a comprehensive hydrological and hydraulic modelling analysis was undertaken for the Langford Brook, using a detailed land survey to produce a digital terrain model (DTM), from which the flood outline could be derived.

Hydrological and Hydraulic Modelling Approach

8.6 The Flood Estimation Handbook (FEH) is the methodology recommended by the Environment Agency for hydrological modelling. The handbook consists of two main methods of flow estimation, namely the Statistical method (FEH-Stat) and the Rainfall-Runoff method (FEH-RR). Both methods have been used in the study. The methods rely on catchment descriptors taken from the FEH CD-ROM. As no previous model exists for the Langford Brook, JBA developed a new steady state HEC RAS hydraulic model is also reported.

Topographic Survey

8.7 JBA commissioned K.V. Surveys of Malvern, Worcestershire, to undertake a topographical survey of the Langford Brook. Details of river structures were also recorded. The cross sections, to Ordnance Datum, were surveyed in July 2004. The Client supplied JBA with a land survey of the site.

Climate Change

8.8 The period October to December 2000 ranks as the second wettest three-month sequence for England and Wales in the last 200-years. Unusual though recent climate change patterns have been, several broadly comparable wet episodes can be identified. These include the October to January periods of 1960/61, 1929/30 and 1952/53. Also, although the high storm rainfall totals recorded, for example in mid-October 2000, are rare; they are by no means unprecedented. The recorded rainfalls are well within the envelope of meteorological fluctuations that characterise the climate of England and Wales.

8.9 Recent research by the Environment Agency suggests that over the next 30 to 50 years the probability of occurrence of severe flood flows will increase. Unfortunately, this increase in severity cannot, as yet, be accurately quantified and analyses of the annual maximum flood series at the longer term gauging stations do not provide compelling evidence for any climate driven trend. Without such a trend or other quantifiable increase in flood magnitudes it is impractical to incorporate the possible effects of climate change into the design of flood alleviation schemes.

8.10 Various organisations have addressed the need to take a precautionary approach to the possibility of enhanced risks due to climate change by adopting an arbitrary percentage increase in the flood estimates computed from historic data sets. For example MAFF (now DEFRA) recommends:

> *"sensitivity analysis of river flood alleviation schemes should take account of potential increases of up to 20% in peak flows over the next 50 years".*

8.11 DEFRA do not make clear however, whether both design flood peaks and flood volumes should be increased by 20%. For some larger rivers the impact of such an increase might involve a shift from a 100-year event to a 1000-year event, in today's terms, depending on the slope of the relevant frequency curve(s).

8.12 Therefore, while we endorse the need to consider the implications of the occurrence of a flood larger than the design event, and we do not rule out the possibility that climate change may affect future flood flows; an agreed value for climate change is not available. As a precautionary measure we recommend the DEFRA guideline of a 20% increase in flow be used as part of the sensitivity analysis.

Hydrology Analysis

Approach to the Hydrology

8.13 The hydrological assessment has been undertaken to derive the 1% AEP (1 in 100-year) flow for the Langford Brook, which flows through the centre of the proposed development site.

8.14 A flow estimate was made for the following inflow point of the Langford Brook:

- OS NGR SP 459636 222565

Methodology

8.15 The Flood Estimation Handbook (FEH) describes two different approaches to flood estimation; the Statistical method and the Rainfall -Runoff method. The Statistical method is based on the estimation of an index flood, and uses information from hydrologically similar sites for flood frequency analysis. The Rainfall-Runoff method is a conceptual unit hydrograph-based model, which derives flood frequency curves from rainfall characteristics.

8.16 The Langford Brook at the above flow estimation point has a catchment area of 17.02 km2. No gauging stations are located within the catchment. The hydraulic model used to estimate the flood risk to the site is a steady-state model, which requires peak flow estimates.

Catchment Descriptors

8.17 The FEH CD-ROM provides catchment boundaries derived from a digital terrain model (DTM). The DTM uses information from 1:50,000 OS maps to position likely drainage paths on a grid of 50m x 50m. The catchment descriptors are then computed digitally from this information. The major descriptors used in this report are shown in **Table 8.1**.

Table 8.1 Definition of Selected FEH Catchment Descriptors

Descriptor	Description
AREA	Catchment area (km^2).
BFIHOST	Baseflow index derived from the HOST soil classification system.
DPLBAR	Mean drainage path length (km).
DPSBAR	Mean drainage path slope (m/km).
FARL	Index to describe the attenuation due to lakes and reservoirs within the catchment area. A value of 1 indicates no attenuation.
PROPWET	Index to describe the proportion of time when soil moisture deficit (SMD) was below 6mm during the period 1961-90.
SAAR	Standard average annual rainfall, taken from the period 1961-90.
SPRHOST	Standard percentage runoff derived from the HOST soil classification system (%).
$URBEXT_{1990}$	Extent of urbanisation. This has been taken from an index of urban and suburban land cover formulated in 1990.

8.18 It is generally accepted that urbanisation augments flow. Therefore, adjustments to flow estimates can be made on the strength of the $URBEXT_{1990}$ descriptor. If $URBEXT_{1990}$ is greater than 0.025, an adjustment is required for the Statistical method, whereas for the Rainfall-Runoff method an adjustment should be made if $URBEXT_{1990}$ is greater than 0.125. $URBEXT_{1990}$ has been updated using the urban expansion factor noted in **Equation 8.1**.

Equation 8.1

$$UEF = 0.8165 + 0.2254 \tan^{-1} \{ (Year - 1967.5)/21.25 \}$$

Where UEF = Urban expansion factor

Year = subject year

8.19 **Table 8.2** shows the catchment descriptors for the Langford Brook catchment and the two analogue catchments discussed in Paragraph 8.20 to 8.22.

Table 8.2 Selected Subject Site and Analogue Site Catchment Descriptors

Descriptor	Catchments		
	Langford Brook (subject site)	**29009 Ancholme @ Toft Newton**	**30017 Witham @ Colsterworth**
NGR	4596 2225	5033 3877	4929 3246
AREA (km^2)	17.02	29.55	50.23
FARL	0.990	1.000	1.000
PROPWET	0.32	0.26	0.27
BFIHOST ($m^3/s/km^2$)	0.684	0.628	0.657
DPLBAR (km)	4.43	5.39	7.38
DPSBAR (m/km)	15.6	12.42	22.59
SAAR (mm)	634	616	641
SPRHOST (%)	23.2	25.6	22.6
$URBEXT_{2004}$	0.046	0.005	0.007

Hydrological Data

8.20 The catchment areas defined by the DTM were verified with boundaries derived manually from topographical maps. No discrepancies were identified.

8.21 In flood hydrology, observed data are preferable to improve flow estimates. In the absence of gauged data within the catchment, donor or analogue catchments can be used to transfer data to the subject site. No suitable donor catchments were identified; instead analogue catchments were selected to improve the subject site QMED estimate. The top four stations selected in the pooling group were analysed for their suitability with respect to the subject catchment. Dowles Brook @ Dowles

was considered unsuitable because the permeability of the catchment is lower than that of the subject site catchment and below the FEH permeability threshold of 20%. River Foulness @ Holme Farm was not used as the area of the catchment is too large, following guidelines outlined in FEH, which state that a factor of 4 to 5 is appropriate.

8.22 Ancholme @ Toft Newton and Witham @ Colsterworth, although located in the Anglian region, were considered suitable analogue catchments having similar catchment descriptors to that of the subject catchment. The suitability of analogue catchments is not easy to judge, and therefore both analogue catchments have been used instead of placing reliance on one alone. A summary of the gauging stations can be found in **Table 8.3** below.

Table 8.3 Summary of Analogue Catchments

Station Name	FEH Number	OS NGR	Catchment Area (km^2)	Period of record	Comments on Data Quality
Ancholme @ Toft Newton	29009	5033 3877	29.55	1974-2001	Flat V weir (3.03m wide) with theoretical calibration confirmed by check gaugings. There is no drowning or bypassing, and the station is immediately u/s of entry point of flows from Toft Newton reservoir. No major abstractions or returns.
Wotham @ Colsterworth	30017	5629 2233	50.23	1978-2001	Flat V weir 4.996m wide; theoretical calibration. Summer flows very heavily augmented by transfers from Rutland Water until Jun 1985, when direct Rutland/Saltersford pipeline opened. *Notes: 3 summer flows prior to June 1985 excluded from the AMAX dataset due to flows being heavily augmented.*

Statistical Analysis – Methodology

8.23 The FEH Statistical methodology is based on the analysis of annual maximum flows, and the index flood is the median annual maximum (AMAX), denoted by QMED. For gauged sites QMED is the median value of either the AMAX or POT series. Where sites are not gauged, the index flood is estimated from catchment descriptors or by data transfer. The index flood (QMED) is then scaled by a growth factor derived from either a mathematical distribution of flow data at the site or a 'pooling group' of gauged UK catchments if the site is ungauged. This pooling group is selected using similar hydrological characteristics to the subject site, and the attributes of their flood data are statistically combined to produce a growth curve, from which growth factors are extracted.

Statistical Analysis – Index Flood

8.24 QMED for the site under consideration was derived for all the analogue catchments, using **Equation 8.2** shown below. **Equation 8.3** calculates $QMED_{cd}$. Note that an adjustment for urbanisation was required as the subject site catchment had an URBEXT2004 value of 0.046. The index floods of the two analogue catchments are shown in **Table 8.4**, whilst the index flood values for the ungauged site can be seen in **Table 8.5**.

Equation 8.2

$$QMED_{s,adj} = QMED_{s,cds} \times (QMED_{g,obs} / QMED_{g,cds})$$

where
$QMED_{s,adj}$ = adjusted QMED for subject site
$QMED_{s,cds}$ = QMED derived by catchment descriptors for subject site
$QMED_{g,obs}$ = QMED of donor site from observed data
$QMED_{g,cds}$ = QMED of donor site from catchment descriptors

Equation 8.3 Summary of Analogue Catchments

$$QMED_{rural} = 1.172\, AREA^{\left(1-0.0150\ln\left(\frac{AREA}{0.5}\right)\right)} \left(\frac{SAAR}{1000}\right)^{1.560} FARL^{2.642} \left(\frac{SPRHOST}{100}\right)^{1.211} 0.0198^{RESHOST}$$

where $QMED_{RURAL}$ = as-rural index flood (m^3/s)
AREA = catchment area (km^2)
AE = 1 - 0.015 ln (AREA/0.5)
SAAR = standard average annual rainfall (mm)
FARL = index to show attenuation by lakes
SPRHOST = standard percentage runoff derived from HOST soil classification (%)
RESHOST = BFIHOST + 1.3 (SPRHOST/100) - 0.987
BFIHOST = baseflow index derived from HOST soil classification

Table 8.4 Index Flood (QMED) for the Analogue Catchments

Gauging Station	$QMED_{AMAX}$ (m^3/s)	$QMED_{cd}$ (m^3/s)	Ratio
29009 Ancholme @ Toft Newton	1.8	2.8	0.66
30017 Witham @ Colsterworth1.35	5.8	4.3	1.35

Table 8.5 Index Flood for the Ungauged Catchment

Location	Donor Catchment	$QMED_{s,cds}$ (m^3/s)	Ratio	$QMED_{s,adj}$ (m^3/s)
L_Sub 1	Toft Newton	1.5	0.66	1.0
L_Sub1	Colsterworth	1.5	1.35	2.0

8.25 In this instance it is necessary to apply the multi-site adjustment procedure as outlined in FEH Volume 3, Chapter 4. Using this methodology, the final QMED estimate is obtained as a weighted average of the individually transferred estimates (using Equation 8.4).

Equation 8.4 Index Flood (QMED) for the Analogue Catchments

Gauging Station	$QMED_{AMAX}$ (m^3/s)	$QMED_{CD}$ (m^3/s)	Ratio
29009 Ancholme @ Toft Newton	1.8	2.8	0.66
30017 Witham @ Colsterworth	5.8	4.3	1.35

8.26 The choice of weights Wi reflects the similarity of the gauged sites to the subject site. Both analogue sites had similar catchment descriptors to that of the subject site, as shown in Table 8.2. Greater emphasis was applied to the analogue catchment Ancholme @ Toft Newton, as the catchment area was more similar to that of the subject site. The final weightings applied are shown in **Table 8.6**.

Table 8.6 Multi-Site Adjustment Procedure Weightings

Location	Weights (W_i)
29009 Ancholme @ Toft Newton	0.6
30017 Witham @ Colsterworth	0.4

The final $QMED_{s,adj}$ derived using the methodology outlined above was calculated to be;

$$\mathbf{QMED_{s,adj} = 1.3m^3/s}$$

Statistical Analysis – Growth Curve

8.27 The pooling group is a group of hydrologically similar catchments whose combined growth curves produce the growth factors with which to scale the index flood. The number of sites within the pooling group is dictated by the target return period (T), where the combined station record of all the pooling sites within the group should be greater than 5T. Therefore, if the target return period is 100-years then the total record length for the whole pooling group should be greater than 500 years.

8.28 Sites for the pooling group are selected by hydrological similarity using three catchment descriptors; namely AREA, SAAR, and BFIHOST, and is carried out by the WINFAP-FEH database. Once chosen, the pooling group can be altered. Stations can be added or taken away if desired. This is determined by a measure of discordancy and record length amongst others.

8.29 A pooling group was constructed for the subject site. The initial pooling group consisted of 22 gauging stations with a total of 501 years of AMAX data. The initial pooling group was characterised as heterogeneous, and thus the entire pooling group was reviewed. Several stations had to be removed due drowning and bypassing of the gauge. The revised pooling group consisted of 20 gauging stations and included 502 years of AMAX data and was characterised as homogeneous and therefore, a further review of the pooling group was not required. WIN FAP FEH selected the General Logistic (GL) distribution as the most suitable to construct the pooled flood frequency curve, as it closely weighted the average L-Kurtosis and L-Skewness of the pooling group sites.

8.30 The final 1% AEP (1 in 100-year) Statistical design flow estimate is shown in **Table 8.7**.

Table 8.7 Final Statistical Design Flow Estimates

Catchment	Return Period/AEP	
	100-year (1%)	100-year +20% (Climate Change)
L_Sub1	3.5	4.2

Rainfall-Runoff Method

8.31 The FEH Rainfall-Runoff method is a conceptual model that uses a hypothetical unit hydrograph and design rainfall to produce a flow hydrograph. Whereas the Statistical method uses a growth curve to estimate flood frequency, the Rainfall-Runoff method estimates the flood frequency curve by factoring the design rainfall for the appropriate return period. These rainfall frequency statistics can be obtained directly from the FEH CD-ROM.

8.32 There are three main parameters that govern the Rainfall-Runoff method. These are:

- Time to peak (Tp)
- Standard percentage runoff (SPR)
- Baseflow (BF)

8.33 These can be estimated using catchment descriptors. However, it is stated in the FEH that flow estimation is greatly improved if parameters (in particular SPR and Tp) are identified directly from observed data or adjusted by data from a suitable donor or analogue catchment.

8.34 Using the UK Event Archive, published in Volume 4, Appendix A, flood event data was only available for one of the analogue catchments (30017 Witham @ Colsterworth). It was considered inappropriate to derive Rainfall-Runoff estimates from observed data using only one analogue catchment where the records available are only for a period in the 1980's. Therefore, the Rainfall- Runoff 1% AEP flow was derived using catchment descriptors only.

8.35 The FEH Rainfall-Runoff model has been implemented in the iSIS modelling software v2.2. This modelling software is capable of performing all the required calculations.

8.36 Due to the catchment being classified as 'essentially rural' a time step of □t = 1.0 hours was chosen.

8.37 The extent of urbanisation in the catchment is low (URBEXT < 0.125 for Rainfall-Runoff threshold) and therefore a winter storm profile was chosen.

8.38 The critical storm duration was estimated as in **Equation 8.5**. A storm duration of 13.0 hours was chosen.

Equation 8.5

$$D=TP(1+SAAR/1000)$$

Design Flow Estimates

8.39 Using the iSIS FEH module, the 1% AEP (100-year) design flow estimate for the Langford Brook using catchment descriptors is shown in **Table 8.8**.

Table 8.8 Final Rainfall-Runoff Design Flow Estimates

Catchment	Return Period/AEP	
	100-year (1%)	100-year +20% (Climate Change)
L_Sub1	7.5	9.0

Choice of Method

8.40 The 1% AEP flow estimates using both the Statistical and Rainfall-Runoff methodologies were;

- 7.5m3/s (Rainfall-Runoff)
- 3.5m3/s (Statistical)

8.41 As shown, the two methods produced different results. Although the pooling group created using the Statistical analysis was considered to be homogeneous and therefore quite a good representation in relation to the subject site. The subject site had an URBEXT value of 0.046 the Statistical method is generally considered to be suitable for essentially rural catchments.

8.42 The subject catchment is also small; 17.02km2, and the FEH favours the Rainfall-Runoff method for smaller catchments.

8.43 In choosing the final methodology, it was considered that 3.5m3/s Statistical derived flow estimate was too low for a 100-year estimate for a catchment of 17.02km2, for which there were no apparent reasons. It was therefore thought that the flow of 7.5m3/s was more representative for this study catchment.

Hydraulic Modelling

General

8.44 In the absence of an existing model of the Langford Brook at Bicester, JBA constructed a steady state model of the brook using the HEC-RAS version 3.1.1 hydraulic modelling software. The software was developed by the US Army Corps of Engineers and was released in May 2003. HEC-RAS can simulate water levels in open channels as well as in various types of structures, and will also resolve the transition from sub-critical to super-critical flow.

8.45 The Langford Brook model extends for just over 1200m, from its upstream extent approximately 300m downstream of the A4421 Charbridge Lane (OS NGR SP 599 230), to approximately 200m downstream of Gavray Drive at OS NGR SP 594 221. Both upstream and downstream boundary conditions were set at the 'normal depth', calculated from the gradient of the river bed.

8.46 Where structures are present in the model, HEC-RAS requires there to be a cross-section at both the upstream and downstream face of the structure, therefore some of the sections had to be duplicated, as the surveyor did not always survey both the faces of the structure, if they were seen to be very similar. On structures that appeared to differ from upstream to downstream, or where complex structures were present, for example Gavray Drive bridge, both the upstream and downstream faces of the structure were surveyed.

Hydraulic Modelling Methodology

8.47 Two hydraulic modelling methodologies were available for use in this study, namely steady state modelling and unsteady state hydrodynamic modelling. The choice of methodology utilised is dependent on engineering judgements made on the nature of the watercourse in question and associated flood routing.

8.48 The main limitation of steady state modelling is that it does not simulate time-varying behaviour such as flood wave attenuation due to storage and time-based operation of control structures and pumps. A hydrodynamic model directly calculates these effects and also provides the opportunity to distinguish between such issues as areas of floodplain serving as purely static storage and those actively conveying flow (functional floodplain).

8.49 For this study, a steady state model was thought to be appropriate, as due to the short model length, the attenuation of flow in the floodplain was considered to be low.

8.50 It was also thought appropriate to use a steady state model to ensure that if the structures at Charbridge Way (upstream of the site) were modified or removed in the future, the model would represent this, as a steady state model assumes the same flow throughout the reach, and ignores any online flood storage due to undersized culverts.

Data Collection

8.51 JBA appointed K.V. Surveys of Malvern to undertake a topographical channel and floodplain survey of the Langford Brook at Gavray Drive, Bicester. This survey consisted of 13 watercourse sections from grid reference OS NGR SP 599 230 at the upstream extent of the model, to grid reference OS NGR 594 221 downstream of the site, and included details of all the structures present along the modelled stretch of watercourse. The survey, to ordnance datum, was undertaken in July 2004.

8.52 JBA staff, with experience in hydrology and hydraulic modelling, undertook a walkover survey during July 2004. Details of watercourse and floodplain roughness values, structures and possible flow routes were assessed and recorded during this survey. This information provided a starting point to develop the hydraulic model.

Open Channel Sections

8.53 The hydraulic model of Langford Brook contained a total of 16 open channel sections (three of the original survey sections had been duplicated as a result of the presence of structures). Survey sections six, five and four were extended to approximately 500m on both the left and right banks, using a topographic spot level survey which was provided to JBA by the client. **Figure 8.2** shows the locations of the cross-sections in the HEC-RAS model.

Roughness Coefficients

8.54 Channel and floodplain roughness is represented by Manning's 'n' values in the model. Initial values were determined by experience and by reference to published literature (e.g. Chow 1959[2]). Geomorphological and hydraulic literature documents the general case that in most rivers, the 'n' value decreases with increasing stage and discharge. During periods of relatively low flow, irregularities on the bed (form roughness) and the effects of bed and bank vegetation tend to elevate the 'n' value, whereas during periods of flood with significant depths above the main channel and floodplain, the value of 'n' is dramatically diminished as bathymetric and topographic irregularities are 'drowned' out and vegetation cover is submerged. The latter is particularly the case between Autumn and Spring when floods are most common and vegetation cover declines.

8.55 The final values were chosen following a walkover survey by an experienced modeller and consideration of the above commentary. As Langford Brook is winding with some weeds and stones, a value of 0.035 was used in the model for the main channel (below the bankfull reference level). When the floodplain is inundated, changes in vegetation within the main channel are considered unlikely to have a marked effect on the stage of flow. For the floodplain a value of 0.040 was adopted, as the land adjacent to the channel consists of light brush and trees in summer.

8.56 A Manning's 'n' value of 0.014 was chosen for the three culverts under the Gavray Drive Bridge. A Manning's 'n' value of 0.011 represents a smooth, concrete culvert, straight and clear of debris, therefore a slightly higher Manning's 'n' of 0.014 was deemed appropriate for these culverts.

