Event with 25% Topsoil and Surface Water Flood Extent

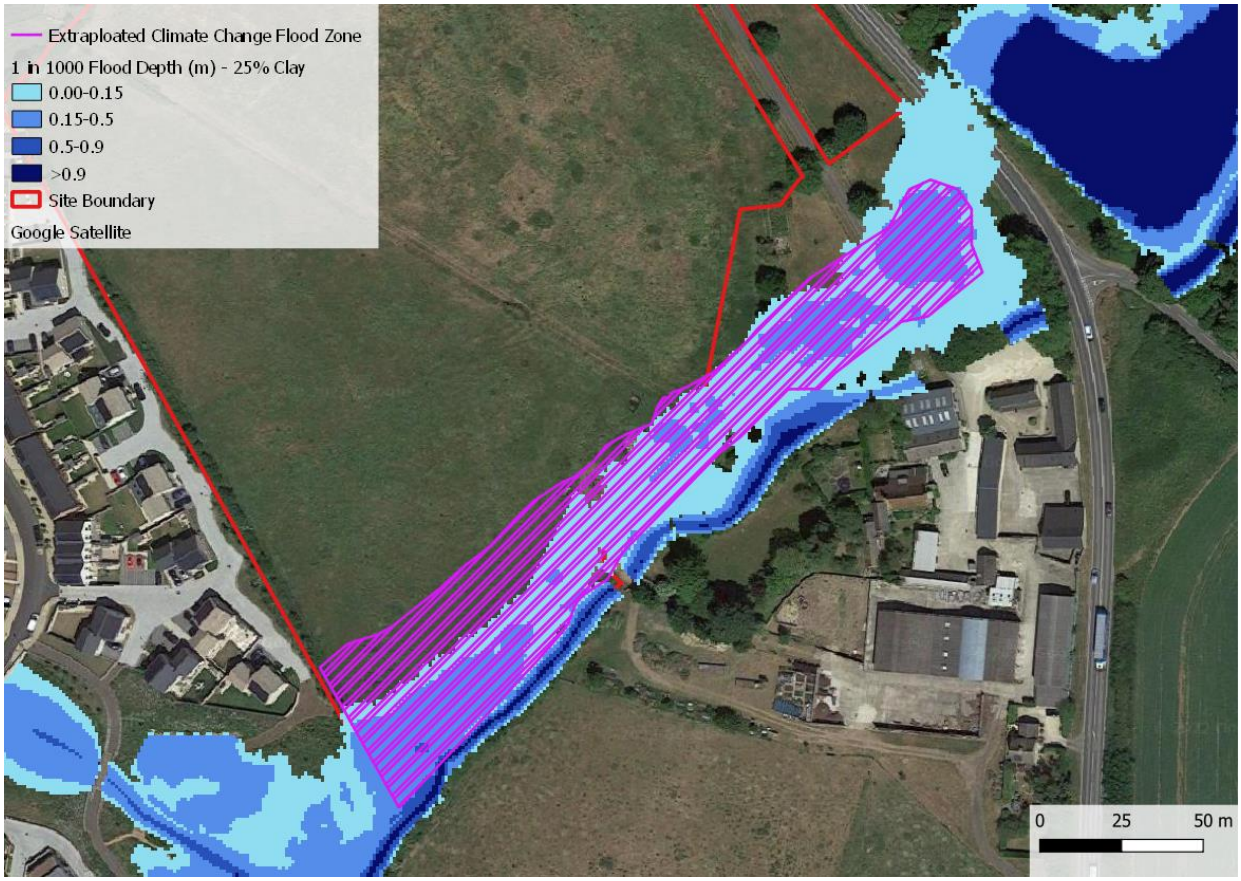


Figure 2 - Comparison of the 0.1% Event with 25% Topsoil and FRA Extrapolated Flood Zone

We hope that you are now satisfied with the revised hydraulic modelling, accept the robust development proposals and can remove your current objection.