Structures

8.57 The modelled reach of the Langford Brook contains a large number of structures, details of which were obtained from the topographical survey. The following details the location of the structures:

- Structure 11.5 – Railway bridge at grid reference OS NGR SP 598 228.
- Structure 10.25 – Bridge near Charbridge Way at grid reference OS NGR SP 592 228.
- Structure 7.95 – Wooden footbridge at grid reference OS NGR SP 596 226.
- Structure 6.5 – Railway bridge at grid reference OS NGR SP 596 225.
- Structure 3.5 – Gavray Drive bridge at grid reference OS NGR SP 595 225.

- Structure 1.7 – Wooden bridge at grid reference OS NGR SP 595 221.

8.58 Contraction and expansion coefficients are essential in the hydraulic model computations, to determine the energy losses due to the expansion and contraction of flow, between two adjacent cross-sections during the standard step profile calculations. These coefficients were determined using the HEC-RAS manual3. The manual suggests that typical values of contraction and expansion coefficients are 0.1 and 0.3 respectively for a gradual transition along an open channel. These values therefore have been adopted for the open channel section. However, the values 0.3 and 0.5 are recommended for the bridge contraction and expansion coefficients respectively in all the relevant HEC-RAS publications. The same values were therefore used in this study.

Floodplains

8.59 The floodplains of the Langford Brook are represented in the model as single cross-sections which extend either side of the main channel. For the sections which flow past the site, the floodplain was extended to approximately 500m from both the left and right banks, using information from a topographical spot level survey, which had been provided by the client.

Model Runs and Results

8.60 The HEC-RAS model of Langford Brook was run for a range of scenario's, detailed below:

- 1% AEP (1 in 100-year) flow.
- Sensitivity to flow - 1% AEP flow + 20% (climate change scenario).
- Sensitivity to variations in Manning's 'n'.
- Sensitivity to changes in downstream boundary.

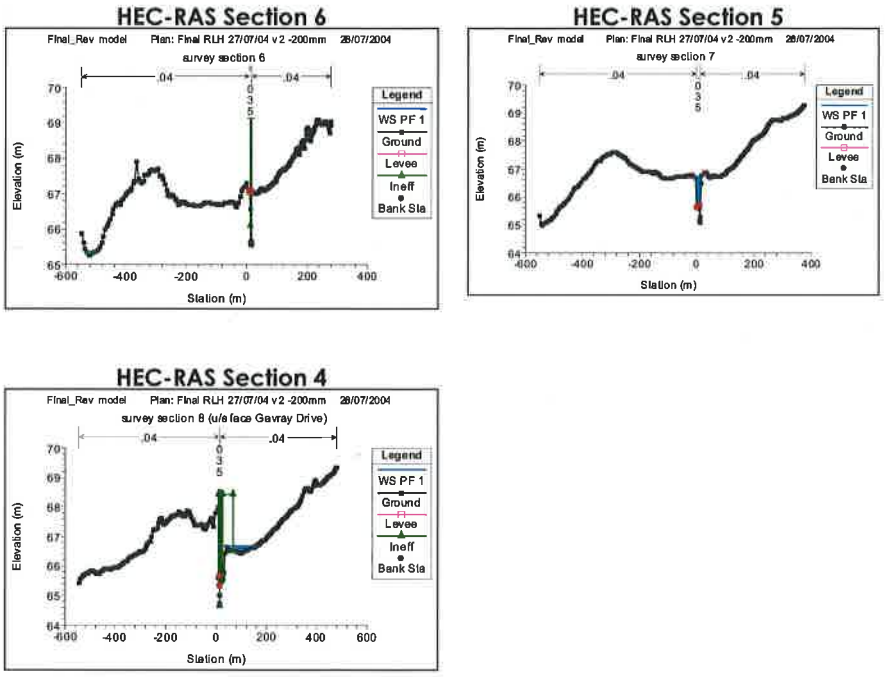
8.61 The Rainfall-Runoff derived 1% AEP (1 in 100-year) peak flow of 7.5m3/s was used for the Langford Brook. DEFRA recommend that a 20% increase in this value is used as a sensitivity analysis, and also to assess possible enhanced risks due to climate change. The 20% flow increase, gives a 'climate change' flow of 9.0m3 /s.

8.62 Summary results from the model are shown in **Table 8.9** and cross sections adjacent to the site and the model longitudinal section are shown in **Graph 8.1** and **Graph 8.2** respectively.

Table 8.9 Summary of Model Results

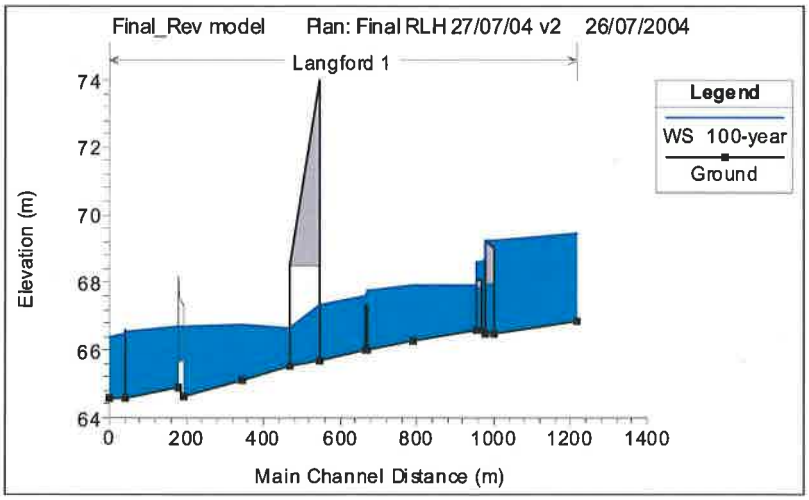
HEC-RAS Label	1% AEP Water Level (m AOD)	1% AEP + 20% Water Level (m AOD)
13	69.44	69.55
12	69.22	69.31
11	68.70	68.77
10.5	68.63	68.66
10	67.90	68.06
9	67.90	68.00
8	67.75	67.87
7.9	67.61	67.80
7	67.31	67.50
6	***66.65***	***66.64***
5	***66.74***	***66.86***
4	***66.69***	***66.85***
3	66.67	66.82
2	66.54	66.67
1.5	66.48	66.57
1	66.41	66.51
Notes: ***Bold & Italic*** text are the cross sections which are adjacent to the site		

Graph 8.1 HEC-RAS Cross Sections Adjacent to the Site



8.63 The effect of the 1% AEP (1 in 100-year) modelled water levels on the site, are discussed in section 4.3.

Graph 8.2 HEC-RAS Model Longitudinal Section



8.64 As shown in **Figure 8.3** the structures in the location of Charbridge Way, upstream of the site, are a restriction on flow. The downstream structure at Gavray Drive is surcharged but does not have a significant head loss.

Flow

8.65 A sensitivity analysis to flow has been carried out for the Langford Brook HEC-RAS model, by increasing the 1% AEP (1 in 100-year return period) flow by 20%. The flow used was 9.0m3/s. The model results for the flow sensitivity analysis can be seen in Table 3-1.

Roughness

8.66 A sensitivity analysis was carried out on the Manning's 'n' values that were chosen to represent the channel and banks of the watercourses. Manning's 'n' values were altered by both -20% and +20%. Results are shown in Table 3-2.

8.67 The results illustrated that the model is sensitive to change in Manning's 'n', and it is therefore recommended that the channel is regularly maintained to ensure that particularly between Autumn and Spring, when larger flood events are more likely to occur, the channel does not become overgrown or obstructed.

Downstream Boundary

8.68 In the absence of known stage-discharge information for the downstream boundary, a sensitivity analysis was carried out on the downstream boundary. This was done by varying the water depth by +/- 200mm. On completion of the 1% AEP (1 in 100-year) flow model run, the water surface elevation of the last cross-section (section 1), was noted. This value was modelled to be 66.41m AOD. Results are shown below in **Table 8.10.**

Table 8.10 Sensitivity Analysis on Mannings 'n' and Downstream Boundary

HEC-RAS Label	Mannings 'n'-20% Water Level (m AOD)	Mannings 'n' +20% Water Level (m AOD)	Downstream Boundary - 200mm Water Level (m AOD)	Downstream Boundary +200mm Water Level (m AOD)
13	69.41	69.47	69.44	69.44
12	69.21	69.24	69.22	69.22
11	68.68	68.73	68.70	68.70
10.5	68.63	68.65	68.63	68.63
10	67.90	67.97	67.90	67.90
9	67.86	67.95	67.90	67.90
8	67.74	67.80	67.75	67.75
7.9	67.50	67.73	67.61	67.61
7	67.18	67.44	67.31	67.30
6	***66.49***	***66.65***	***66.65***	***66.70***
5	***66.62***	***66.80***	***66.74***	***66.84***
4	***66.58***	***66.80***	***66.69***	***66.83***
3	66.55	66.79	66.67	66.81
2	66.41	66.64	66.54	66.71
1.5	66.37	66.57	66.48	66.64
1	66.29	66.51	66.41	66.61

Notes: Bold & italic text are the cross sections which are adjacent to the site

Flood Risk

Planning Policy Guidance Note 25 (PPG25)

8.69 In July 2001 the DTLR issued Planning Policy Guidance note 25 (PPG25), now published by the ODPM. This introduced the sequential tests and the risk based approach to flood risk and development. Development priorities are to be based on flood zones as outlined in PPG25. The flood zones are shown in **Table 8.11**.

Table 8.11 PPG25 Flood Risk Zones

FLOOD ZONE (see note a)	Appropriate Planning Response
Zone 1: Little or No Risk Annual probability of river flooding 0.1% (1 in 1000-year)	No constraints due to river flooding.
Zone 2: Low to Medium Risk Annual probability of river flooding 0.1% to 1.0% (1 in 1000-1 in 100-year)	Suitable for most development. For this and higher flood risk zones, flood risk assessment is required appropriate to the scale and nature of the development. Subject to operational requirements in terms of response times, these and higher risk zones are not generally suitable for essential civil infrastructure, such as hospitals, fire stations, emergency depots etc.
Zone 3: High Risk (see note b) Annual probability of flooding with defences where they exist 1% or greater (less than a 1 in 100-year protection).	
Zone 3a: Developed Areas	These areas may be suitable for residential, commercial, and industrial development providing the appropriate minimum standard of flood defence (including suitable warning and evacuation procedures) can be maintained for the lifetime of the development.
Zone 3b: Undeveloped and sparsely developed areas	These areas are generally not suitable for residential, commercial and industrial development unless a particular location is essential, e.g. for navigation and water based recreation uses, agriculture and essential transport and utilities infrastructure, and alternative lower-risk location is not available.
Zone 3c: Functional floodplains	These areas may be suitable for some recreation, sport, amenity and conservation uses (providing adequate warning and evacuation procedures are in place). Built development should be wholly exceptional and limited to essential transport and utilities infrastructure that has to be there. Such infrastructure should be designed and constructed so as to remain operational even in times of flood.

Notes:
Zone 3 is split into three sub-zones.
Tidal flooding risks have not been included in this table.
Appropriate Planning Responses have been limited to those relevant to this flood risk assessment.

Note a: All risks relate to the time at which a land allocation decision is made or an application submitted. The Environment Agency will publish maps of these flood zones. Flood Zones should be identified from Agency flood data ignoring the presence of flood defences. Local Authorities should, with the Agency, identify those areas currently protected by those defences and the standard of protection provided by those defences.

Note b: Development should not be permitted where existing sea or river defences, properly maintained, would not provide an acceptable standard of safety over the lifetime of the development, as such land would be extremely vulnerable should a flood defence embankment or sea wall be breached, in particular because of the speed of flooding in such circumstances (see PPG25 paragraph 69).

Flood Risk to the Site

8.70 Flood risk to the site is considered to be from one main source; the Langford Brook. The appropriate standard for flood protection is 1% AEP (1 in 100-year).

Derivation of the 1 in 100-year Flood Outline

8.71 The 1% AEP (1 in 100-year) water level estimates, derived from the Langford Brook model, have been used to plot the 1% AEP flood outline across the site. This process was achieved by firstly creating a digital terrain model (DTM) of the study area (illustrated in **Figure 8.4**) based on the land survey supplied to JBA by the Client. Secondly, the maximum stage results from the hydraulic model were combined with the DTM to create a water surface, detailing the extent of the flood event. The 1% AEP (1 in 100-year) flood extent across the site is shown in.

8.72 As shown in **Figure 8.5**, due to the topography of the area, a small area of the site will be affected by flooding during a 1% AEP flood event. At CS 6, the model is in bank and therefore the northern area of the site should not be affected by flooding. At CS 5 the model is slightly out of bank and at CS 4, at the southern part of the site, the model shows increased out of bank flooding. The maximum water level across the site is 66.74m AOD, with the lowest spot level being approximately 66.39m AOD. The maximum depths of flooding could therefore be approximately 0.35m.

8.73 The 1% AEP (1 in 100-year) outline derived represents the worst case scenario, as to derive the outline the water levels from the model were projected across the

floodplain until the topography of the site is equal to the 1% AEP water level. In reality there may not be sufficient volume of water to reach these extents.

8.74 Note that, as shown in **Figure 8.4**, on the left bank of the Langford Brook, the topography of the site is lower immediately adjacent to the watercourse (blue/green shading), rising gently to an area of higher ground. It is this area of higher ground which protects the very eastern part of the site, which is lower, from being affected by flooding.

Environment Agency

8.75 Following discussions with the Environment Agency, it was considered appropriate to derive the flood outline using the water levels derived running the model with +20% Manning's 'n' values. Deriving the outline with these slightly higher water levels would incorporate intolerances in the survey data and sensitivity within the model runs.

8.76 The flood extent was derived in the same way as outlined above and the final flood outline across the site is illustrated in

Flood Zone of the Proposed Site

8.77 The proposed site at Gavray Drive, Bicester, lies within PPG25 flood risk zones 2 and 3 – medium to high risk. The area of the site which lies outside of the 1% AEP (1 in 100-year) flood extent is considered to be suitable for most development. Zone 3 of the site, the area which lies within the 1% AEP (1 in 100-year) flood extent, may be suitable for residential development providing the appropriate minimum standard of flood defence (including suitable warning and evacuation procedures) can be maintained for the lifetime of the development.

Proposed Finished Floor Levels

8.78 The Environment Agency recommends that floor levels of all new developments be set a minimum of 600 mm above the 1 in 100-year flood levels.

8.79 The maximum estimated 1 in 100-year water level in the vicinity of the site was 66.74 m AOD. Floor levels of the proposed development should therefore be constructed at a minimum elevation of 67.34 m AOD.

Flood Risk Downstream of the Site

8.80 At this stage, the exact details of the site drainage are unknown, however it is envisaged that surface water from the development will discharge into the existing public surface water sewers. It will be necessary to demonstrate that adequate surface water sewers exist and that the surface water runoff from the development site will be no more than existing runoff.

Dry Access

8.81 The Environment Agency states that during times of flooding in a 1% AEP (1 in 100-year) flood event, a dry means of access must be available to the site. A dry means of access would be available to the site from all main access roads, particularly the A4421.

Climate Change

8.82 PPG25 states that '... best estimates, based on the most up-to-date findings, should also be made of climate change impact on probabilities. The assessment should ensure that the development meets an acceptable standard of flood defence for the design life of a development.'

8.83 The HEC-RAS model developed by JBA was run with a 20% increase n flow, to assess the affect of climate change. Discussion and model results for this are shown in paragraphs 8.65 to 8.68.

Flood Plain Compensation

General

8.84 Part of the proposed development site lies within the flood outline and it is proposed to rationalise the floodplain on the site rather than have a layout that fits around the existing floodplain outline. In order to undertake this, floodplain compensation calculations have been carried out to ensure that the new development does not reduce the floodplain capacity.

8.85 An extract of the proposed development plans are illustrated in **Figure 8.7** with the full plan being shown in **Figure 102**. The area of land to be raised is 0.5 hectares and the land available for compensation is 0.9 hectares.

8.86 The floodplain compensation calculations have been undertaken by spreadsheet calculations. Using Vertical Mapper (VM), the ground levels within the area to be raised were extracted to determine the depths of flooding. All depths within the area, apart from two small areas illustrated in **Figure 8.8**, were lower than 300mm and therefore it was considered necessary to compensate in one band only and provide a like for like compensation.

8.87 The volume was derived by using the cell size of the grid of 2.5m. The total volume within the area to be developed was calculated to be 673.40m^3, for the derived flood outline.

8.88 It was considered feasible to use only 0.4 hectares (hatched area on **Figure 8.7**) of the available land for compensation, the area immediately adjacent to the Langford Brook. Using the methodology outlined above, grounds levels within this compensation area were extracted. To provide sufficient compensation it is considered necessary to lower the ground levels to a constant level of 66.6m AOD.

8.89 By lowering the area to a level of 66.6m AOD this will provide a storage capacity of 742.2m^3, which is sufficient to compensate for the area being raised and will slightly increase the floodplain volume.

Conclusions and Recommendations

Conclusions

8.90 JBA were appointed by Gallagher Estates in June 2004, to undertake a Flood Risk Assessment for a proposed site at Gavray Drive, Bicester. The existing site is open fields.

8.91 The study has considered flooding from the Langford Brook, which flows through the centre of the site. This Flood Risk Assessment and this report follow the relevant sections of the guidelines in Appendix F of PPG25 – Planning Guidance Development and Flood Risk.

8.92 The Environment Agency's 2004 Flood Zone Maps which were obtained from the local council were initially used to determine the flood risk to the site.

8.93 JBA commissioned K.V. Surveys of Malvern to undertake a topographical survey of the watercourse. This survey provided information on the shape of the channel and the dimension of any structures found along the watercourse, and was undertaken in June 2004.

8.94 Flows for input in the model were obtained using the FEH Rainfall-Runoff methodology. The 1% AEP flow was estimated to be 7.5m3/s, and the +20% increase in flow, to take into account the possible effects of climate change, was taken to be 9.0m3/s.

8.95 A steady state HEC-RAS model was developed using the new topographic survey, with the cross sections adjacent to the site being extended across the floodplain using the land survey provided to JBA by the Client.

8.96 A DTM of the site was created using the land survey, from which the 1% AEP (1 in 100-year) flood extent was derived. Following discussions with the Environment Agency it was considered appropriate to derive the flood outline using the water levels when the model was ran with a 20% increase in Manning's 'n' values. This would to take into account any intolerance in the survey data and sensitivity of the model runs. The model results indicated that an area of the site would be at risk from flooding with all but a small area of the site experiencing depths of flooding less than 300mm.

8.97 The proposed site at Gavray Drive, Bicester lies within PPG25 flood risk zones 2 and 3 – medium to high risk. The area of the site which lies outside of the 1% AEP (1 in 100-year) flood extent is considered to be suitable for most development.

8.98 The Environment Agency states that during times of flooding in a 1% AEP (1 in 100-year) flood event, a dry means of access must be available to the site. A dry means of access would be available to the site from all main access roads, particularly the A4421.

Mitigation

8.99 The Environment Agency recommends that floor levels of all new developments be set a minimum of 600 mm above the 1 in 100-year flood levels. The estimated 1 in 100-year water level in the vicinity of the site was 66.74 m AOD. Floor levels of the proposed development should therefore be constructed at a minimum elevation of 67.34 m AOD.

8.100 Floodplain rationalisation has been considered and it is proposed to rationalise the floodplain on the site rather than have a layout that fits around the existing floodplain outline.

9.0 AIR QUALITY

Introduction

9.1 The proposed development of Land North of Gavray Drive, Bicester, has the potential to affect local air quality, therefore an air quality assessment needs to be undertaken in order to consider the likely impacts and effects of the proposed development.

9.2 This chapter discusses the relevant European and national air quality standards, explains the methodology used to assess any potential impacts that could occur as a result of the planned development and also looks at assumptions made in the absence of data for the assessment.

9.3 In the assessment of air quality for the proposed development, an initial evaluation of the existing (baseline) air conditions surrounding Bicester was made and this was then used as a basis to investigate the likely impacts to future air quality. The air quality assessment has been carried out using the *Design Manual for Roads and Bridges* (DMRB) "screening" methodology. To determine the significance of the air quality impacts they have been compared to the national and European air quality standards and also to the number of nearby residential properties, the number of people who could be affected, the duration of any effects and their likelihood of occurring.

Assessment Methodology

Approach

9.4 The assessment was carried out using the screening method outlined in *Version 1.02 (Environmental Assessment) of the Design Manual for Roads and Bridges (DMRB) (Highways Agency, November 2003)*, assessing the five key pollutants recommended in the methodology. These pollutants include carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide (NO_2) and particulate matter (PM_{10}).

9.5 The DMRB methodology allows the assessment of changes in local air quality as a result of changes in traffic flows and proportions of Light Duty Vehicles and HGVs, associated with the proposed development. Given the relatively small scale of the development (500 residential units, with associated facilities), its residential nature as opposed to industrial or commercial and the existing forecast that air quality standards and objectives will be met by the relevant dates, it was considered that this

was an appropriate approach to be taken for the assessment rather than full-scale modelling.

9.6 The purpose of the methodology is not for use as an indicator of exact pollutant concentrations, but provides a useful tool to make comparisons between various scenarios. In this assessment comparison is made between the existing 2004 scenario and the future (2006, 2010 and 2016) scenarios without the development in place, with a 500 unit development in place. This methodology also identifies where further, more detailed assessment could be necessary.

9.7 For the assessment of pollutant concentrations surrounding the development site, receptors in close proximity to the site and on roads immediately affected, representative of other nearby properties, were chosen. Four existing residential properties were chosen as receptors and two further proposed residential properties on-site were also chosen as receptors, assessed for the scenarios with the proposed development in place.