Yours sincerely

Nick Bosanko

Nick Bosanko
Associate Director
07947220321
nick.bosanko@vectos.co.uk

Appendix A – Revised Flood Maps


1 in 20 Depth (m) - Rev 27
0.00-0.15
0.15-0.5
0.5-0.9
>0.9
Site Boundary
Google Satellite
0
250
500 m


1 in 100 Depth (m) - Rev 27
0.00-0.15
0.15-0.5
0.5-0.9
>0.9
Site Boundary
Google Satellite
0
250
500 m


1 in 100_CC Depth (m) - Rev 27
0.00-0.15
0.15-0.5
0.5-0.9
>0.9
Site Boundary
Google Satellite
0
250
500 m


1 in 100+HC-CC Depth (m) - Rev 27
0.00-0.15
0.15-0.5
0.5-0.9
>0.9
Site Boundary
Google Satellite
0
250
500 m

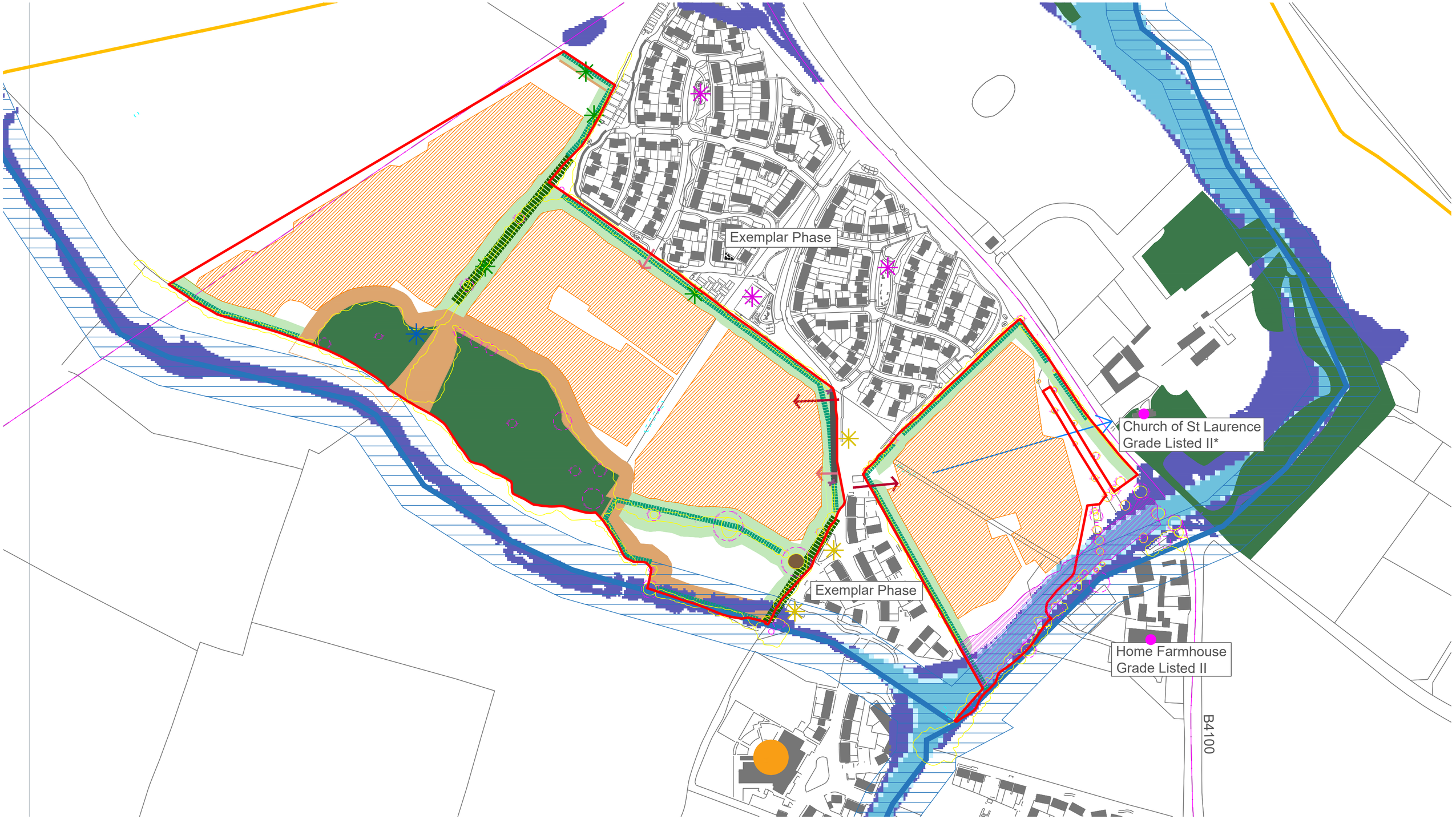

1 in 1000 Depth (m) - Rev 27
0.00-0.15
0.15-0.5
0.5-0.9
>0.9
Site Boundary
Google Satellite
0
250
500 m

Appendix B – Revised Flood Maps – Sensitivity Testing


1 in 1000 Depth (m) - Rev 27 - 10% Clay
0.00-0.15
0.15-0.5
0.5-0.9
>0.9
Site Boundary
Google Satellite
0
250
500 m


1 in 1000 Depth (m) - Rev 27 - 25% Clay
0.00-0.15
0.15-0.5
0.5-0.9
>0.9
Site Boundary
Google Satellite
0
250
500 m

Appendix C – Opportunity and Constraints Plan



N

0 metres 100
(1:2,500)

- Site boundary
- Tree line (Aspect)
- Hedgerow (Aspect)
- Watercourse (OS)
- Priority Habitat Woodland (desktop)
- Dry ditch (Aspect)
- Dry pond (Aspect)
- Tree with High Bat Roosting Potential (Aspect)
- 30m watercourse buffer (SPD)
- Listed buildings (desktop)
- Public right of way (desktop)
- Flood zone 2 (Vectos)
- Flood zone 3 (Vectos)
- Parish boundary (desktop)
- Gagle Brook Primary School