9.8 The receptors used in the DMRB assessment are:

- Residential property with rear façade backing centre of Gavray Drive (7 Heron Court)
- Residential property at the corner of Gavray Drive and the Eastern Distributor Road (rear façade of property backing onto Shearwater Drive)
- Residential property between Peregrine Way entrance and exit (rear façade of property on Ravenscroft backing onto Eastern Distributor Road)
- Residential property on Peregrine Way (property on the northern 'exit' portion of the road)
- Proposed residential property on-site, property at the corner of Gavray Drive turning north onto the Eastern Distributor Road
- Proposed residential property on-site, property at the northern most limit of the eastern portion of the site (adjacent to railway line)

9.9 The receptors have been assumed to be at ground floor level as the DMRB method does not make a distinction between receptor heights. The methodology used in this assessment therefore can be described as providing a "worst-case" scenario, as receptors at a higher vertical level will generally be exposed to lower pollutant concentrations compared with those at ground level.

Assumptions

9.10 Due to a lack of data, a number of assumptions have been made in the air quality assessment. The first of these assumptions are the existing background pollutant concentrations. As the scope of this assessment does not require a full-scale modelling assessment, no monitoring of local air quality has been carried out, therefore background pollutant concentrations on which to base the air quality assessment have been taken from the Government's National Air Quality Archive.

9.11 The other assumptions that were made were due to deficiencies in traffic data. A requirement of the DMRB screening assessment is that the traffic numbers are given in AADT (Annual Average Daily Traffic), however, the data were provided in the form of AM and PM AADT peaks. So in order to use these data in the correct format an average was taken of the two.

9.12 Within the traffic data, assumptions were also made of the percentage of HGVs in the overall totals and the speed limits along the various roads. Percentages of HGVs were provided for the existing scenario, but it was not anticipated by the traffic consultants (Colin Buchanan and Partners) that there would be a significant change in these in the future and so the same proportions of HGVs have been used for all scenarios in the assessment. The speeds that vehicles would be travelling at for the roads surrounding the site were not provided for the assessment either. A reasonable estimate was made, however, as to what the speed limits on the particular roads would be.

9.13 All calculated flows for the present and estimated traffic flows and background pollution concentrations used in the DMRB screening assessment are given in Volume 2, Technical Appendix, Chapter 09.

Significance Criteria

9.14 The following criteria have been applied to the construction and operational effects of the development:

Major positive or negative effect	Where the development would cause a significant deterioration (or improvement) to the existing environment. These effects are likely to be important considerations in the planning process, depending upon the scale and relative importance attached to the issues in planning policy and development plan terms. Mitigation measures and detailed work are unlikely to remove all the effects upon the affected interests.
Moderate positive or negative effect	Where the development would cause a noticeable deterioration (or improvement) to the existing environment. Adverse effects of this kind are not likely to require design changes. Mitigation measures and design changes are likely to remove some but not all of the adverse effects upon the affected interest.
Minor positive or negative effect	Where the development would cause a barely perceptible deterioration (or improvement) to the existing environment. Adverse impacts of this nature are not key issues. These effects are minor issues that are of importance to the consideration of the design of the proposals and the mitigation measures proposed.
No change or neutral effect	No discernible deterioration or improvement to the existing environment.

Regulatory Background

Air Quality Objectives and Limit Values

9.15 European Union (EU) air quality policy provides the basis for UK national air quality policy. The EU Air Quality Framework Directive on Ambient Air Quality Assessment and Management was brought into operation in September 1996, with succeeding daughter directives following on from this and setting Europe-wide air quality standards.

9.16 Within the UK the Environment Act (1995) brought about the National Air Quality Strategy (1997) (NAQS), which is responsible for forming the UK air quality standards and objectives (guidelines) for specific pollutants. The NAQS also sets out measures for local authorities to work towards meeting the standards and objectives under Local Air Quality Management (LAQM). The NAQS was revised in 2000 as the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR, 2000a) and an addendum to this was published in 2003 (DEFRA, 2003a). Standards and

objectives relevant to LAQM are set in the Air Quality Regulations (England) (2000 and 2002) and are set in order to ultimately protect the most vulnerable groups in society in terms of human health and in some cases for the protection of vegetation and ecosystems.

9.17 Objectives are set in the Air Quality Regulations for seven key pollutants and those relevant to this assessment are shown below in **Table 9.1**.

Table 9.1: UK Air Quality Objectives set in Regulations

Pollutant	Averaging Period	UK Objectives/ Limit Values	Year for Compliance	EU Limit Values	Year for Compliance
Benzene	Running annual mean	16.25 µg/m^3	31 Dec 2003	5 µg/m^3	1st Jan 2010
	Annual mean (Eng & Wales)	5 µg/m^3	31 Dec 2010		9.18
1,3-butadiene	Running annual mean	2.25 µg/m^3	31 Dec 2003	N/A	N/A
Carbon monoxide	Maximum daily running 8 hour mean	10.0 mg/m^3	31 Dec 2003	10.0 mg/m^3	2005
Nitrogen dioxide	1 hour mean	200 µg/m^3 (not to be exceeded more than 18 times per year)	31 Dec 2005	200 µg/m^3 (not to be exceeded more than 18 times per year)	2010
	Annual mean	40µg/m^3	31 Dec 2005	40µg/m^3	2005
PM_{10} (gravimetric)	24 hour mean	50 µg/m^3 (not to be exceeded more than 35 times per year)	31 Dec 2004	50 µg/m^3 (not to be exceeded more than 35 times per year)	2005
	Annual mean	40 µg/m^3	31 Dec 2004	40 µg/m^3	2005

Baseline Conditions

Air Pollution Sources

9.19 The primary air pollution source for the immediate vicinity of the site at present is road traffic, with the associated pollutants being nitrogen dioxide, particulate matter, carbon monoxide, benzene, and 1,3-butadiene.

9.20 Two railway lines also border the site to the north and to the west, both bringing electric and diesel powered trains in close proximity to the site. Such locomotives emit nitrogen oxides, sulphur dioxide and particulate matter. Moving locomotives do not, however, make a significant contribution to short-term pollutant concentrations.

9.21 Exposure to stationary locomotives may be more significant, but only if locomotives are regularly stationary for periods of 15-minutes or more and if there is regular outdoor exposure within 15m of the stationary locomotives. The nearest stations to the Gavray Drive site are at a great enough distance for emissions from these to be considered insignificant.

Cherwell District Review and Assessment of Air Quality

9.22 The most recent Review and Assessment of Air Quality and subsequent Updating and Screening Assessment (*Air Quality Updating and Screening Assessment for Cherwell (Draft), February 2004)*, concluded that there would be no exceedence of the air quality objectives for any of the seven key pollutants in the relevant years and therefore no Air Quality Management Area has been declared in the district.

Background Pollutant Concentrations

9.23 The screening method requires annual mean background concentrations for each pollutant assessed. The background concentrations for all pollutants were taken from the background pollution tables for Cherwell District Council available in the Government's National Air Quality Archive (http://www.airquality.co.uk/archive/laqm/tools.php?tool=background) at National Grid Reference 462500, 224500. These were obtained for the present scenario of 2004 and for 2006, 2010 and 2020 using the procedures detailed on the National Air Quality Archive website.

9.24 Background concentrations used in the DMRB screening assessment are shown below in **Table 9.2.**

Table 9.2: Annual Average Background Pollutant Concentrations

Pollutant	Annual Average Concentration (μgm^{-3})			
	2004	2006	2010	2016
CO	0.19	0.16	0.12	0.11
Benzene	0.21	0.19	0.18	0.17
1,3-butadiene	0.09	0.07	0.06	0.06
NO_2	19.37	17.72	15.4	13.97
PM_{10}	17.8	17.58	16.4	16.4

Potential Impacts

Construction Effects

9.25 Atmospheric emissions from construction activities will depend on a combination of the potential for emission (the type of activities) and the effectiveness of control measures. In general terms, there are two sources of emissions that will need to be controlled to minimise the potential for adverse environmental effects:

- Exhaust emissions from site plant, equipment and vehicles
- Fugitive dust emissions from site activities.

9.26 The operation of site equipment, vehicles and machinery would result in emission to the atmosphere of un-quantified levels of waste exhaust gases but such emissions are unlikely to be significant, particularly in comparison to levels of similar emissions from road traffic. The principal construction activities with transportation implications are:

- Removal of materials from any demolition work
- Delivery of materials for new development
- Movement of heavy plant.

Construction traffic could have any impact on adjoining occupiers if not properly controlled, however mitigation measures will reduce these impacts.

9.27 The construction activities that are the most significant potential sources of fugitive dust emissions are:

- Demolition activities;

- Earth moving, due to excavation, handling, storage and disposal of soil and subsoil materials;
- Construction aggregate usage, due to the transport, unloading, storage and use of dry and dusty materials (such as cement powder and sand);
- Movement of heavy site vehicles on dry untreated or hard surfaces;

Movement of vehicles over surfaces contaminated by muddy materials brought off the site, for example, over public roads.

Operational Effects

9.28 Referring back to the national air quality standards and objectives (see Table 9.2), all pollutants are well within all relevant standards and objectives for all pollutants assessed. Pollutant concentrations also decrease or remain at the same level over time from the 2006 scenarios to the 2016 scenarios as they do from the Do Minimum to Do Something scenarios. This is as a result of improving vehicle technologies and removal of older cars from the national vehicle fleet over time. Any increases are negligible, however, and all remain well within the respective standards and objectives.

9.29 In comparison with the 2004 pollutant concentrations, the predicted concentrations for the greater majority of the future scenarios, both with and without the proposed development in place, show slight decreases.

9.30 As previously discussed the railway lines to the north and west of the site do not represent a significant problem in terms of air quality to the site.

Mitigation Measures

Proposed Construction Mitigation Measures

9.31 Prior to commencement of construction activities, a Code of Construction Practice (CoCP) will be agreed with the local council to ensure the potential for adverse environmental effects on local receptors will be avoided. The Code is expected to contain the following air quality mitigation measures:

- Wheel washing facilities to prevent mud from construction operations being transported on to adjacent public roads;
- Damping down of site haul roads during prolonged dry periods;
- Regular cleaning of hard-surfaced site entrance roads;

- Ensuring that dusty materials are stored and handled appropriately (e.g. wind shielding or complete enclosure, storage is away from site boundaries, drop heights of materials are restricted, watersprays are used where practicable to reduce fugitive dust emissions);
- Ensuring that dusty materials are transported appropriately (e.g. sheeting of vehicles carrying spoil and other dusty materials);
- Confinement of vehicles to designated haul routes within the site;
- Restricting vehicle speeds on haul roads and other unsurfaced areas of the site;
- Hoarding and gates to prevent dust breakout;
- Appropriate dust site monitoring is included within the site management practices to inform site management of the success of dust control measures used.

9.32 Construction activities would hereby be controlled to reduce as far as possible the potential environmental impacts, and therefore limiting residual impacts.

Proposed Operational Mitigation Measures

9.33 In terms of the five key pollutants (carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide and particulate matter) the proposed development has no negative impact on the local air quality, especially so over time and therefore no mitigation measures are proposed with respect to operational traffic.

Residual Effects

9.34 With suitable mitigation measures in place, **minor negative** to **neutral** effects on local air quality are expected as a result of the construction of the Gavray Drive site. These effects would be relatively short-term and temporary. No long-term residual effects are expected as a result of the construction of the proposed development.

9.35 The effects of the proposed development on local air quality are primarily positive with the majority of receptors showing the development effects to be **neutral**.

Conclusions

9.36 This air quality assessment examines existing air quality, outlines the relevant air quality standards and objectives and assess the potential changes in air quality arising from the development of the Gavray Drive site in Bicester.

9.37 Cherwell District Council's Review and Assessment of Air Quality concluded that there would be no exceedence of the air quality objectives in the relevant years and therefore no Air Quality Management Area has been declared in the district. This conclusion was recently confirmed by Cherwell District Council's Updating and Screening Assessment (*Air Quality Updating and Screening Assessment for Cherwell (Draft), February 2004*).

9.38 The principal construction effect of the proposed development on local air quality will be where dust causes a nuisance for the limited time of construction activities. Such nuisance will be controlled, however, through mitigation measures contained within the code of Construction Practice, making certain that adverse impacts of construction on air quality are kept to an absolute minimum or completely avoided

9.39 Impacts to local air quality from the proposed development with a range of community facilities will be from associated road traffic. The pollutants assessed were carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide and particulate matter. Together with background pollutant concentrations for the site, traffic data with anticipated changes in traffic flows due to the developments were used to predict air pollution concentrations for the existing scenario (2004) and in the future years 2006, 2010 and 2016, with and without the development in place.

9.40 The predicted concentrations indicated that all national air quality objectives will be met by the relevant years with and without the development in place. The predicted concentrations also indicate that the effects of the proposed development on local air quality is **negligible**.

10.0 NOISE AND VIBRATION

Introduction and Scope Of The Assessment

10.1 It is proposed that the site adjacent to Gavray Drive in Bicester be developed for residential purposes and for a rail link. Arup Acoustics has carried out a noise examination of the proposals and this is attached to this EIA as a Technical Report. The findings included in this Report form the basis upon which this assessment has been prepared.

10.2 This assessment examines the potential noise changes that are likely to occur in the surrounding area as a result of these proposals. The short term sources associated with the construction phases and the long term occupational noise consequences are separately considered. The occupational sources are limited to the changes in traffic flow or composition on the existing road network with the possible importation of additional sources from plant and equipment to serve the school and associated community buildings.

10.3 The assessment does not consider the suitability of the site for residential development as part of the EIA but this point is fully examined in the Technical Report.

Reference Material and Assessment Method

Construction Noise

10.4 The most significant civil engineering work on this site will be that associated with the provision of the internal estate roads and the building of the new school. There will be some groundwork required with regard to local levelling but large scale earthworks are not envisaged. At this stage of the process details are not available as to the type of plant that would be used, nor the timing or timescale of a particular activity. It is noted that Gavray Drive has been laid out in such a way as to incorporate access points into the proposed development site and this will limit the amount of disruption of traffic on this road that may occur. It will also result in their being a separation of some 40-50 m from the facades of the nearest buildings to the on-site activity.

Traffic Noise

10.5 The proposed development of this area of land for residential purposes will result in increased traffic flows along Gavray Drive and the Eastern Distributor Road around Bicester. In order to gauge the likely effect of these increases in noise terms an analysis has been carried out that examines the change in noise exposure that would result. Two scenarios have been compared. The 'do minimum' situation which would reflect the situation where no development takes place and the 'do something' situation which reflects the situation where the development is in place and fully operational.

10.6 The following significance descriptors are proposed for traffic noise assessment. The threshold at which traffic noise change becomes significant is based on relevant research [Harland (1977)] and current guidance [Department of Transport (1994)]. For greater noise changes, increasing significance categories have been assigned at 5 dB(A) increments as changes of this magnitude are generally accepted as being noticeable by most people. This framework of significance levels, although not based on any official guidance document, is widely recognised and has been frequently adopted in traffic noise assessments.

- **major adverse**: Noise levels warrant mitigation of residential properties on a widespread basis in a community where practicable. This would relate to increases in noise level of 11-15 dB(A).
- **major beneficial**: Reduction of traffic noise to a level where it does not have a significant influence on the ambient noise in the area;
- **moderate adverse**: Noise levels warrant mitigation of residential properties in a community where practicable. This would relate to increases in noise level of 5-10 dB(A).
- **moderate beneficial**: Reductions in noise level of 5-10 dB(A) at residential communities;
- **slight adverse**: Increases in noise levels of 3-5 dB(A) in residential areas or at outdoor recreational areas in close proximity to the highway.
- **slight beneficial**: Reductions in noise level of 3-5 dB(A) at residential communities;
- **negligible**: Changes in noise level of less than 3 dB(A) in residential areas or at outdoor recreational areas in close proximity to the highway.

Plant Noise

10.7 The potential for any installed plant to generate complaints will be assessed using the Methods and Procedures of BS 4142 *Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas.* This method compares the pre-existing background noise level and compares it with the incoming noise level. This incoming level is weighted to take account of its acoustic characteristics. The difference is taken as an indicator of the likelihood of complaints arising. Differences of 5 dB are of *marginal* significant and rating noise around 10 dB greater than the background noise is taken as a *positive indication that complaints could arise.*

Assumptions Limitations and Technical Difficulties

10.8 The traffic noise changes were calculated using the predicted road traffic volumes at the appropriate times. Absolute traffic noise levels were not calculated. There was no information available concerning the construction methods that would be employed at this site. This is not unusual at this stage of a proposal and generic equipment and procedures were assumed to be relevant to this scheme.

Existing Conditions

10.9 The existing noise condition in the local area were examined with a baseline noise survey. This was carried out by Arup Acoustics' engineers Jamie Walker and Julien Francois over a period from 12:00 on Tuesday 29 July 2004 to 12:00 on Wednesday 30 July 2004. Measurements were taken at locations 1 to 4 in rotation over each hour. A logging meter was set up at location 5 to log data every 5 minutes for the 24 hour period.

10.10 For each noise measurement, the sound level meter used, noise climate, wind speed and direction, and the precise measured noise levels were noted. LA10, LA90, LAeq and LAmax, noise indices were recorded as was traffic counts on adjacent roads where necessary. The results are reported in the Technical Report.

Measurement Location Descriptions

10.11 Noise measurements were taken at five locations during the survey period and these are shown in **Figure 10.1** and detailed below.

Location 1- North-east corner of the site

10.12 The sound level meter (SLM) was sited 3 m to the north of a virtually dry pond and 12 m west of the hedge which runs along the east side of the field. The field is covered with long grass and surrounded on all sides by hedges. Gavray Drive was 260 m away to the south-west, the A4421 was 140 m to the east and the London to Bicester railway line was approximately 100 m to the north-east.

10.13 During the daytime the A4421 dominated with some very intermittent noise from Gavray Drive. Cars on Gavray Drive were only just audible, though larger vehicles were noticeable. When the A4421 and Gavray Drive were quiet distant road noise from the A41 in the west-south-west was audible. There was some, sporadic noise from children playing around lunch time. Birdsong was particularly significant just before sunset and in the morning. There were occasional trains throughout the day though those in the evening, when other noise sources were quiet were more noticeable. There were occasional aircraft over head and some noise from the wind in the trees. There was no noise from the depot on the north side of the railway line.

10.14 During the night-time noise from the A41 was almost constantly heard with intermittent noise from the A4421, a number of HGVs passed which were particularly noisy. Noise from Gavray Drive was also present but very intermittent. The A4421 got louder before the A41.

Location 2 – South-eat corner of the site

10.15 The SLM was sited 7 m north-west of the corner of the field and had hedges 5 m away to the south-east and south-west. To the north-west, north and north-east was an open field covered in long grass. Location 1 was approximately 120 m to the north-east with the railway 100 m further away in the same direction. Gavray Drive was approximately 150 m away to the south-west and the A4421 was approximately 120 m away to the east.

10.16 The daytime noise climate was dominated by the A4421 together with the A41 audible during quiet periods. Very infrequent traffic on Gavray Drive was audible including one or two vans and HGVs. Trains were audible though not visible and not

frequent. There were a number of aircraft overhead during the day including a loud flypast by a helicopter. There was occasional low noise from Bicester town centre and from the wind in the trees. Birds also had some local input though this varied greatly throughout the day.

10.17 The night-time noise was dominated by intermittent traffic on the A4421 including HGVs and fairly constant noise from the A41, the roads were quietest between 02:00 and 05:00. At around 04:00 just as it started to get light, noise from bird song was as significant as road noise from all sources. Trains in the early hours (02:00) of the day and up until midnight were heard, though not throughout the rest of the night.

Location 3 – On the footpath between Gavray Drive and Peregrine Way

10.18 The measurement location was on the east side of the path adjacent to the rear façade of the closest house on Merganser Drive. Gavray Drive was approximately 30 m away to the north-east and visible at the end of the footpath. The A4421 was approximately 130 m away to the south-east and screened by hedges and two storey residential buildings. The edge of the proposed development was approximately 50 m to the north east.

10.19 The daytime noise climate was dominated by the A4421 together with the intermittent traffic on Gavray Drive. The A41 was audible when other noise sources were quiet. Noise from people on the footpath was loud but brief. Lawn mowing and gardening 20-30 m away as well as people in their gardens were heard throughout most of the daytime measurements though, except for the lawn mower, these events were relatively quiet. Occasional bird song and aircraft overhead also had some input though neither was significant during the day.

10.20 The night-time measurements were dominated by the A4421 and the A41 with intermittent input from Gavray Drive. A very small number of trains were heard, although from this location these were very quiet. Bird song was significant during the early hours reaching a peak around 04:00, although bird song was the loudest noise at this time it was still intermittent.

Location 4 – On the footpath at the western end of the site

10.21 The measurement location was at the northern end of the field 15 m south of where the footpath crossed the line of the north to south hedge. The London to Bicester railway was 60m away to the north-east and the freight railway was 60 m to the north-west. Approximately 90 m to the north was the London to Bicester railway bridge

over the freight railway. The footpath continued to the north under this same bridge. Gavray Drive was approximately 150 m away to the south-west and hidden from view by the hedge along the southern edge of the field. The London to Bicester railway was on an approximately 10 m high embankment and trains on it were visible for some distance in both directions.

10.22 Day time noise was from a large number of intermittent sources. Trains on the London to Bicester line were frequent and often blew their horns before crossing the bridge over the Freight line and a noise like trains shunting was heard at various times to the west. Traffic on the A41 provided a fairly constant background noise which was audible when other sources were quiet, the same was true of the A4421 though this was more intermittent noise. Bird song was fairly loud at times but not constant. The wind through the trees was audible when the wind was strongest. Some noise sounding like an industrial fan was heard to the west though as this was relatively quiet it was mainly heard when other noise sources were quiet. There were a number of aircraft overhead including two helicopters which were particularly loud though only briefly in the area. In the evening children camping in a field adjacent to the measurement location meant that it was necessary to move the measurement location 100 m along the footpath to the south-west. This noise continued throughout the whole evening and night.

10.23 Night-time noise also had no single dominant source except that the noise from the A41 was the most consistent. Intermittent traffic on the A4421 could be heard faintly, traffic on Gavray Drive was also heard though this was even more infrequent. Birdsong at first light was particularly noisy though only after 03:30. A single freight train on the north to south railway line was heard; this was a large train with 50+ aggregate trucks.

Location 5 – The Logging Meter

10.24 The logging meter was placed 10 m east of a hedge 160 m north-east of Gavray Drive. The SLM was on the edge of a large field with a hedge approximately 35 m to the north-east. The London to Bicester railway was approximately 180 m to the north-east and was almost completely obscured by trees along its edge. Location 1 was 200 m away to the east but obscured by a large mature hedge.

10.25 Location 3 was the only position that was not on the site and accordingly the only measuring point strictly relevant to the EIA examination. However the other points do give an indication to the character of the local noise climate. At location 3 the daytime background noise levels ranged from 35 – 46 dB(A) L_{A90} with the evening

part of the day recording the lower level. During the night time period the levels ranged from 31-41 dB L_{A90} . The level in the quietest part of the night falling to 31 dB. The general character of the noise in this area was dominated by traffic on the A41 and the A4421. During the day traffic on Gavray Drive was noted. The noise from trains was not at a significant level at this location. Traffic noise exposure in terms of L_{A10} or L_{eq} were well below any level where action would be taken under the Noise Insulation Regulations.

Potential Impacts

Construction

10.26 Notwithstanding the limited potential for adverse effects from construction activities, it remains relevant to consider the means whereby this source may be controlled. The Code of Practice BS 5228 sets out methods and procedures whereby construction noise may be minimised and would require that these methods are followed. The selection of the quietest machinery available to carry out any given task would, for example be an advantage if piling operations are to be carried out. Timing a particular on site operation to coincide with the noisier ambient conditions, perhaps during peak traffic periods, would serve to limit the impact of that operation. The erection of a temporary noise screen would assist in some circumstances.

10.27 In order to ensure that the favourable circumstances of this development are maintained it is recommended that a Construction Schedule is drawn up with the contractor at the appropriate time and that this is agreed with the Local Authority. In this way the most appropriate mitigation measure can be specified if required and the overall residual noise from construction activity reduced to a level where it is not significant.

Operational

10.28 For this site potential operational impacts are limited to those from road traffic changes and incoming plant. The calculated road traffic changes are set out in the technical appendix and reproduced in **Table 10.1** below for convenience.

Table 10.1 Change in noise level resulting from traffic change as a result of the development

	2006 no dev. Do minimum	2016 with dev Do something	Increase factor	Change in noise level

	18 hour AAWT	18 hour AAWT		dB $L_{A10, 18\ hour}$
Gavray Drive	1780	6237	3.50	+5
EDR	14963	20636	1.38	+1

Assessment of Traffic Noise

10.29 The classification of effects was set out in paragraph 10.6. Using these indications it can be seen in Table 10.1 that the increase in traffic noise will expose the dwellings adjacent to Gavray Drive to an increase that can be classified as on the boundary between a **slight adverse** effect and a **moderate adverse** effect. It would be expected that most of the exposed population would recognise that an increase of traffic noise had taken place.

10.30 Although traffic noise levels are forecast to increase with the scheme in place, it is considered that the noise levels would still be acceptably low. To put this into context, the forecast traffic noise levels would be well below guideline levels for outdoor living areas recommended by the World Health Organisation. Using this same criterion, traffic noise levels are not considered high enough to cause annoyance.

10.31 For the dwellings that are primarily exposed to the traffic noise from the eastern distributor road the traffic noise increase would be considered to be **negligible.** The residents of these dwellings would not be expected to register the change in noise exposure.

10.32 The traffic noise analysis set out above assumes that the increases in traffic volumes for the phases of the development are relevant for the whole length of Gavray Drive. Traffic figures are available only for the activity at the junction of Gavray Drive with the Eastern Distributor Road. This being the case the analysis is restricted to the area between the last exit onto Gavray Drive, from both the existing development and the proposed development, and the junction. However, in reality it can reasonably be assumed that the proportional change, and therefore the noise level increase, would be relevant to any position adjacent to this road.

Installed Plant Noise

10.33 There is almost no likelihood that there will be any significant plant or machinery installed with the residential element of this development. The school building would almost certainly opt to install natural ventilation and the only plant would be that associated with heating. The school is some 70 m from the nearest existing dwelling and at this distance such plant would not have a significant effect. The proposed community facility would be expected to have some plant provided, such as a chiller or heating plant. To avoid any such impact on the existing residential receptors on the adjacent area of Gavray Drive, any such plant should be specified such that the

resulting noise sensitive receptor does not have a rating level that exceeds the existing backround noise level.

Mitigation

10.34 After consideration of the potential noise effects as set out above, it is concluded that no significant adverse effect is likely. Accordingly no mitigation measures are proposed and there would be no adverse residual effects.

11.0 ARCHAEOLOGY AND CULTURAL HERITAGE

Introduction

11.1 This Chapter assesses the impact of the proposed development on potential archaeological resources on land at Gavray Drive, Bicester, Oxfordshire.

11.2 It describes the methods used to assess the impacts, the baseline conditions currently existing at the site and in the vicinity, the potential direct and indirect impacts of the development arising from construction activities, and the mitigation measures required to prevent, reduce or offset the impacts and the residual impacts.

Methodology

11.3 The archaeological background has been assessed using the Oxfordshire Sites and Monuments Record which reports on chance discoveries and archaeological site works. A brief history of the development site has been documented by a study of historical maps, books and articles in the Centre for Oxfordshire Studies and the Oxfordshire Archives. Aerial photographs at the National Monuments Record in Swindon have also been consulted.

11.4 This assessment has been carried out in accordance with standards set by the Institute of Field Archaeologists (IFA 2001) and English Heritage Guidelines for archaeological desk-based assessments. It follows guidance set out in the Department of Environment document 'Planning Policy Guidance: Archaeology and Planning (PPG16) which identifies the need for early consultation in the planning process to determine the impact of construction schemes upon any buried archaeological strata. It indicates that there is a presumption in favour of preservation *in situ* over excavation, where remains are of national importance. PPG16 goes on to state that once the results of a desk-based assessment and, where necessary, the follow-up trial work is known, an informed decision for determining whether any further archaeological work is required in advance of, or during, the development programme can be made (paragraphs 19 and 20).

11.5 In summary, the work has involved:

(i) A review of policy considerations and the legislative framework and requirements;

(ii) Review of previous archaeological reports on Bicester Park and Bicester Fields Farm;

(iii) Undertaking a geophysical survey on the western part of the site;

(iv) Examination of relevant publications, articles, historic maps and plans;

(v) An evaluation of likely impacts of the development and of the need for further work, based upon the potential for resources to be present at the site;

(vi) A review of information held by the Oxfordshire Sites and Monuments Record (OSMR).

National Planning Policy

Planning Policy Guidance Note 16 (PPG16) - Archaeology and Planning

11.6 PPG16 sets out the Government's policy on the preservation and recording of archaeology. The general policy is similar to that for the historic environment in that archaeological remains are seen as finite and non-renewable and therefore require appropriate management to ensure their preservation in a good condition. Field evaluations and early consultations with planning authorities are advocated where proposed developments impact upon archaeological remains.

Local Planning Policy

11.7 Policies relating to archaeology in the adopted Cherwell Local Plan (adopted November 1996) mirror advice contained in PPG16. Policy C25 states the council will want to maintain its overall historic character and will protect, enhance and preserve scheduled ancient monuments, other nationally important archaeological sites and monuments of special local importance, where appropriate. C26 states that for determination of an application for development that may affect a known or

potential site of archaeological interest or its setting, applicants will be required to provide detailed information, and may be asked to provide an archaeological field evaluation.

11.8 Policies are similar in the Cherwell Local Plan Deposit Draft February 2001. Policy EN47 states there will be a presumption in favour of preservation *in situ* of archaeological remains of national importance including scheduled ancient monuments. It would not permit development that would adversely affect archaeological remains and their settings unless the applicant can demonstrate that the archaeological resource will be physically preserved *in situ*, or a suitable strategy has been put forward to mitigate the impact of development proposals. Measures will be secured either by a planning agreement or by a suitable planning condition.

Significance Criteria

11.9 The following significance criteria have been adopted in undertaking the assessment of impacts.

Substantial Adverse

11.10 Adverse effects caused to sites of High Archaeological Potential or Archaeological Priority Areas, Scheduled Ancient Monuments including their settings and to other archaeological sites of importance in breach of PPG16 and archaeology policies in Local Plans. The severity of the effects would require the impacts to be redesigned, to allow for *in situ* preservation and/or considerable archaeological works. Demolition of a Grade I Listed Building.

Moderate Adverse

11.11 The adverse effects would be to archaeological resources at a local level by engineering impacts which would leave large areas of the resource *in situ*. Archaeological investigation would provide a positive contribution to research agendas. Extensive change to the setting of a Grade II* listed building. Encroachment upon a Conservation Area, historic parkland or other historic landscapes where the quality of the setting or its amenity would be noticeably impaired.

Minor Adverse

11.12 Minor adverse effects are to small areas of known or potential resources at a local level. The monitoring of the effects and recording of any resources would be achieved by an archaeological watching brief. The removal of the archaeological resource would not effect future archaeological investigation and would increase archaeological knowledge. Slight adverse change to the setting of a Grade II* listed building or significant adverse change to the setting of a Grade II listed building. Demolition of a locally listed building. Encroachment upon a Conservation Area or historic parkland, but where no intrusive views are created or affects upon its integrity would result.

Negligible

11.13 No effects on a known or predicted archaeological resources or their settings. Mitigation protects the resource from accidental impacts and adverse effects.

Minor Beneficial

11.14 Change of land use or management to enhance the preservation of identified archaeological deposits.

Baseline Conditions

Introduction

11.15 The following summarises the most pertinent archaeological and built heritage information relating to the proposed development site. The location of the sites taken from the Oxfordshire Sites and Monuments Record in the vicinity of the site are tabled in Appendix 1 and indicated on **Figure 11.1** using the OSMR reference number.

Prehistoric

11.16 SMR information indicates prehistoric and Romano-British occupation on the edge of Bicester including the floodplain of the Langford Brook is greater than previously thought and the area was more extensively farmed.

11.17 Prehistoric ring ditches and an enclosure are recorded on the SMR in two locations to the north of the site (D5630 and D5631). Archaeological investigations at Slade Farm, on the north western side of Bicester, recovered worked flint dating to the Mesolithic period, as well as evidence of Bronze Age and Iron Age occupation. This

included a wide linear ditch of Iron Age date possibly relating to a droveway. Several pits and possible palisade gullies appeared to be associated with this feature. An Iron Age ring ditch was identified to the west of the linear feature, which is probably a foundation trench for the wall of a roundhouse. In addition, an irregular sub-rectangular feature and a linear gully with two possible postholes at its base contained Mesolithic microliths (BUFAU 1996).

11.18 Recent archaeological investigations in the form of geophysical survey and trial trenching at Bicester Fields Farm to the south of the site (OX36/OX47/16120) revealed evidence of later prehistoric settlement in the form of a sub rectangular enclosure and associated pits and gullies. A possible circular structure was also revealed on the outer edge of the enclosure ditch. The pottery indicated a Middle to Late Iron Age date (OAU July 1998). Post-Medieval quarrying had destroyed any archaeology in the south eastern part of the site.

11.19 The following open area excavation expanded the results of the evaluation and revealed the plan of a substantial rectilinear ditched enclosure of Middle to Late Iron Age date occupying around a hectare, with a possible causeway formed of a dump of burnt stone (OAU November 1998). A central building was indicated by a group of stone-packed postholes and curvilinear gullies. There was also evidence of animal and human burial.

11.20 Excavations undertaken by the Birmingham University Field Unit in 1996 at Oxford Road, Bicester recorded transitional Iron Age / Romano British activity on the floodplain of Langford Brook. The site was buried by post-Roman alluvium. Iron Age and Roman pottery and features including a ditch and a posthole were discovered to the north east of the site on the Bicester Perimeter Road (16540).

Romano-British

11.21 Bicester is located approximately 2km north of the Roman town of Alcester, which was built near the cross roads of Akeman Street and the Alcester to Towcester Roman roads. Late Iron Age to early Roman settlement is known in the area from an investigation on the A421 and an excavation to the south west of the site at the Bicester Village shopping centre.

11.22 An evaluation on the eastern part of the site on behalf of Unipart in 1996 revealed evidence of a low status Roman settlement of 2nd century date (OX103/16071) (Oxford Archaeology Unit 1996). The evidence consisted of a number of ditches and

gullies interpreted as a phase of unenclosed settlement succeeded by an enclosed settlement.

Early Medieval to Post-Medieval

11.23 The evaluation on the eastern part of the site in 1996 also revealed Anglo-Saxon activity indicated by small quantities of pottery. A parish boundary along the southern boundary of the site may be late Saxon in date. A hedgerow survey carried out by EPCAD in 1996 indicated that the hedge associated with the parish boundary was one of the oldest on site, possibly as early as the late Medieval period. An earthwork survey of surviving ridge and furrow was also undertaken in 1996. The Medieval earthworks formed a more widespread arrangement of ridge and furrow than was evident on air photographs.

11.24 The site lies within the parish of Bicester, Launton and a small section in Ambrosden. Although the town of Bicester probably had Roman origins, it grew in the Middle Ages around the River Buse. The Domesday records of 1086 state that Bernecestre had two mills and was ruled by Robert d'Oilly, Sheriff of Oxfordshire. The place name Bernestre, the old English for Bicester, might come from the words byrgen (meaning burial mound), and ceaster (meaning Roman fort or market). Alternatively, the origins of the name might come from Birinus, a Saxon who traditionally founded a frontier garrison by the ruins of Alcester.

11.25 In the 12th century the town became a religious centre and housed the nuns of Markgate at Nonnes Place. In 1182 Gilbert Bassett, heir to Milo de Crispin's Norman estates, established a priory for eleven Black cannons. In c1239 King Henry III gave a grant of a market to William de Longspee and floodplain areas near the river were reclaimed to build new properties. Waterlogged archaeological deposits dating to the Medieval period were encountered during excavation.

11.26 The Saxon name Launton means the "long tun" and was a large settlement in the Medieval period. The 18th century village is shown on Davis's map of 1797 **(Figure 11.2)**. The first enclosure for pasture was made in 1582 by agreement between the manor of Launton and a Ralph Heydon, farmer. At enclosure in 1814 there remained around 1,650 acres of open field arable and waste shown on Davis's map as Launton Field. Documentary research carried out by OAU in 1996 consulted a parish map of 1607 in a private collection at Stratton Ardley House. The map shows no detail on it, as at this time it had already been enclosed, possibly as part of the 1582 agreement. The ridge and furrow is evidence that it was once part of the open field system. The

current field boundary ditches and hedges on the eastern part of the site studied are shown on the 1607 map (OAU 1996).

11.27 **Figure 11.3** is an extract from the Pre-Ordnance Survey map of 1812-1814 that shows field systems in the site area prior to enclosure in 1814.

11.28 The first edition Ordnance Survey map of 1885 (not reproduced) shows the field boundaries as almost identical to today's layout (see 1923 Ordnance Survey map **Figure 11.4**). The position of the green lanes which run east-west and north-south are also shown on the Tithe Map of 1850 (not reproduced).

11.29 A Scheduled Ancient Monument, Wretchwick Deserted Medieval Village, lies to the south east of the site (3257). Wretchwick dates from before 1234, when part of the manor was given to Bicester Priory. The final part of the manor was given to the priory in 1279. At this time Wretchwick is believed to have had 7 cottages. The village was depopulated by the Prior of Bicester in 1488. After the Dissolution in 1536 the land was given to Charles Brandon, Duke of Suffolk. Well-preserved earthworks survive around Middle Wretchwick Farm, however, no evidence for the village was found during construction work in the field west of Middle Wretchwick Farm.

11.30 A Medieval / Post Medieval windmill mound survives at (12695) to the north of the site at Launton.

11.31 SMR 12779 refers to ditched earthworks that may relate to fish ponds belonging to Bicester priory, which have since been destroyed by development. Medieval pottery was recovered at 8-16 London Road to the south west of the site (11500). In Launton are the Medieval Cross at St Mary's Church (2789) and the church itself (5142). The remains of a market cross (2790) also lie in Launton. Post-Medieval ornamental ponds are also recorded (2791).

11.32 The nearest references to the site are SMR 558, the site of a builders brickyard which was later used as a rubbish tip, and the Bicester London Road railway station (SMR 601). Other buildings recorded on the SMR relate to a Post-Medieval pest house (D1801), the site of a tollhouse (10165), 17/17A London Road buildings and lock up and the site of 8-16 London Road.

11.33 There are also two ancient hedgerows marked on the SMR at Love Alley (16633) and Jarvis Lane (16631).

Historic Buildings

11.34 There are no listed or locally listed buildings in the vicinity of the site.

Geophysical Survey

11.35 Archaeological services WYAS conducted a geophysical survey on the western part of the site in June 2004. The detailed survey was negative and no anomalies likely to be indicative of archaeological activity were identified. It was suggested in the report (Archaeological Services WYAS 2004) that alluvium from the Langford Brook could be masking magnetic responses from any underlying features.

Analysis of Aerial Photographs

11.36 The collection of aerial photographs held by the National Monuments Record Centre (NMRC) at Swindon was searched in May 2004. A total of seventeen oblique and 47 vertical aerial photographs, showing the proposed development site and its immediate environs, were made available for inspection and analysis. These photographs span the period from 1930 to 2001.

11.37 The seventeen oblique aerial photographs held in the NMRC's collection span the period from 1930 to 1998. Of these, fourteen showed the Middle to Late Iron Age enclosed settlement just to the south of the site (OX36/OX46/16120) under excavation in July 1998 (NMR 18074, 18077 & 18102). Although the very southern edge of the proposed development site is shown in a number of the photographs, no detail is discernible and no archaeological features can be identified.

11.38 Three oblique photographs (CCC 5249), which are dated 1st January 1930, show the western part of the site. The quality of the images is relatively poor, but the three photographs appear to show an area of ridge and furrow earthworks, which represent the remains of medieval or post-medieval ploughing.

11.39 The 47 vertical aerial photographs span the period from 1947 to 2001. The majority of the photographs show an area of ridge and furrow earthworks in the western part of the site. However, these earthworks appear to respect the alignments of the existing field boundaries and trackways and suggest that they are either contemporaneous with, or later than, the field system with which they are associated. This therefore suggests that they are of post-medieval, rather than medieval, date.

11.40 Detailed examination of the vertical photographs has also shown that the central part of the site have been extensively ploughed for the cultivation of arable crops since at least 1954 (1563). This is likely to have impacted upon any sub-surface archaeological deposits that may exist within the boundaries of the proposed development site. The only other noteworthy vertical photograph is one taken on 19th September 2001 (13884), which is the first to show the roads that define the southern and eastern boundaries of the site. Otherwise, the vertical photographs do not show any hitherto unidentified archaeological sites or features within the application site.

Assessment of Potential Impacts

11.41 The construction of residential units may have an adverse impact on potential archaeological remains. The ground conditions recorded on the eastern part of the site during the archaeological evaluation in 1996 consisted of topsoil overlying a Medieval plough soil, which was up to 0.40m deep, that in turn overlay an orange-brown to blue-grey subsoil containing features of Roman date. Construction activities such as topsoil and subsoil stripping, foundation construction and installation of services as part of the development may have an impact on archaeological remains.

11.42 There will be no impacts on archaeological remains in the area that is to remain a County Wildlife Site. Similarly, areas designated as open space on the Development Framework will also not impact on archaeological remains, unless the creation of landscaped areas will involve tree planting and ground reduction.

Mitigation

11.43 An archaeological evaluation has already been undertaken on the eastern part of the site prior to the determination of a previous application in 1996. As the eastern area is known to lie in an area of archaeological potential with a low status Roman settlement on the eastern part of the site and an Iron Age settlement to the south of the site, the Development Control Archaeologist at Oxfordshire County Council is likely to recommend further archaeological investigation in areas of impact secured by a PPG 16 planning condition. However, some archaeological remains will be preserved *in situ* under areas of open space within the Development Framework. The archaeological mitigation for the central area will also be preservation *in situ* as this area will remain a County Wildlife Site.

11.44 A geophysical survey has also been undertaken on the western part of the site, but no archaeological features were recorded during the survey. This does not necessarily mean that no archaeological remains are present. Further archaeological investigation in the form of trial trenching will be required on the western area to mitigate any impacts from the development.

Assessment of Likely Residual Impacts

11.45 Following mitigation detailed above, to include preservation *in situ* in areas of open space and preservation by record in areas of development, there will be no residual impacts.

Conclusions

11.46 This assessment has been carried out in accordance with standards set by the Institute of Field Archaeologists (IFA 2001) and follows guidance set out in Planning Policy Guidance: Archaeology and Planning (PPG16) and Local Plan policies on archaeology.

11.47 An assessment of the baseline conditions included a review of the Oxfordshire SMR, a study of aerial photographs in the NMR, assessment of historic maps and the undertaking of a geophysical survey on the western part of the site.

11.48 No historic buildings will be affected by the development proposals.

11.49 The baseline study and previous archaeological evaluation indicates the eastern part of the site has a high potential for archaeological remains. An archaeological evaluation has been carried out on the eastern part of the site to inform a previous planning application.

11.50 The construction of residential units is likely to involve topsoil stripping, service installation and foundation construction. There are likely to be impacts to archaeological remains from these activities.

11.51 Further archaeological evaluation will be required on the western part of the site. Archaeological investigation or preservation by record is the proposed mitigation for the eastern part of the site. This will be secured by a PPG16 planning condition. Archaeological mitigation in the form of preservation *in situ* of archaeological remains

is proposed for the County Wildlife Site and areas of open space within the Development Framework.