- 15m woodland buffer and bat corridor (Aspect)
- 10m hedgerow buffer (SPD/Aspect)
- Historic hedgerow (Cotswold)
- Potential NDA
- Surface water flooding 1 in 1000 extent
- Servient Land (Velocity)
- Flood zone for the 1 in 100 year event + 35% climate change
- Potential access points (RP)
- Potential secondary access points (RP)
- View towards the Church of St Laurence (Cotswold)
- Access to be provided between this points (Velocity)
- Indicative tree root protection area - retention trees only (Flac)
- Trees for removal to facilitate development (Flac)
- Vegetation canpopy (Flac)
- Exemplar Phase Children's Play
- Exemplar Phase Growing Spaces

Project
Land at North West Bicester

Drawing Title
Considerations

Date	Scale	Drawn by	Check by
17/02/2021	1:2,5000 at A3	ML	LA

Project No	Drawing No	Revision
1192	002	H

Mosaic

Key

- 01 Vehicular, pedestrian and cycle access point
- 02 View to church
- 03 Sustainable Drainage System(SuDS)
- 04 Play
- 05 Small new copses
- 06 Trim trail
- 07 Edible landscapes
- 08 Wetland habitat
- 09 Woodland with some limited public access
- 10 Pedestrian connection
- 11 Potential oedestrian connection
- 12 Modern farmstead interpretation
- 13 Lower density rural edge
- Site boundary

0m 100m

N.

CLIENT:
Firethorn

PROJECT:
North West Bicester

DRAWING:
Illustrative masterplan

PROJECT NUMBER:
1192

DRAWING NUMBER: SK004
CHECKED BY: ML/LA
REVISION: C
STATUS: Draft
DATE: 14/04/2021
SCALE: 1:2,000

MOSAIC
Urban Design & Masterplanning