11.52 Following mitigation there will be **no residual impacts** on archaeological remain.

12.0 TRANSPORT

Introduction

12.1 This section considers and assesses the transport aspects of the proposed development of 500 residential units and a primary school at Gavray Drive, Bicester. It should be read in conjunction with the Transport Assessment set out in a separate folder.

12.2 It is important that the impact of traffic generation from the development is fully considered to ensure that the implications on the surrounding highway network are fully understood. In particular, the potential to alter current and future traffic flows must be examined and where there are significant deteriorations in the free flow of traffic, adequate mitigation measures should be identified.

12.3 Of at least equal importance to providing highway improvements as mitigation is the provision of improvements to more sustainable modes of transport. These will offer new (and existing) residents opportunities to reduce their dependence on the private car. The Transport Assessment gives a full review of all of these issues and a summary is included in this section of the ES.

Policy Background

National Policies

12.4 In recent years the Government's approach to rising levels of car traffic has changed. In the past, the approach has been to meet increasing demand for road capacity by simply increasing supply. During the early nineties it was recognised that the construction of new roads alone leads to the generation of more traffic and an ever escalating spiral was in effect. This led the Government to review its policy on development traffic and to issue new guidelines which allow for new road building but as part of more integrated traffic solutions. Current guidance includes:

- PPG 1: General Policy and Guidance
- PPG 3: Housing;
- PPG 13: Transport;
- Places Streets and Movement: Companion Guide to Design Bulletin 32

PPG 1 General Policy and Guidance February 1997

12.5 PPG1 reaffirms that the role of the planning system is to enable the provision of homes and buildings, investment and jobs, in a way which is consistent with the principles of sustainable development, stating at paragraph 4:

> *"Sustainable development seeks to deliver the objective of achieving, now and in the future, economic development to secure higher living standards while protecting and enhancing the environment. The most commonly used definition is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (World Commission on Environment and Development 1987). The Government is committed to the principles of sustainable development set out in Sustainable Development: the UK Strategy (1984)."*

Planning Policy Guidance 3 - Housing

12.6 PPG3: Housing reinforces the Government's commitment to promoting development in a sustainable manner and advocates that development plans should aim to increase residential densities to a minimum of 35 dwellings per hectare.

12.7 The PPG introduces a sequential approach to the allocation of land for housing development, stressing that any land allocated must be in locations accessible by a range of modes of transport, particularly non-car modes.

Planning Policy Guidance 13 - Transport

12.8 The PPG supports the approach found in PPG 3, that new residential development should be located close to a range of retail, service and leisure facilities as well as jobs, so as to reduce the need to travel. The PPG encourages higher density residential development to occur at transport nodes.

12.9 The development at Gavray Drive accords with these principles by providing a high quality, dense development adjacent to an existing urban area. Additional public transport will be provided to serve the site and enhance accessibility. Local facilities provided as part of the development along with existing services further help to ensure that the development proposals accord with PPG 13 and the objective of minimising car use.

Places, Streets and Movement: Companion Guide to Design Bulletin 32

12.10 This guide identifies good practice in designing development layouts that help to promote sustainable trip making. In particular the need for safe, well connected, good quality and direct footpath and cycle links are identified. Pedestrian links should be separated from but also visible to car traffic. Roads should be designed to be safe for cyclists and where cyclists and pedestrians share links, segregation is preferred.

12.11 Car traffic should be calmed ideally by design at the outset through good streetscape layout either by narrow curvatures or by frequent junctions. Traffic calming such as road cushions or chicanes can be used, but these need to be considered carefully along bus routes.

12.12 These principles have been embraced in the design of the development which ensures that walking, cycling and public transport use are encouraged by providing direct and accessible pedestrian and cycle routes. The flow of car traffic through the development is controlled by a carefully designed road layout that discourages drivers from speeding and dissuades through traffic movements that are not related to the development.

The Bicester Integrated Transport and Land Use Study (BITLUS)

12.13 The Bicester Integrated Transport and Land Use Study (BITLUS, March 2000) was produced by W S Atkins for Oxfordshire County Council (OCC) and Cherwell District Council (CDC). Its aim was to:

> *"identify appropriate policies and practical, implementable and achievable measures which will create a more sustainable transport framework and improve the environment of the town as a whole without detriment to its vitality and viability. Taking account of sustainable transport requirements, the study will seek to establish the most suitable locations for developments for inclusion in Bicester "Directions for Growth" proposals."*

12.14 The general aims of the BITLUS Report, to reduce the reliance on the private car and to encourage the use of more sustainable modes of transport, obviously have a bearing on any new development in Bicester. In addition, there are a number of specific proposals / suggestions identified in BITLUS that relate closely to the Gavray Drive site. These include:

- East-West Rail
- New station east of Bicester Town Centre
- 'Green Link' connecting Gavray Drive to Launton Road
- Extension of bus services to Gavray Drive

Public Transport

Rail

12.15 There are two railway stations in Bicester.

- Bicester North located on the main line between London Marylebone and Birmingham and served by Chiltern Railways.
- Bicester Town, located on a branch line with Thames Trains providing services to Oxford.

12.16 Of the two stations, Bicester North is the most heavily used as it has direct and frequent services to London with extensive car parking facilities. By comparison, Bicester Town has a poor service to Oxford, is a rundown station with little or no passenger facilities. Bicester Town station is, however, located on a line which is the subject of East West Rail's proposals for new services between Oxford and Bedford (and by extension to other destinations further a field such as Bristol and Cambridge / Norwich).

12.17 Phase 1A of the ongoing Project Evergreen has been completed by Chiltern Railways. This involved providing a second 9 mile section of track north of Bicester North station at a total cost of £16 million. As part of the project, line speeds were upgraded to 100mph between Banbury and South Ruislip, extra tracks around Beaconsfield and between West and South Ruislip were also provided. These works have resulted in increased capacity between Banbury and Marylebone with better operational stability.

12.18 These improvements, alongside the introduction of new rolling stock, have led to a 26% increase in the number of train services across the week from between May 1996 and September 2001. In 2002, a number of stations, including Bicester North, had their platforms lengthened in order to accommodate longer trains, thereby further increasing capacity.

12.19 Phase 2 of Project Evergreen is currently in progress and concerns mainly improvements at Marylebone including two new platforms and extra signalling and points on the station approaches. These measures will further improve operational performance.

12.20 Future committed plans include:

- more frequent services (twice hourly) to Birmingham;
- more frequent services both in the peak and off-peak periods to Banbury via Bicester North; and,
- provision of a new £22 million depot for rolling stock at Wembley and expenditure of a further £6 million improving the Aylesbury depot.

12.21 Chiltern Railways also have aspirations for the following projects:

- a new interchange at West Hampstead linking Chiltern directly to the Jubilee Line, the Metropolitan Line, the North London Line and Thameslink services (for Gatwick & Luton airports);
- a new through line to Oxford;
- re-opening the Aylesbury to Bletchley/Milton Keynes line and the provision of a new Aylesbury Parkway station to the north of the town;
- re-opening the old Great Central route to a point near the M1/M6 intersection; and
- a half hourly Chiltern 'Metro' service from the suburban stations to Marylebone.

12.22 Of particular interest is Chiltern's aspirations to provide through services to Oxford. This will require a new rail 'chord' linking the Chiltern line with the East West Line thus enabling trains from London Marylebone to run direct into Oxford via Bicester Town. Bicester North already attracts many passengers from the area around the north of Oxford because of the ease of access via the A34, and the better quality service offered by Chiltern. The recently opened fifth Park & Ride site for Oxford at

Water Eaton which the Bicester Town line passes, also adjacent to the A34, is central to their plans.

12.23 Land at the western end of Gavray Drive would be required to construct this link and this has been safeguarded as part of the development plans.

Buses

12.24 There are three bus routes that pass through or near to the Langford area of Bicester. Of these, two are commercially operated by Stagecoach. The most proximate bus route to the site is route 27, which runs between Langford and Oxford via Glory Farm in the north part of Bicester. Service 29 also passes fairly close to the Langford area en route from Arncott to Oxford via Ambrosden. These routes both operate on an hourly frequency. They are timetabled together with the route 28 to provide a 20-minute headway for services to Oxford.

12.25 In addition to the two Stagecoach services there is also a town service (route 22) operated by Graylines Coaches serving the Langford area of Bicester. This service is supported by Oxfordshire County Council and operates a 30-minute headway, Monday to Saturday.

12.26 In addition, Chiltern Railways operate a Taxibus service to and from Bicester North Station for use by Chiltern Rail customers. The Taxibus network is currently made up of four urban services and four rural services. The services operate as regular timetabled bus services during the peak periods, and as taxi services in the off-peak. Each vehicle can accommodate up to seven people and one of the vehicles is designed to accommodate wheelchair users.

12.27 Chiltern Railways have indicated that the scheme has been quite successful, particularly in the urban areas. This is attributable to several factors including:

- Well-designed routes that serve key Chiltern commuter catchment areas;
- Provision of branded customised vehicles and a uniformed driver;
- A dedicated interchange and priority measures for Taxibus vehicles at Bicester North station; and
- Fares well below the parking prices at Bicester North station.

12.28 Currently, there is one Taxibus route that runs from Bicester North to Langford Village, passing close to the development site.

12.29 The existing Chiltern Railways Taxibus route as it stands is currently suitable for diversion through the site without adverse effects to existing Chiltern customers. Using this route as a base a simple alternative routeing scenario has been considered.

12.30 In both the peak periods the Taxibus service is timed to connect with train departures for London in the morning, and train arrivals from London in the evening. The main objective for the Taxibus service is to provide a connection with Chiltern rail services thereby eliminating the need for commuters to park at the station. Therefore any adjustment to the route must maintain the same running time in order to ensure that connections to train services can be made in a similar manner.

12.31 The option presented has been examined in terms of the extra length added to the route and the impact this may have on running times. The proposed route alteration adds only around 200 metres to the current route. Assuming average speed remains the same as the current operation, this adds less than a minute extra to the overall journey time.

12.32 This proposed route has been discussed with Chiltern Railways, and they have agreed in principle with the diversion of the Taxibus into the development. This may require additional funding, including the provision of an extra vehicle should it be required to meet the train departures and arrivals at Bicester North station.

Walking

12.33 Gavray Drive is a 7.3m wide single carriageway road with 2 metre wide footways on both sides. The condition of paving is good. Gavray Drive ends at the rail line to the west that serves Bicester Town Station and no link across the railway is provided at this point. However, there is a footpath link that connects to Gavray Drive to the east of the railway line. This runs southwards to an un-controlled level crossing and on to connect to Launton Road. This footway is generally 2m wide and its provided with street lighting along it length. The level crossing is already well used by pedestrians walking from the Banbury Fields and Langford Village developments. The northern section of this footpath is less well used, but usage would increase as a result of these development proposals. Appendix 3 includes photographs of this pedestrian route, along with other routes in the area of the site.

12.34 Immediately to the north of where this footpath connects to Launton Road there is a Toucan crossing provided to give access for pedestrian and cyclists using the shared footway/cycleway on the western side of Launton Road. The footway on the western side of Launton Road is generally 3m wide, but as it approaches the town centre, it narrows in places to less than 2m and cyclist dismount markings are provided to improve safety.

12.35 This route will form an important link from the site to the centre of Bicester, which is approximately 1.5km from the centre of the development.

12.36 To the east of the site, Wretchwick Way is a busy road and forms part of the Eastern Distributor Road around Bicester. It is well lit and a 3 metre wide footway/cycleway runs along the length of the western side only. This is constructed from bituminous material and is generally of good quality.

12.37 There are also several footpath links from Gavray Drive running to the south through Langford Village and the open space then runs along the watercourse. These are generally for use by pedestrians and cyclists, although most have a thermoplastic marking running along the centre to segregate the two user groups. These routes provide good access to the local centre and primary school in Langford Village and certain of them can be used to walk to Bicester Town Station to the south.

12.38 As part of the development proposals there is the potential to introduce measures to reduce vehicles speeds along Gavray Drive. In particular, in order to ensure pedestrian linkages between the site and the existing residential development are good, it would be beneficial to introduce crossing facilities at the main pedestrian desire lines (i.e. where existing footpaths join Gavray Drive on its southern side). These could take the form of uncontrolled crossings with a central island and, potentially, the road surface raised to the same level as the footway. Alternatively, if demand was anticipated to be sufficient, signal controlled Pelican crossings could be installed where necessary.

12.39 No detailed scheme has yet been developed for this, but crossing facilities could also be accompanied by other measures to discourage high vehicles speeds, such as carriageway narrowing, chicanes, changes of surface texture, etc.

Cycling

12.40 The BITLUS study reviewed the issue of cycle facilities in Bicester, recognising that beneficial routes exist and that the current level of provision is considered sufficient but that it could be improved upon.

12.41 Gavray Drive currently forms part of the SUSTRANS National Cycle Network and provides a segregated route extending towards the town centre to the west and Wretchwick Way to the east.

12.42 The north section of Wretchwick Way also forms part of the SUSTRANS Cycle network which then extends to the east towards Launton.

12.43 At present no facilities exist along the length of Peregrine Way but there is a network of segregated footway/cycleway through the Layford Village developments.

12.44 Cycle distances of up to 5miles are generally considered as reasonable by most members of the cycling community and such journeys would take up to 27½ minutes. On this basis, the whole of Bicester, Ambrosden, Middleton Stoney, Upper Arncott and Marsh Gibbon are all accessible within a 30minute cycle ride.

12.45 In order to mitigate traffic impact it is proposed to install traffic signals at the Neunkirchen Way arm of the A41 roundabout. One beneficial effect of these is that they would enable pedestrians / cyclists to cross from the footway on the east side of Neunkirchen Way to that on the north side of the A41 West. Although it is only proposed to operate the signals during the AM peak period, the crossing facility could be set up to operate on demand (i.e. push button operated) during other periods.

12.46 This addresses a specific concern that was raised by residents at the public consultation at Langford Village Community Centre on the 5th June 2004 on the development proposals, who felt that the current movement between the A41 West and Neunkirchen Way cycle routes was hazardous.

Traffic Impact

Existing Highway Network

12.47 The site under consideration is bounded to the south by Gavray Drive and by the Bicester Eastern Distributor Route to the east. Gavray Drive is a wide single carriageway road without frontage development, but it provides access to residential development to the south via Mallards Way and Whimbrel Close. A number of bellmouths have been constructed along the northern side of Gavray Drive to enable future development, even though the area is currently open grassland. Gavray Drive terminates just short of the rail line that serves Bicester Town Station to the south.

12.48 Wretchwick Way (A4421) forms part of the Eastern Distributor Route which skirts the eastern side of Bicester, connecting the A41 in the south to the A421 to the north. Where it passes the site it is a wide single carriageway. The junction between Gavray Drive and Wretchwick Way is located at the south-east corner of the site and takes the form of a normal three-armed roundabout.

12.49 To the south of Gavray Drive, Wretchwick Way provides access to Peregrine Way, which is effectively a large crescent acting as the main spine road to the Langford Village development. The northern connection between Peregrine Way and Wretchwick Road takes the form of a ghost island priority junction, whilst the southern junction is a normal three arm roundabout.

12.50 To the south of this roundabout the A4421 is dualled with two lanes on each carriageway, before joining the A41 at a large five-arm roundabout. As well as the A41, this roundabout also gives access to the town centre via London Road. The fifth arm accesses a Ministry of Defence site to the south.

Existing Junction Performance

12.51 In order to be able to assess the effects of the proposed development accurately, a number of junctions have been identified in discussion with Oxfordshire County Council that require detailed capacity assessment. These have been tested using industry standard software and traffic flows obtained from recent surveys. These tests provide the basis from which to compare the impact of any additional traffic generated by the proposed development. The junctions tested are:

- Gavray Drive / Mallards Way priority junction
- Gavray Drive / Wretchwick Way roundabout
- Peregrine Way / Wretchwick Way priority junction
- Peregrine Way / Wretchwick Way /Neunkirchen Way roundabout
- Boundary Way / London Road / Neunkirchen Way roundabout.

12.52 The results of traffic surveys undertaken at these junctions in early 2004 are included in the Transport Assessment.

12.53 The junction modelling software for priority junctions and roundabouts (PICADY and ARCADY) gives output in terms of ratios of flow to capacity (RFC) and queue lengths. RFC's below 0.85 indicate that the junction is operating within capacity, between 0.85 and 1.0 that the junction is over its practical capacity but within its theoretical capacity and over 1.0 the junction is over-capacity and significant levels of queuing would be expected.

12.54 The following tables summarise the performance of the junctions under existing traffic flows. The full results can be seen in the Transport Assessment.

Table 12.1 Gavray Drive /Mallards Way Priority Junction – Existing Performance

	0800-0900			1700-1800		
	RFC	Modelled Queue	Observed Queue	RFC	Modelled Queue	Observed Queue
Mallards Way – left	0.004	0	0	0.011	0	0
Mallards Way – right	0.118	0	0	0.066	0	0
Gavray Drive - right	0.014	0	0	0.000	0	0

Table 12.2 Gavray Drive / Wretchwick Way Roundabout – Existing Performance

	0800-0900			1700-1800		
	RFC	Modelled Queue	Observed Queue	RFC	Modelled Queue	Observed Queue
Wretchwick Way	0.294	0	0	0.286	0	0
Gavray Drive	0.061	0	0	0.029	0	0
Charbridge Road	0.316	0	0	0.310	0	0

Table 12.3 Peregrine Way / Wretchwick Way Priority Junction – Existing Performance

	0800-0900			1700-1800		
	RFC	Modelled Queue	Observed Queue	RFC	Modelled Queue	Observed Queue
Peregrine Way – left	0.285	0	0-4	0.195	0	0
Peregrine Way – right	0.274	0	0-4	0.118	0	0
Wretchwick Way – right	0.189	0	0	0.310	0	0

Table 12.4 Peregrine Way / Wretchwick Way / Neunkirchen Way Roundabout – Existing Performance

	0800-0900			1700-1800		
	RFC	Modelled Queue	Observed Queue	RFC	Modelled Queue	Observed Queue
Neunkirchen Way	0.178	0	0	0.389	1	0-4
Peregrine Way	0.316	1	0-2	0.179	0	0-2
Wretchwick Way	0.393	1	0-7	0.243	0	0-4

Table 12.5 Boundary Way / London Road / Neunkirchen Way Roundabout – Existing Performance

	0800-0900				*1700-1800*			
	RFC	Modelled Queue	Observed Queue		RFC	Modelled Queue	Observed Queue	
			Near side	Off side			Near side	Off side
Neunkirchen Way	1.085	48	8-27	3-27	0.474	1	0-3	0-1
A41 East	0.640	2	0-9	0-3	0.815	4	0-6	0-1
MoD Access	0.114	0	0		0.131	0	0-3	
A41 West	0.638	2	0-3	0-3	0.718	3	0-9	0-3
London Road	0.551	1	0-8	0-2	0.805	4	0-5	0-2

12.55 Under existing traffic flows the only junction to have capacity problems is the Boundary Way / London Road / Neunkirchen Way Roundabout. In the AM peak this junction has queues on the Neunkirchen Way arm.

Traffic Growth

12.56 Discussions with Oxfordshire County Council have resulted in a number of different growth scenarios being identified for testing. These are:

- Opening year based on TEMPRO traffic growth
- Opening year based on NRTF central traffic growth
- Design year of 10 years after opening based on TEMPRO traffic growth
- Design year of 10 years after opening based on NRTF central traffic growth.

12.57 The anticipated opening year for the development is 2006, which means that the proposed design year is 2016.

12.58 The traffic flows used in assessing the existing conditions are from surveys in early 2004. The relevant growth factors from this year are shown in the following table.

Table 12.6 Growth Factors

	AM Peak	PM Peak
2004 – 2006 TEMPRO	1.033	1.033
2004 - 2006 NRTF	1.034	1.034
2004 – 2016 TEMPRO	1.178	1.178
2004 – 2016 NRTF	1.200	1.200

12.59 As the NRTF factors are higher, these have been applied to give a 'worst case' assessment.

Committed Development

12.60 It is normal practice to include within the assessment of traffic impact estimates of traffic from other developments in the area under consideration which have planning approval but have not yet been implemented. Enquiries have been made with Cherwell District Council but it appears that there are no committed developments that are likely to significantly change traffic in the area under consideration.

Trip generation

12.61 In order to estimate what level of traffic the proposed 500 residential units are expected to generate, reference has been made to the Transport Assessment for the nearby Bicester Fields development. The following table shows the trip rates that were agreed with Oxfordshire CC for the purpose of this development.

Table 12.7 Residential Trip Rates Agreed for the Bicester Fields Development

	In		Out		Total	
	Private	Affordable	Private	Affordable	Private	Affordable
0800-0900	0.17	0.09	0.63	0.26	0.8	0.35
1700-1800	0.59	0.26	0.16	0.2	0.75	0.46

12.62 As these rates were previously considered to acceptably reflect residential traffic generation in the area, they have been adopted for the proposed Gavray Drive development. It has been assumed that of the 500 units proposed, 30% will be

affordable housing. On this basis the anticipated residential traffic generation would be as shown in the following table.

Table 12.8 Residential Trip Generation – 500 Units

	In		Out		Total	
	Private	Affordable	Private	Affordable	Private	Affordable
0800-0900	60	14	221	39	281	50
1700-1800	207	39	70	30	277	69

12.63 As part of the development proposals it is intended to reserve a site for a single form of entry primary school on the site. Reference has been made to the TRICS database to obtain car trip rates for primary schools. The selected TRICS sites and output are shown in Appendix 4. The proposed school is to accommodate 210 pupils. The prospective development would be expected to generate 125 primary aged pupils (25 per 100 dwellings). These pupils would not generate car trips on the wider road networks and it is therefore only necessary to estimate car trips from the remaining 85 pupils. The TRICS trip rates and anticipated traffic generation can be seen in the following table.

Table 12.9 Primary School Trip Rates and Traffic Generation

	In		Out		Total	
	Trip Rate	Car Trips	Trip Rate	Car Trips	Trip Rate	Car Trips
0800-0900	0.23	20	0.18	15	0.41	35
1700-1800	0.03	3	0.03	3	0.06	6

Trip Distribution

12.64 All vehicular access to the site is to be from Gavray Drive. The wider distribution of residential trips has been based on 2001 Census Data (journeys to work by current residents) and the aggregate assumptions are as follows:

- 13% A4421 North
- 6% A41 South
- 7% London Road
- 74% A41 towards M40.

12.65 The trips to/from the primary school will be much more local in nature and the following assumptions have been made:

- 20% to the north
- 30% from Layford Village
- 30% from Bicester Fields
- 20% from the town centre.

Traffic Impact

12.66 The following tables summarise the performance of the junctions under 2006 and 2016 traffic flows with and without the full development of 500 residential units and a primary school. Full junction model output can be found in the Transport Assessment.

Table 12.10 Gavray Drive / Mallards Way –RFC's (500 units + School)

	0800-0900				1700-1800			
	2006		2016		2006		2016	
	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev
Mallards Way – Left	0.004	0.004	0.004	0.004	0.011	0.011	0.013	0.013
Mallards Way - Right	0.121	0.122	0.141	0.142	0.066	0.066	0.077	0.077
Gavray Drive – Right	0.014	0.014	0.017	0.017	0.000	0.000	0.000	0.000

Table 12.11 Gavray Drive / Wretchwick Way Roundabout –RFC's (500 units + School)

	0800-0900				1700-1800			
	2006		2016		2006		2016	
	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev
Wretchwick Way (South)	0.331	0.374	0.385	0.427	0.319	0.442	0.371	0.495
Gavray Drive	0.069	0.334	0.084	0.364	0.033	0.117	0.039	0.139
Charbridge Lane (North)	0.422	0.479	0.490	0.555	0.323	0.350	0.374	0.404

Table 12.12 Peregrine Way / Wretchwick Way Priority Junction –RFC's(500 units + School)

	0800-0900				1700-1800			
	2006		2016		2006		2016	
	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev
Peregrine Way – Left	0.298	0.313	0.361	0.402	0.230	0.247	0.252	0.285
Peregrine Way – Right	0.297	0.352	0.392	0.477	0.157	0.173	0.168	0.218
Wretchwick Way - Right	0.196	0.208	0.234	0.248	0.361	0.352	0.397	0.442

Table 12.13 Peregrine Way / Wretchwick Way Roundabout – RFC's (500 units + School)

	0800-0900				1700-1800			
	2006		2016		2006		2016	
	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev
Neunkirken Way (South)	0.184	0.218	0.214	0.242	0.427	0.516	0.496	0.586
Peregrine Way	0.328	0.343	0.397	0.409	0.193	0.225	0.238	0.280
Wretchwick Way (North)	0.408	0.558	0.484	0.635	0.285	0.328	0.333	0.377

Table 12.14 Boundary Way / London Road / Neunkirchen Way Roundabout – RFC's (500 units + School)

	0800-0900				1700-1800			
	2006		2016		2006		2016	
	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev	NRTF Base	NRTF with Dev
Neunkirchen Way	1.189	1.446	1.589	1.929	0.500	0.566	0.621	0.657
A41 East	0.627	0.674	0.748	0.762	0.848	0.879	1.012	1.044
MOD Access	0.079	0.126	0.151	0.159	0.145	0.162	0.251	0.272
A41 West	0.733	0.756	0.857	0.890	0.752	0.904	0.932	1.085
London Road	0.590	0.605	0.739	0.771	0.851	0.971	1.109	1.194

12.67 The only junction to have any capacity problems after the addition of development traffic is the Boundary Way / London Road / Neunkirchen Way Roundabout it can be seen that during the AM peak hour all base-line tests (2006 – 2016) show the Neunkirchen Way arm of the junction as being over-capacity (i.e. RFC's greater than 0.85). The addition of development traffic worsens this situation.

12.68 The PM peak period in 2006 and 2016 the addition of development traffic pushes the A41 east, A41 west and London Road arms of the junction over-capacity; thereby

requiring significant junction improvements to accommodate the predicted traffic levels.

Proposed Junction Mitigation Measures

12.69 The only junction to require improvement in the case of development with the proposed residential use is the junction between the Boundary Way / London Road / Neunkirchen Way Roundabout. The main problem at this junction occurs during the morning peak hour on Neunkirchen Way. This is caused by the volume of traffic travelling from the A41 West and London Road towards the A41 East offering very few gaps for traffic to join the roundabout from Neunkirchen Way. The logical way to resolve this problem would be to introduce part-time traffic signals on the roundabout and the Neunkirchen Way arm of the junction to provide guaranteed opportunities to exit. These signals would only need to be operational during the AM peak period.

Table 12.15 AM Peak junction Performance (RFC and Degree of Saturation) with 500 Units and a Primary School

	2006		2016	
	Baseline (RFC)	Signals + Dev (%Sat)	Baseline (RFC)	Signals + Dev.(%Sat)
London Road	0.590	32	0.739	37
Neunkirchen Way	1.189	90	1.589	95
A41 East	0.626	46	0.748	54
MoD Access	0.079	5	0.151	5
A41 West	0.733	51	0.857	59
Neunkirchen Way (Northbound)		65		73
Circulatory Carriageway		75		86
		75		86
		11		12

12.70 A part-time signal arrangement at this junction has been modelled using TRANSYT. The results of this test are summarised in the following table.

12.71 The output from TRANSYT has a different format to that of roundabout models. The junction performance is given as degree of saturation, which is the flow along a link as a percentage of its capacity. Degrees of saturation of 90% or below indicate that the junction is operating acceptably, whilst result between 90% and 100% show that the particular link exceeds its practical capacity, but is within its theoretical capacity.

12.72 The results shown in the above table indicate that in 2006 the junction would operate within capacity with the flow from 500 residential units and a primary school (i.e. 90% maximum degree of saturation). This is based on the signals running with a 42 second cycle time and results in a mean maximum stationary queue on the roundabout circulatory carriageway of 5.8 vehicles, which would not be expected to block the exit from the previous arm. In 2016, the maximum degree of saturation increases to 95% on Neunkirchen Way, with a cycle time of 50 seconds. In addition, the mean maximum queue on the circulatory carriageway would increase to 8.4 vehicles, and the London Road arm of the junction would be blocked by this for approximately 10 seconds out of every 50 seconds. However, as this arm of the junction is under capacity we would not expect this reduction in exit opportunities to cause a significant problem. With the signals in place the queue on Neunkirchen Way would be 17 vehicles in 2006 and 26 vehicles in 2016, both with the development in place. This is a significant improvement on the current AM peak period, when queues in excess of 50 vehicles were observed.

12.73 In the PM peak situation in 2006, the introduction of traffic from 500 residential units and a Primary School causes the A41 East and London Road arm of the junction to have RFC's in excess of 0.85. In 2016 these arms, as well as the A41 west, are over-capacity without development and the introduction of development traffic exacerbates the situation. In order to mitigate for these impacts, the entry width at London Road and the flare length on the A41 can be increased as shown in Figure 58. The PM peak performance of the junction with these changes to the geometry implemented can be seen in the following table.

Table 12.16 PM Peak Junction Performance (RFC) with 500 Units and a Primary School

	2006		2016	
	Baseline	Imp + Dev	Baseline	Imp + Dev
Neunkirchen Way	0.500	0.568	0.621	0.717
A41 East	0.847	0.844	1.012	1.011
MoD Access	0.144	0.162	0.251	0.308
A41 West	0.752	0.798	0.932	0.965
London Road	0.850	0.782	1.109	1.011

12.74 It can be seen that with these improvements in place in 2006 after the development is complete the roundabout would operate within capacity during the PM peak hour. In 2016, some arms of the roundabout would have RFC's over 0.85 but an overall improvement is achieved compared with the situation without development or the changes to the roundabout.

Statement of Effects

12.75 The analysis of the transport impact of the proposed development has examined the baseline situation under current traffic flows, and the baseline and with development scenarios in the anticipated year of opening (2006) and 10 years after opening (2016). The findings show that the proposed junction improvements and the package of supporting transport measures associated with the development will result in improvements to the traffic situation when compared to the baseline. In particular, at the Boundary Way / London Road / Neunkirchen Way Roundabout there will be significant improvements in capacity.

12.76 Overall, the proposed development can be accommodated on the transport network and the proposed highway improvement scheme will improve the current situation for all traffic.

13.0 SOCIO ECONOMIC ISSUES

Introduction

13.1 This chapter provides an assessment of the socio economic impacts the proposed development of Land North of Gavray Drive, Bicester. This Chapter was prepared by David Lock Associates.

13.2 The potential impacts of the proposed development upon human beings are also examined in other specific sections of the ES (e.g. air quality, noise etc). This chapter concentrates on those aspects that are not covered elsewhere. These include impacts associated with an increase in population in the area (residents, working and visiting), the pressure this may place on services and facilities in the area and any necessary mitigation.

13.3 The potential impacts can be summarised as follows:

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- impact upon education facilities; and
- impact upon open space.

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13.5 The socio economic impacts of the development will affect the resident population of the site and the surrounding areas of Langford Village. Having established a baseline position, the assessment methodology will consider the direct changes brought about by development (such as the additional dwellings) and will consider the indirect impacts be assessing the needs generated by the proposed development and how such needs are to be accommodated. Impacts will be assessed during both the construction and operational phases of the development.

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13.9 Bicester South contains a younger population than the Cherwell District average. The average age in Bicester South is 29 years old, compared with 37 throughout Cherwell District, in particular Bicester South has a proportionately larger number of people aged 20 to 29 and 30 to 59. In contrast only 0.8% of Bicester South residents are aged over 75, as opposed to Cherwell District where 6.3% of residents are over 75 years.

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Existing Community Facilities (inc Health, Social Services and Emergency Services)

13.17 There are no existing community facilities within the site, although the site is used on an unofficial basis by local residents for dog walking and informal recreation.

13.18 Beyond the site boundary there is a range of existing community facilities. The closest facilities for the new residents are those at Langford Village local centre. The local centre lies approximately half a kilometre to the south of the site and contains:

- medical practice;
- community centre;
- pharmacy;
- supermarket and newsagent (approximately 300m^2 of floor space);
- takeaway; and
- public house

13.19 All of the facilities listed above will benefit from increase local patronage. Within the local area, there are two core areas of commercial activity which will benefit from the additional increase in local population: Bicester Town Centre, located 1.3km from the western boundary of the site and Bicester Village, located 1.8km from the site.

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13.22 Within Bicester there are thirteen primary schools, two secondary schools and one 6th Form College (Bicester Community College). In addition to the potential primary school located within the Gavray Drive scheme, the closest existing primary schools are:

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- Longfields Primary School and Nursery (900m from the centre of the site)
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- St Edburghs Church of England (VA) School (1.5km from the centre of the site)

13.23 In October 2004 Oxfordshire County Council agreed the School Organisation Plan 2004-2009. The latest 'Agreed' report identifies the growth of Bicester. Paragraphs 97 and 98 summarise the position in Bicester.

> *"Following further pupil growth at the Bure Park Estate in Bicester, at primary level, a further two classrooms are being provided to bring Bure Park School up to a fourteen-class primary school. Numbers are falling at some of the older estates in the town and temporary classrooms are being removed at Glory Farm Primary School and a replacement of timber–framed buildings at Brookside School will reduce the overall capacity.*
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13.26 The plan forecasts the number of surplus places or insufficient capacity. The figures take into account housing developments that have received planning permission. Surplus places are calculated by comparing each school's capacity with forecast pupil numbers. **Table 13.1** identifies school capacity for the nearest schools to Gavray Drive.

Table 13.1 Oxfordshire School Organisation Plan 2004-2009, Agreed, November 2004

School	Distance from Site	Net Capacity	Temp	2003	2004	2005	2006	2007	2008	2009	2010
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Bicester Community College	2.1km	1462	18	202	199	105	118	102	68	69	59
The Cooper School	1.7km	1179	0	134	113	147	161	167	141	134	117

(- means places needed)

Source: Oxfordshire County Council

13.27 The School Organisation Plan 2004-2009 sets out the following information

- demographic information relevant to the supply of school places;
- policies and principals relevant to the provision of school places; and
- need to add/remove places

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Predicted Effects

Construction Phase - Population and Population Characteristics

13.29 Due to the limited size of the development it is considered unlikely that there will be any significant migration of construction workers to the area during the construction phase of the development.

Operational Phase

13.30 The development of the land to the north of Gavray Drive will generate approximately 1200 residents which assumes some 500 dwellings with an average occupancy rate of 2.4 persons per dwelling (the local and national average).

13.31 The dwelling mix within the scheme has yet to be determined; there will nevertheless be a mix of dwelling types across the grid square as a whole. There will be a mix of housing tenure to facilitate access to the new dwellings by all sections of the community. It is proposed that 30% of the development will be affordable housing. The range of house types and tenures will provide the opportunity for local residents to find alternative accommodation within the local community as their needs change. This positive impact is of moderate scale and permanent in nature and will contribute to the vitality of the development.

Existing Local Economy

13.32 The economic impact of the application proposal must be seen in the context of the local economy as a whole area, and the impacts assessed against the likely economic outputs arising from the development.

13.33 During the construction phase of the development there will be employment created on the site. This employment will have a positive impact on the local economy of minor significance through expenditure in local shops for example at lunch breaks. There will also be indirect effects through the supply of materials from local businesses and through the expenditure of salaries in the wider locality.

Existing Community Facilities (Inc Health, Social Services and Emergency Services)

13.34 The impacts on local community facilities during the construction phase and operational phase are the same but will vary in magnitude dependent on the increase in resident population. The additional population within the area will place an additional demand upon the existing community facilities in the immediate area and on the town as whole. This might include increased use of existing community centres and bolstering of existing community activities such as churches and libraries for example. The impact of this additional use is expected to be beneficial and minor in magnitude.

13.35 As well as the increase in patronage on local community facilities. The scheme proposes the inclusion of a primary school and land reserved for community facilities. This and the anticipated increase in people in the area may well give rise to the setting up of new activities and the enriching of community life. This positive impact is considered to be minor in magnitude.

13.36 With the increased population the housing development will produce it is inevitable that additional demand will be generated for health care facilities. It is anticipated that emergency services can be provided within the appropriate response times. The impact on these public services is therefore assessed to be neutral.

Existing Educational Facilities

13.37 The impacts on educational facilities during the construction phase and the operational phase are the same but will vary in magnitude dependent on the release of dwellings for sale and resident population. Oxfordshire County Council have identified the following formula for calculating pupil yields:

- Primary School: For every 100 residents, 25 will require a primary school place.
- Secondary School: For every 100 residents, 20 will require a secondary school place.

13.38 Adopting this formula in the Gavray Drive context the proposed development of approximately 500 dwellings could generate:

- primary school places: 125 pupils
- secondary school places: 100 pupils

Note: This assessment takes no account of phased housing completions.

Existing Sport and Recreational Facilities

13.39 The impacts on sport and recreational facilities during the construction phase and the operation phase are the same but will vary in magnitude dependent on the resident population. Provision, as identified in the Ecology Chapter, will be made to ensure that the County Wildlife Site is protected throughout the construction phase and a management plan adopted to manage access.

13.40 The proposals which include open space in a variety of contexts. Specifically the proposals include the County Wildlife Site (CWS), creation of new water features, provision LAPs and LEAPs as prescribed by local policy, provision of greenways and the retention of existing vegetation throughout the proposals. The development therefore offers a range of formal and informal recreational opportunities. The provision of open space within the development is complementary to the wider recreational opportunities in the wider area.

13.41 Given the proximity to Langford Village and the existing open space along Langford Brook it is anticipated that the open space associated with the CWS will be used by the wider community. This use is anticipated as part of extending the green corridors throughout Bicester. The proposals, other than the County Wildlife Site, are not expected to attract visitors from beyond the immediate vicinity. Therefore no detrimental impact in terms of additional traffic generated is anticipated and this impact is assessed as being neutral.

Minimisation of Demand- Energy Strategy

13.42 Consumption of energy and its subsequent production of green house gases, such as C02, is a major issue facing all new development. Meeting national and international commitments on mitigating climate change should be a primary consideration for all new development projects. Design considerations will consider the two areas of energy efficiency and energy supply, as each play an important, but different, role in

reducing energy consumption. Both microclimate design and energy efficiency will form the basis of the energy strategy for the development.

Microclimate design

13.52 Energy demands can be reduced through careful consideration of the orientation and design density of the development and should be optimised to achieve good microclimatic properties to reduce the basic need for energy.

13.53 Solar gains can lead to substantial reductions on the demand for space heating in winter and the inter-season, but unwanted direct gains in summer should be avoided. Maximising the benefits of solar heat requires good solar access to external spaces and surfaces, and attention to the thermal properties of building and landscape materials will be required.

13.54 These and the following factors are incorporated into the Framework Plan where possible:

- where possible windows will be placed facing south and north facing windows will be minimised;
- aim where possible to site dwellings to allow for one elevation to face within 25° of due south;
- adequate spacing between the units to minimise overshadowing; advantage may be taken of the topography to reduce minimum spacing where possible;
- adaptability to seasonal variations to allow for solar gains in winter but exclude high level direct solar radiation in the summer;
- the use of exposed masonry to provide thermal storage in rooms with high solar gains;
- avoidance of dark rooms which require constant use of artificial lighting through establishing target daylight factors for residential developments;
- where possible, putting temperature sensitive rooms or constantly occupied rooms on the western elevation; and
- reduction in wind exposure through control of orientation, density and height of buildings.

13.55 The incorporation of these measures will mitigate effects on the microclimate resulting in a minor impact.

Energy Efficiency

13.56 In order to reduce the energy requirement, the new community needs to reduce heat losses and balance infiltration and ventilation such that energy use is minimised whilst maintaining a healthy internal environment. The applicants have considerable experience of adopting best practice in this regard and will develop a comprehensive strategy for the promotion of energy efficiency.

13.57 Designs of dwellings in the development will demonstrate compliance with an appropriate standard of construction and energy efficiency. This may be related to the Ecohomes standards set by Building Research Establishment. Specific targets will be developed in consultation with the relevant authorities. Nevertheless in the sections below the elements to be considered in an appropriate strategy are highlighted.

13.58 This approach is particularly relevant to the Government's commitments under the Kyoto agreement. Through the benchmark of energy performance of a New Community home against design specifications, targets for energy (and carbon dioxide, CO_2) reductions can be set and can contribute to the Government's Kyoto target of a 20% reduction in CO_2 by 2010 on 1995 levels.

13.59 The appropriate standard should address a wide range of opportunities to minimise the energy requirements of the development such as:

- the thermal properties of the building envelope;
- the energy efficiency rating of supplied appliances;
- the specification of appropriate boiler systems;
- the specification of appropriate insulation; and
- the installation of low energy lighting.

13.60 Specific examples of matters to be considered for inclusion in the appropriate standard include:

- the selection of efficient building forms and layout
- air tightness standards with good detailing at joints;
- the installation of double-glazing with Low Energy coating;
- the glazing area of unfavourably oriented windows;
- appropriate insulation standards using the *Standard Assessment Procedure* (SAP Rating System);
- insulation to hot water tanks and pipes and specification of efficiency standards and Nitrous Oxide emissions of all installed boilers;

- effective use of heating controls and where appropriate zonal heating can make significant energy and CO_2 savings and will be promoted;
- the provision of internal drying space/utility;
- the use of insulation with zero-ozone depletion potential;
- the installation of low energy lighting.

13.61 The establishment of appropriate standards and the incorporation of a range of the mitigation measures outlined above will mitigate the effects of additional green house gas emission and so the impact is assessed as being insignificant, although insofar as the development demonstrates best practice in terms of energy efficiency then the impact of the development will be beneficial.

Minimise demand for water

13.62 In order to minimise the demand for water supply in the development, measures for minimising water usage will be incorporated. The management of water consumption will be achieved through setting targets for maximum water consumption. One way of establishing such targets would be through the use of a standard, based on cubic metres per bedspace per annum, to be delivered by adopting a range of measures such as the following:

- the collection and re-use of rain water;
- the promotion the use of water metering;
- the use of aerated taps to basins using reduced mains pressure flow;
- the use of low flow/dual flush WCs;
- where appropriate, the use of baths and showers with reduced filling capacity and with environmental economy settings; and
- the provision of white goods, dishwasher and washing machine, meeting water consumption and efficiency A/B ratings.

Renewable energy

13.63 Renewable energy should be considered as a component of any good energy strategy. There are a range of renewable energy options that can be considered:

- advances in technology over the timescale of the development;
- uncertainty for potential residents as a result of investing in unreliable emerging technology;
- high market and investment costs incurred due to limited supply;

- immature market conditions meaning there are limited specialists to install and maintain the equipment;
- difficulties in reliably estimating the energy supply and matching this to energy demand; and
- unwillingness of energy providers to receive back excess energy on the grid, due to penalty clauses in electricity trading agreements.

13.64 Despite these difficulties no energy strategy should be complete without evaluating the opportunity. Consideration will be given in the detailed design of the development to the use of renewable energy technologies, in conjunction with the relevant local authorities and taking account of changing government funding to support the installation of such measures. Design of dwellings and commercial development should, as a minimum, safeguard the retrofitting of renewable energy technologies in the design.

Residual impacts

13.65 It is inevitable that the development will result in the consumption of additional energy resources. However following mitigation it is anticipated that the impact on energy supplies will be minor.

13.66 The possible upgrading of existing supplies to the site will have no long term effects but will result in short term adverse impacts assessed as moderate but local.

13.67 Design measures to promote efficiency in the use of resources will have the primary role of mitigating the demand for energy but will also have a long term beneficial impact in terms of demonstrating the application of best practice approaches. Careful attention to microclimate design will also have a beneficial effect on the consumption of energy.

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Operational Phase

13.30 The development of the land to the north of Gavray Drive will generate approximately 1200 residents which assumes some 500 dwellings with an average occupancy rate of 2.4 persons per dwelling (the local and national average).

13.31 The dwelling mix within the scheme has yet to be determined; there will nevertheless be a mix of dwelling types across the grid square as a whole. There will be a mix of housing tenure to facilitate access to the new dwellings by all sections of the community. It is proposed that 30% of the development will be affordable housing. The range of house types and tenures will provide the opportunity for local residents to find alternative accommodation within the local community as their needs change. This positive impact is of moderate scale and permanent in nature and will contribute to the vitality of the development.

Existing Local Economy

13.32 The economic impact of the application proposal must be seen in the context of the local economy as a whole area, and the impacts assessed against the likely economic outputs arising from the development.

13.33 During the construction phase of the development there will be employment created on the site. This employment will have a positive impact on the local economy of minor significance through expenditure in local shops for example at lunch breaks. There will also be indirect effects through the supply of materials from local businesses and through the expenditure of salaries in the wider locality.

Existing Community Facilities (Inc Health, Social Services and Emergency Services)

13.34 The impacts on local community facilities during the construction phase and operational phase are the same but will vary in magnitude dependent on the increase in resident population. The additional population within the area will place an additional demand upon the existing community facilities in the immediate area and on the town as whole. This might include increased use of existing community centres and bolstering of existing community activities such as churches and libraries for example. The impact of this additional use is expected to be beneficial and minor in magnitude.

13.35 As well as the increase in patronage on local community facilities. The scheme proposes the inclusion of a primary school and land reserved for community facilities. This and the anticipated increase in people in the area may well give rise to the setting up of new activities and the enriching of community life. This positive impact is considered to be minor in magnitude.

13.36 With the increased population the housing development will produce it is inevitable that additional demand will be generated for health care facilities. It is anticipated that emergency services can be provided within the appropriate response times. The impact on these public services is therefore assessed to be neutral.

Existing Educational Facilities

13.37 The impacts on educational facilities during the construction phase and the operational phase are the same but will vary in magnitude dependent on the release of dwellings for sale and resident population. Oxfordshire County Council have identified the following formula for calculating pupil yields:

- Primary School: For every 100 residents, 25 will require a primary school place.
- Secondary School: For every 100 residents, 20 will require a secondary school place.

13.38 Adopting this formula in the Gavray Drive context the proposed development of approximately 500 dwellings could generate:

- primary school places: 125 pupils
- secondary school places: 100 pupils

Note: This assessment takes no account of phased housing completions.

Existing Sport and Recreational Facilities

13.39 The impacts on sport and recreational facilities during the construction phase and the operation phase are the same but will vary in magnitude dependent on the resident population. Provision, as identified in the Ecology Chapter, will be made to ensure that the County Wildlife Site is protected throughout the construction phase and a management plan adopted to manage access.

13.40 The proposals which include open space in a variety of contexts. Specifically the proposals include the County Wildlife Site (CWS), creation of new water features, provision LAPs and LEAPs as prescribed by local policy, provision of greenways and the retention of existing vegetation throughout the proposals. The development therefore offers a range of formal and informal recreational opportunities. The provision of open space within the development is complementary to the wider recreational opportunities in the wider area.

13.41 Given the proximity to Langford Village and the existing open space along Langford Brook it is anticipated that the open space associated with the CWS will be used by the wider community. This use is anticipated as part of extending the green corridors throughout Bicester. The proposals, other than the County Wildlife Site, are not expected to attract visitors from beyond the immediate vicinity. Therefore no detrimental impact in terms of additional traffic generated is anticipated and this impact is assessed as being neutral.

Minimisation of Demand- Energy Strategy

13.42 Consumption of energy and its subsequent production of green house gases, such as C02, is a major issue facing all new development. Meeting national and international commitments on mitigating climate change should be a primary consideration for all new development projects. Design considerations will consider the two areas of energy efficiency and energy supply, as each play an important, but different, role in

reducing energy consumption. Both microclimate design and energy efficiency will form the basis of the energy strategy for the development.

Microclimate design

13.52 Energy demands can be reduced through careful consideration of the orientation and design density of the development and should be optimised to achieve good microclimatic properties to reduce the basic need for energy.

13.53 Solar gains can lead to substantial reductions on the demand for space heating in winter and the inter-season, but unwanted direct gains in summer should be avoided. Maximising the benefits of solar heat requires good solar access to external spaces and surfaces, and attention to the thermal properties of building and landscape materials will be required.

13.54 These and the following factors are incorporated into the Framework Plan where possible:

- where possible windows will be placed facing south and north facing windows will be minimised;
- aim where possible to site dwellings to allow for one elevation to face within 25° of due south;
- adequate spacing between the units to minimise overshadowing; advantage may be taken of the topography to reduce minimum spacing where possible;
- adaptability to seasonal variations to allow for solar gains in winter but exclude high level direct solar radiation in the summer;
- the use of exposed masonry to provide thermal storage in rooms with high solar gains;
- avoidance of dark rooms which require constant use of artificial lighting through establishing target daylight factors for residential developments;
- where possible, putting temperature sensitive rooms or constantly occupied rooms on the western elevation; and
- reduction in wind exposure through control of orientation, density and height of buildings.

13.55 The incorporation of these measures will mitigate effects on the microclimate resulting in a minor impact.

Energy Efficiency

13.56 In order to reduce the energy requirement, the new community needs to reduce heat losses and balance infiltration and ventilation such that energy use is minimised whilst maintaining a healthy internal environment. The applicants have considerable experience of adopting best practice in this regard and will develop a comprehensive strategy for the promotion of energy efficiency.

13.57 Designs of dwellings in the development will demonstrate compliance with an appropriate standard of construction and energy efficiency. This may be related to the Ecohomes standards set by Building Research Establishment. Specific targets will be developed in consultation with the relevant authorities. Nevertheless in the sections below the elements to be considered in an appropriate strategy are highlighted.

13.58 This approach is particularly relevant to the Government's commitments under the Kyoto agreement. Through the benchmark of energy performance of a New Community home against design specifications, targets for energy (and carbon dioxide, CO_2) reductions can be set and can contribute to the Government's Kyoto target of a 20% reduction in CO_2 by 2010 on 1995 levels.

13.59 The appropriate standard should address a wide range of opportunities to minimise the energy requirements of the development such as:

- the thermal properties of the building envelope;
- the energy efficiency rating of supplied appliances;
- the specification of appropriate boiler systems;
- the specification of appropriate insulation; and
- the installation of low energy lighting.

13.60 Specific examples of matters to be considered for inclusion in the appropriate standard include:

- the selection of efficient building forms and layout
- air tightness standards with good detailing at joints;
- the installation of double-glazing with Low Energy coating;
- the glazing area of unfavourably oriented windows;
- appropriate insulation standards using the *Standard Assessment Procedure* (SAP Rating System);
- insulation to hot water tanks and pipes and specification of efficiency standards and Nitrous Oxide emissions of all installed boilers;

- effective use of heating controls and where appropriate zonal heating can make significant energy and CO_2 savings and will be promoted;
- the provision of internal drying space/utility;
- the use of insulation with zero-ozone depletion potential;
- the installation of low energy lighting.

13.61 The establishment of appropriate standards and the incorporation of a range of the mitigation measures outlined above will mitigate the effects of additional green house gas emission and so the impact is assessed as being insignificant, although insofar as the development demonstrates best practice in terms of energy efficiency then the impact of the development will be beneficial.

Minimise demand for water

13.62 In order to minimise the demand for water supply in the development, measures for minimising water usage will be incorporated. The management of water consumption will be achieved through setting targets for maximum water consumption. One way of establishing such targets would be through the use of a standard, based on cubic metres per bedspace per annum, to be delivered by adopting a range of measures such as the following:

- the collection and re-use of rain water;
- the promotion the use of water metering;
- the use of aerated taps to basins using reduced mains pressure flow;
- the use of low flow/dual flush WCs;
- where appropriate, the use of baths and showers with reduced filling capacity and with environmental economy settings; and
- the provision of white goods, dishwasher and washing machine, meeting water consumption and efficiency A/B ratings.

Renewable energy

13.63 Renewable energy should be considered as a component of any good energy strategy. There are a range of renewable energy options that can be considered:

- advances in technology over the timescale of the development;
- uncertainty for potential residents as a result of investing in unreliable emerging technology;
- high market and investment costs incurred due to limited supply;

- immature market conditions meaning there are limited specialists to install and maintain the equipment;
- difficulties in reliably estimating the energy supply and matching this to energy demand; and
- unwillingness of energy providers to receive back excess energy on the grid, due to penalty clauses in electricity trading agreements.

13.64 Despite these difficulties no energy strategy should be complete without evaluating the opportunity. Consideration will be given in the detailed design of the development to the use of renewable energy technologies, in conjunction with the relevant local authorities and taking account of changing government funding to support the installation of such measures. Design of dwellings and commercial development should, as a minimum, safeguard the retrofitting of renewable energy technologies in the design.

Residual impacts

13.65 It is inevitable that the development will result in the consumption of additional energy resources. However following mitigation it is anticipated that the impact on energy supplies will be minor.

13.66 The possible upgrading of existing supplies to the site will have no long term effects but will result in short term adverse impacts assessed as moderate but local.

13.67 Design measures to promote efficiency in the use of resources will have the primary role of mitigating the demand for energy but will also have a long term beneficial impact in terms of demonstrating the application of best practice approaches. Careful attention to microclimate design will also have a beneficial effect on the consumption of energy.

14.0 SERVICES AND UTILITIES ISSUES

Introduction

14.1 This section of the ES investigates the likely impacts of the proposed development on the existing utilities and of the strategy for serving the proposed development.

14.2 The following statutory undertakers were contacted to determine the availability and capacity of gas, water, electricity and telecommunications service:

- Southern Electric
- Thames Water
- British Gas Transco

Reference Material and Assessment Method

14.3 This assessment has been undertaken by contacting the relevant service providers and confirming the current status and spare capacity of their services with respect to the proposed development as outlined in Chapter 2.

Existing Site Conditions

14.4 There are no existing services within the site itself. The majority of the services run along Gavray Drive which boarders the site to the south.

Potential Impacts of the Proposal- Construction Phase

14.5 During construction the provision of services and utilities by the different service providers will be co-ordinated with road and footway construction inline with best practice. This will minimise disturbance and disruption to occupiers of initial phases of development as latter phases are constructed. This impact is seen as neutral subject to the adoption of best practice.

Potential Impacts of the Proposal – Operational Phase

14.6 Southern Electric do not foresee any problems in providing a supply to land north of Gavray Drive, sufficient for approximately 500 domestic properties together with a

primary school and an area of potential community facilities. A high voltage power cable currently runs along Gavray Drive, which require reinforcing with 1950m of cable offsite to the Heron Way substation. After these works have been carried out there will be adequate supplies available to all elements of the proposed development. The impact of the operational phase of the development on electricity infrastructure is therefore considered to be minimal.

14.7 BT ducting was placed in Gavray Drive during its construction, along which BT will extend their cables from existing apparatus in Cambridge Way and Langford Village. The company does not require additional ducting, as the original proposals allowed for commercial development of the site. Adequate telecommunications services will therefore be available to all elements of the proposed development. The impact of the operational phase of the development on telecommunications infrastructure is therefore considered to be neutral.

14.8 Thames Water has advised that there is sufficient capacity within the Bicester supply zone for any additional demand generated by the development of land north of Gavray Drive. There will therefore be adequate water services available to all elements of the proposed development from the existing 200mm main in Gavray Drive. The impact of the operational phase of the development on water supply infrastructure is therefore considered to be neutral.

14.9 Thames Water has advised that there is sufficient capacity within the local foul water infrastructure to support any additional demand generated by the development on land north of Gavray Drive. There will therefore be adequate foul water provision to all elements of the proposed development. The impact of the operational phase of the development on water supply infrastructure is therefore considered to be neutral.

14.10 British Gas Transco has been consulted on the capacity of infrastructure to supply the proposed development as a whole and have confirmed the adequacy of existing supplies. British Gas Transco have confirmed that no services currently cross the site, however they have identified a 250mm low pressure pipeline running along Gavray Drive which can supply the proposed development at land north of Gavray Drive. The impact of the operational phase of the development on gas supply and infrastructure is therefore considered to be neutral.

14.11 Substations, where required, will be carefully located as part of detailed schemes submitted in due course. Locations will be provided for appropriate maintenance access whilst minimising any adverse visual impacts on the private realm or on the amenities of occupiers. On the basis of the identification of appropriate sites within the development, the impact of this infrastructure is considered to be neutral.

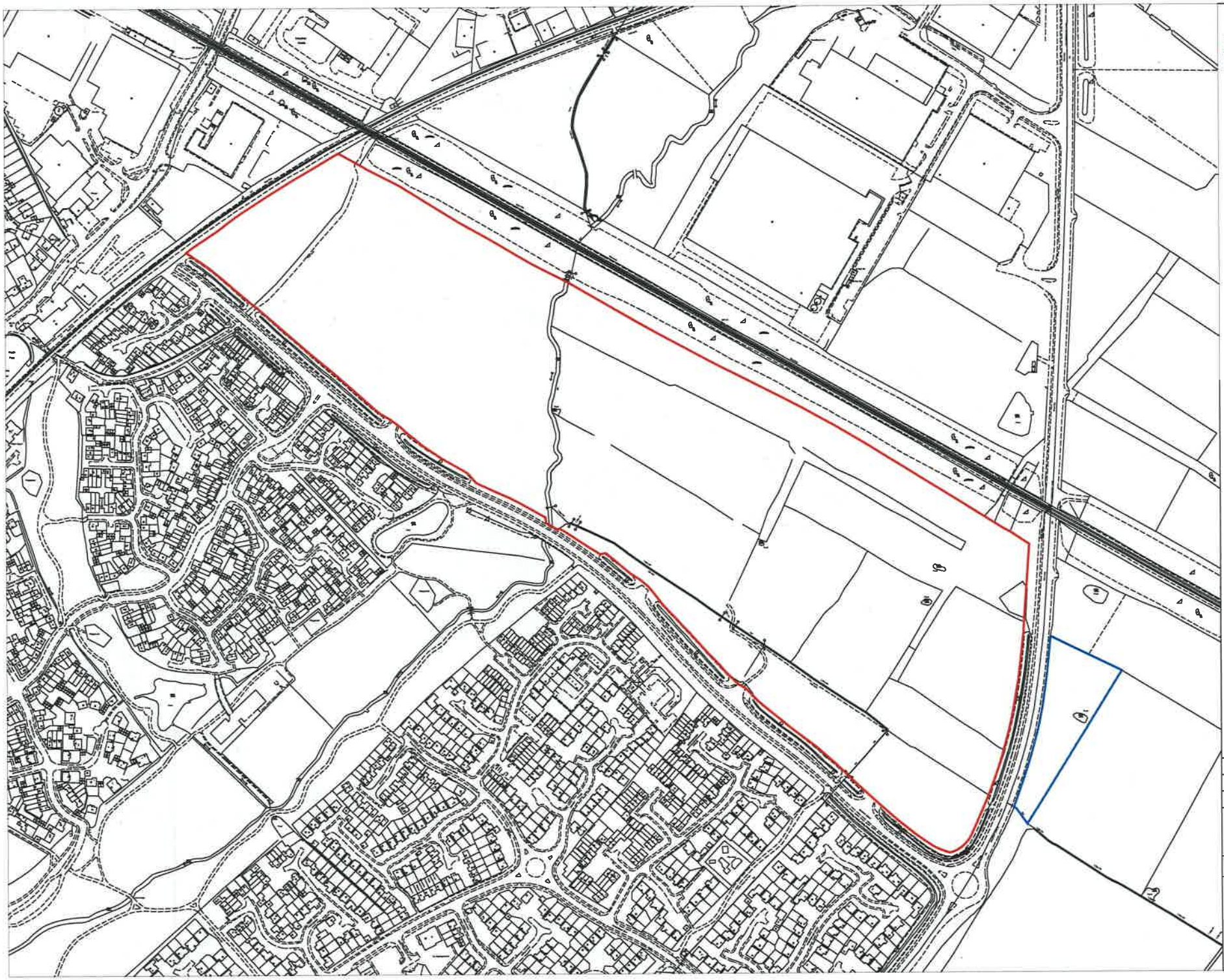
Conclusion and Summary

14.12 There will be no residual impacts on the existing supply of services and utilities as a result of the development; therefore the development is proposed to have a **neutral** impact.

No Figures

Figures

101	Red Line Plan
102	Development Framework Plan



REVISION LIST

Revision	Details	Rev Date

Dec 2004 | 1:2500@A2

LAND NORTH OF GAVRAY DRIVE ,BICESTER

Application Site Plan

Drawn	Designed	Checked	Approved	Drawing Number	Revision
ADW		AG	DK	JJG014 / 101	

DAVID LOCK ASSOCIATES
TOWN PLANNING AND URBAN DESIGN

DAVID LOCK ASSOCIATES LIMITED
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Key :-

- Site Boundary
- Developable Area (Max building height 10m)
- Retained Open Space, Wildlife Corridor and TPO's.
- Retained Open Space, Hedgerows and TPO's
- Country Wildlife Site
- TPO's to be retained subject to detailed design.
- Retained existing ponds.
- Created ponds.
- Land Reserved For Rail Chord
- Land Reserved For Primary School
- Land Reserved For Potential Community Facilities
- Existing And Retained Public Footpath
- Primary street corridor.

REVISION LIST

Revision	Details	Rev Date
A	Areas modified	08/04
B	Areas modified	11/04
C	Areas modified	11/04

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LAND NORTH OF GAVRAY DRIVE ,BICESTER

Development Framework Plan

Drawn	Designed	Checked	Approved	Drawing Number	Revision
ADW		AG	DK	JJG014 / 102	C

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No Figures

Figures

Auger Boring Location

ALC Grade 2

ALC Grade 3b

Site Boundary

N

0 40 80 120 160 200metres

Drawing Title

Figure 4.1: Distribution of ALC Grades and Auger Boring 13 Location

Client

Gallagher Estates Ltd & London and Metropolitan

Project

Land North of Gavray Drive, Bicester, Oxfordshire - Phase 1

Scale

As shown

Drawing No

CPM2172/42a

Date

11/04 RWB/MP

Checked

RB

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Figures

FIGU 5.0 : SIGNIFICANCE MATRIX FOR IMPACTS ON . ORICULTURAL QUALITY

(Quality class categories in accordance with BS 5837 : Trees in Relation to Construction (1>>1))

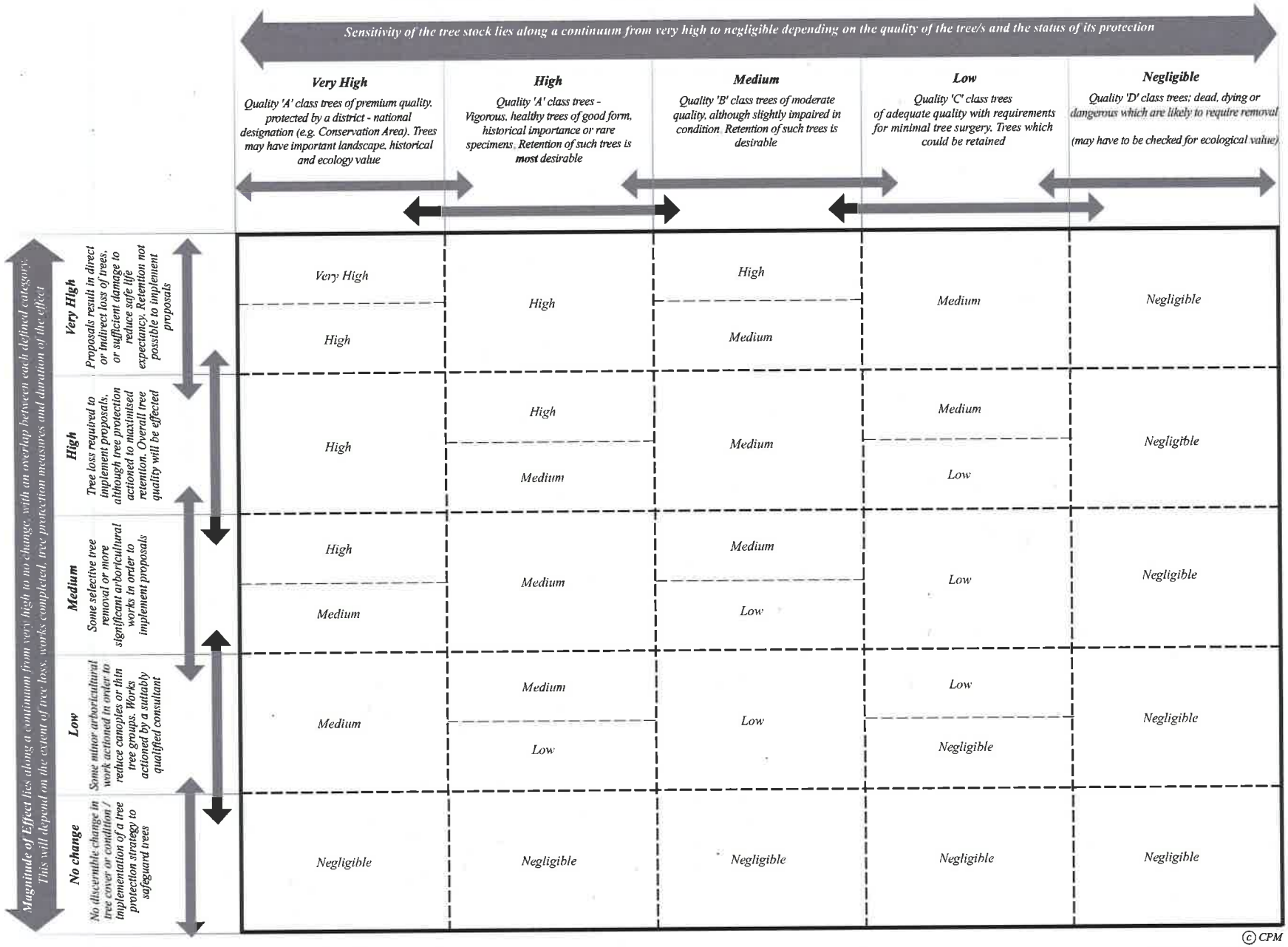

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FIGURE 5.1 : SIGNIFICANCE MATRIX FOR IMPACTS ON ARBORICULTURAL AMENITY

(Arboricultural and visual amenity interpretations in accordance with the Arboricultural Association Guidance Note 4 (The Helliwell System) and the DETR Guidance for Tree Preservation Orders: A Guide to the Law and Good Practice)

Sensitivity of tree amenity lies along a continuum from very high to negligible depending on the visibility of the tree/s, the individual impact of a tree/s, and the significance of a tree/s within their local surroundings. The sensitivity of the viewers and the activities of the viewer should also be considered

***Magnitude of Effect** lies along a continuum from very high to no change, with an overlap between each defined category. This will depend on the extent of impact to amenity and setting, the number of viewers effected and the duration of effects*

Magnitude of Effect	Very High *Tree/s with important position in the landscape and very suitable for setting. Clearly visible by the public and special value in terms of size, form and location. Often designated trees - covered by TPO / Conservation Area*	High *Tree/s with important position in the landscape and suitable for setting. Visible by the public, although less important in relation to its contribution to the wider landscape. No designation usually applicable*	Medium *Tree/s with a less significant position in the landscape, usually less visible to the public, and less suitable in relation to the setting (e.g. non-native / too large)*	Low *Tree/s with little importance of position in the landscape, poor suitability for setting and barely visible from public places*	Negligible *Dead, dying or dangerous trees with no importance of position in the landscape, and providing no contribution to the local setting. Also trees that are not visible by the public* *(this does not include ecological value)*
Very High *Development proposals and tree works that are highly destructive, resulting in tree loss and significant changes to amenity, setting and public views*	*Very High* *High*	*High*	*High* *Medium*	*Medium*	*Negligible*
High *The loss of a tree/s will have a direct impact on the amenity, setting and views from public places as a result of tree works and development pressure*	*High*	*High* *Medium*	*Medium*	*Medium* *Low*	*Negligible*
Medium *A noticeable change in amenity, setting or views towards the tree/s*	*High* *Medium*	*Medium*	*Medium* *Low*	*Low*	*Negligible*
Low *A barely perceptible change in amenity or usability of the tree/s*	*Medium*	*Medium* *Low*	*Low*	*Low* *Negligible*	*Negligible*
No change *No discernible change in amenity, usability of the tree/s*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*

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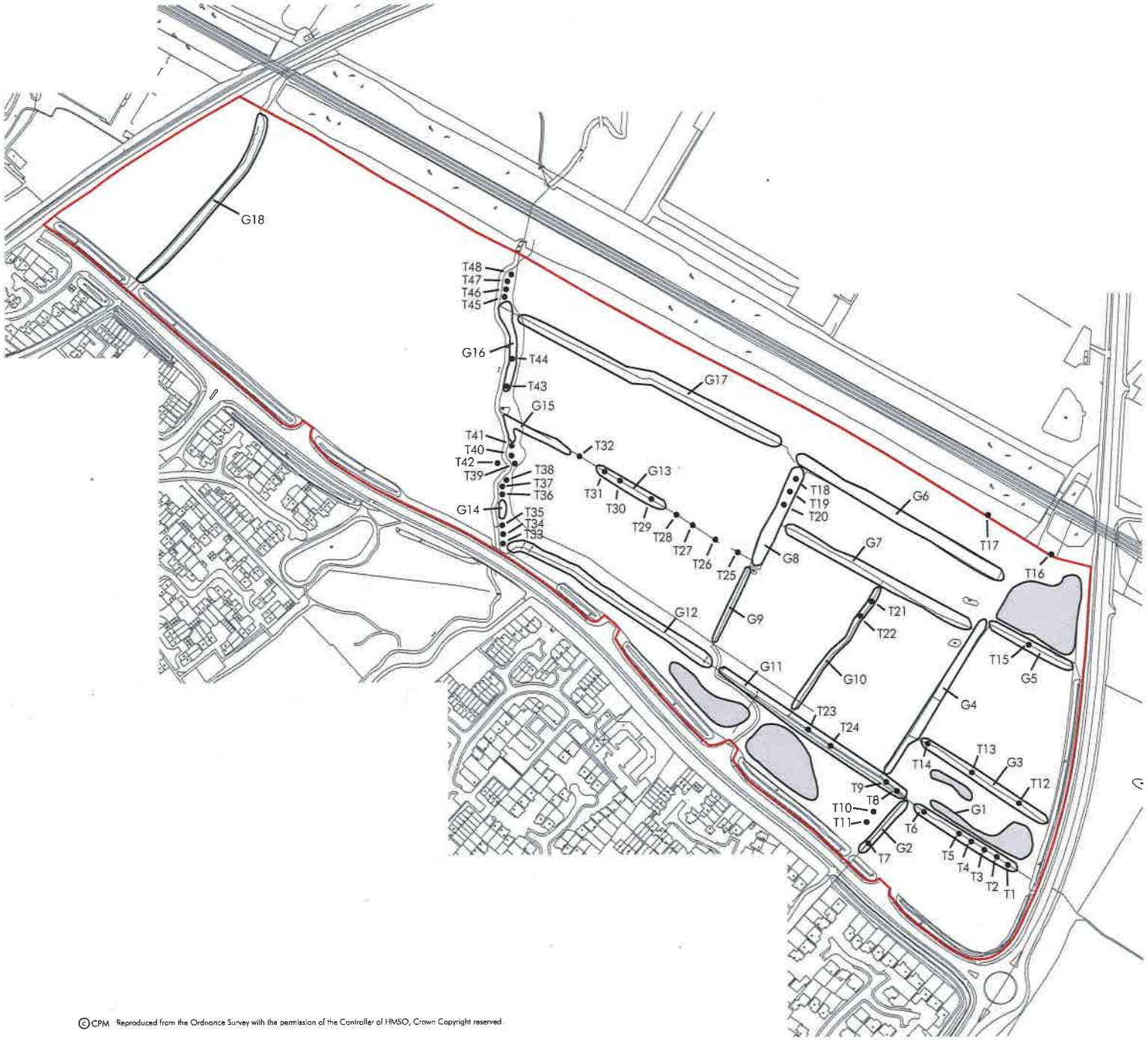

Study area

Individual tree (approximate location)

Tree group / hedgerow group (approximate extent)

Scrub / vegetation not surveyed (see CPM ecology survey)

N

0 100m

Drawing Title	**Findings of Arboricultural Survey**
Client	Gallagher Estates Ltd & London and Metropolitan
Project	Land North of Gavray Drive, Bicester, Oxfordshire
Scale	As shown
Drawing No	CPM2172/10a
Date	11/04 JB/SH
Checked	

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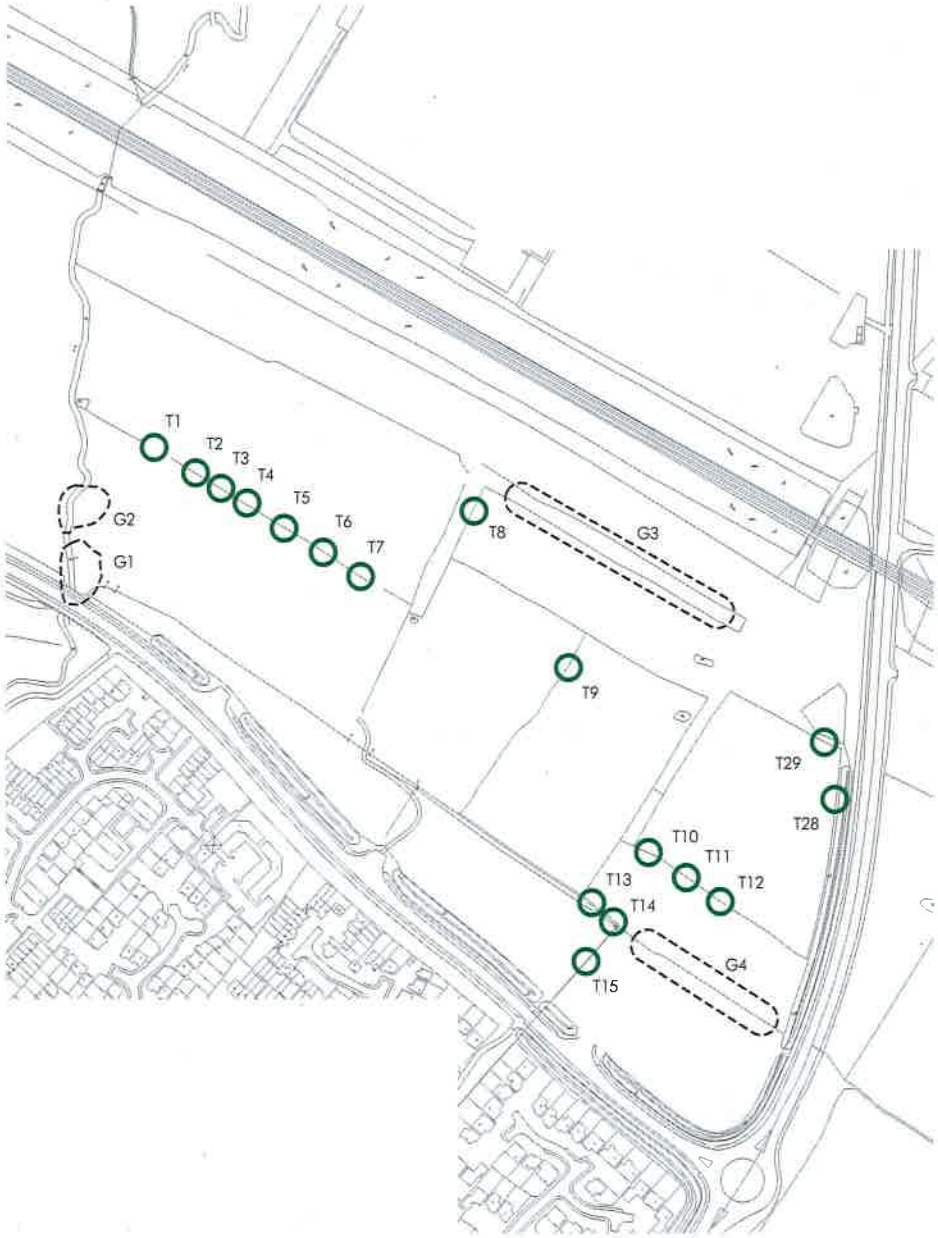

Tree Presevation Order No 17/90

N

0 40 80 120 160 200metres

Drawing Title	**Tree Preservation Order Details**
Client	Gallagher Estates Ltd & London and Metropolition
Project	Land North of Gavray Drive, Bicester, Oxfordshire
Scale	As shown
Drawing No	CPM2172/47a
Date	11/04 JB/LS
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Figures

FIGURE 6.0 : SIGNIFICANCE MATRIX FOR IMPACTS ON LANDSCAPE CHARACTER AND FEATURES

Landscape impacts are changes in the fabric, character and quality of the landscape as a result of development. Landscape Impact Assessment is therefore concerned with:

- *Direct impact on specific landscape elements*
- *Subtle effects on landscape character and distinctiveness*
- *Impact on acknowledged special interests or values*

Sensitivity of Landscape Character and Landscape Features lies along a continuum depending on the items importance - from international to low local importance - with overlap between each defined category. The sensitivity of these depends upon the level of existing designation and on the inherent quality and condition of the landscape character and individual features

	International	***National***	***County***	***High (local)***	***Moderate (local)***	***Low (local)***
	Internationally designated feature or landscape character, susceptible to relatively small changes	*Nationally designated feature or landscape of particularly distinctive character, susceptible to relatively small changes*	*County designated feature or landscape reasonably tolerant of changes*	*A landscape or feature designated as being of District / Borough value with characteristics reasonably tolerant of changes*	*Locally valued components or landscape reasonably tolerant of changes*	*A non designated landscape character or feature, the nature of which is potentially tolerant of substantial change*
Very High *At complete variance with the landform, scale and pattern of the landscape*	*Severe*	*Very High*	*High*	*High* / *Medium*	*Medium*	*Medium* / *Low*
High *A significant deterioration (or improvement) in landscape character or loss of features over an extensive area*	*Very High*	*High*	*High* / *Medium*	*Medium*	*Medium* / *Low*	*Low*
Medium *A noticeable deterioration (or improvement) in landscape character and landscape elements*	*High*	*High* / *Medium*	*Medium*	*Medium* / *Low*	*Low*	*Low* / *Negligible*
Low *A barely perceptible deterioration (or improvement) to elements or character*	*High* / *Medium*	*Medium*	*Medium* / *Low*	*Low*	*Low* / *Negligible*	*Negligible*
No change *No discernible change to any landscape elements or character*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*

Nature of impact

Magnitude of Effect lies along a continuum from very high to no change, with an overlap between each defined category. This is determined by assessing the amount of the character, landscape type or feature effected within the context of the site and the permanence of the effect

Nature of impact

Nature of impact

Nature Of Impact (After construction and maturation of mitigatory measures).

Adverse

- ***Severe*** *: Would irrevocably damage, degrade or badly diminish the characteristic features, elements and their setting.*
- ***High (Very High - High):*** *Total permanent loss or major alteration to key elements/features of the landscape. Introduction of elements totally uncharacteristic of the surrounding landscapes.*
- ***Medium*** *: Substantial permanent loss or alteration to one or more key elements/landscape. Introduction of elements that are prominent but may not be substantially uncharacteristic with the surrounding landscape.*
- ***Low (Minor or Negligible)*** *: Minor permanent/temporary loss or alteration to one or more key elements/features of the landscape. Introduction of elements that may not be uncharacteristic with the surrounding landscape and may provide positive enhancement.*

Beneficial

- ***High (Very High - High):*** *Fit very well with scale, landfo rd pattern. Potential through measures to restore landscape characteristics, further policy objectives.*
- ***Medium*** *: Fit well with scale, landform and pattern, incor easures to blend with surroundings. Maintain or enhance existing character.*
- ***Neutral (Minor or Negligible)*** *: Complement scale, landform and pattern of the landscape. Maintain existing character.*

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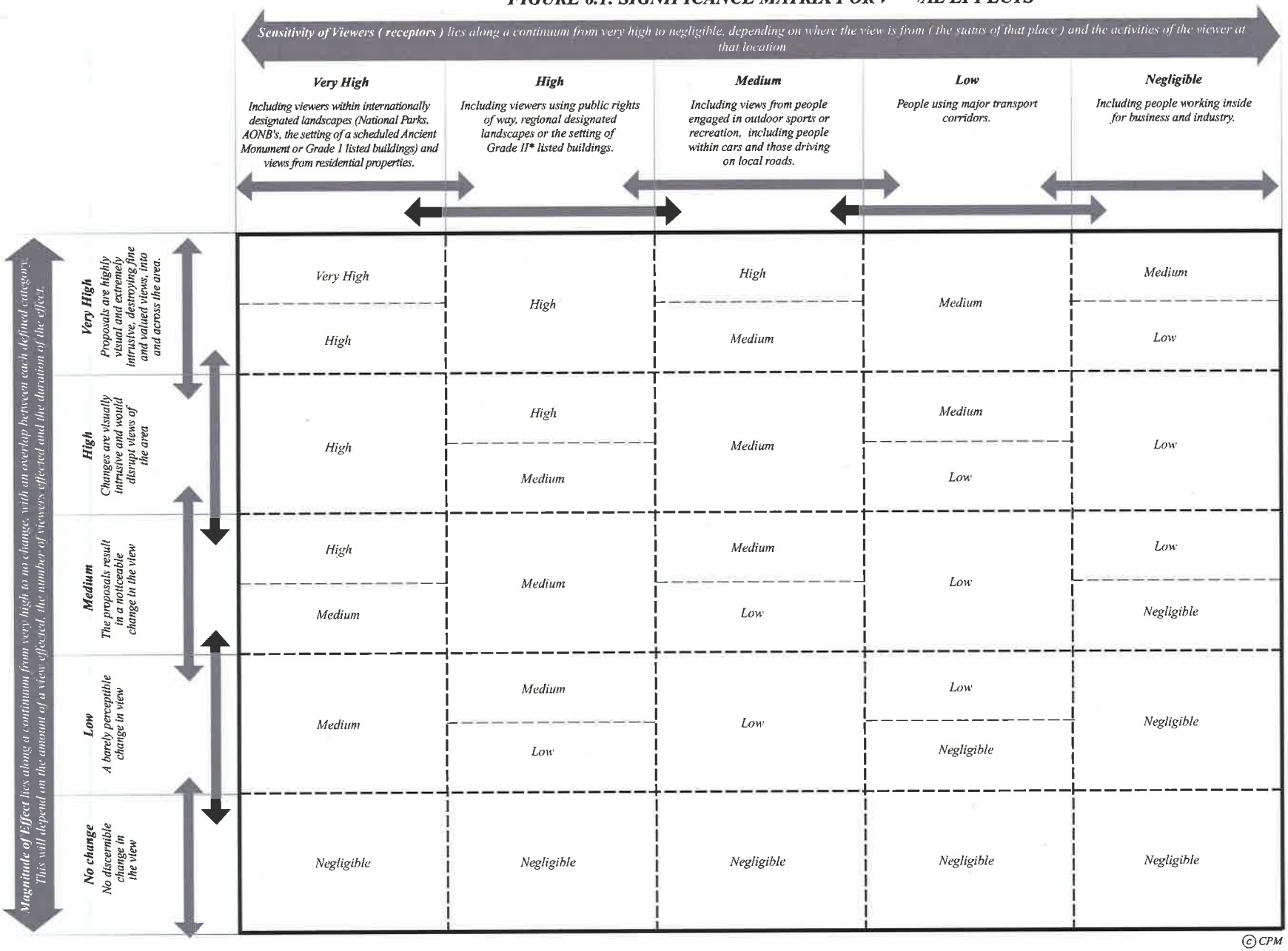
FIGURE 6.1: SIGNIFICANCE MATRIX FOR V IAL EFFECTS



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Nature of the Impact (After construction and maturation of the mitigatory measures).

Adverse

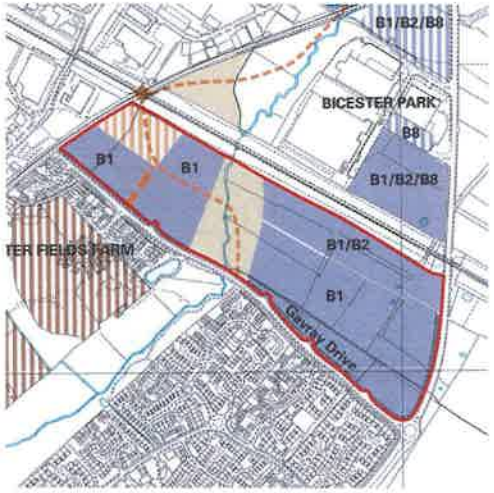
- ***High (Very High - High):*** *The proposals are highly visually intrusive and would disrupt fine and valued views both into and across the area.*
- ***Medium*** *: The proposals are visually intrusive and will adversely impact on the landscape.*
- ***Low (Minor or Negligible)*** *: Little visual intrusion which can be mitigated for without an impact on the landscape character.*

Beneficial

- ***Low (Minor or Negligible)*** *: Where the scheme would result in a barely perceptible improvement in the existing view.*
- ***Medium*** *: A noticable improvement in the view.*
- ***High*** *: A significant improvement in the view. Sense of place restored.*

Cherwell Local Plan, adopted November 1996

- Application area
- Commited Site for Employment Generating Development
- Proposed Site for Employment Generating Development
- R — Recreational Purposes

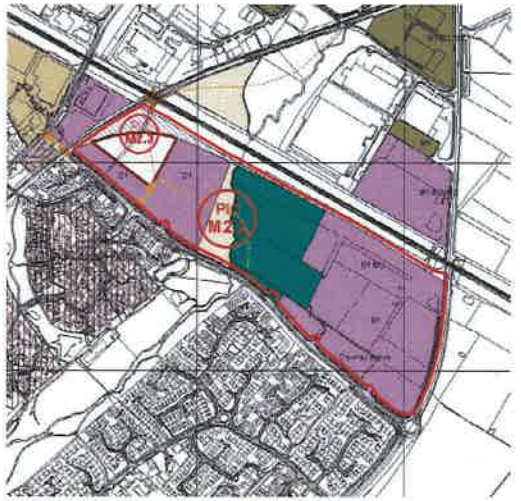


Cherwell Local Plan 2011, Deposit Draft, February 2001

- Proposed Site for Employment Generating Development
- Proposed Recreational Use
- Strategic Footpath Cycleway Link
- Proposed Multi Modal Transport Interchange
- Proposed New or Improved Road

Cherwell Local Plan 2011, Revised Deposit Draft, September 2002

- Proposed Housing Site
- 2.6 — The reference number(s) shown on this map refer to changes that have been made to the Deposit Draft Cherwell Local Plan 2011: February 2001
- Proposed Site for Community Care Home
- Proposed Primary School



Cherwell Local Plan, Revised Deposit Draft, Pre-Inquiry Changes, June 2004

- Proposed Site for Employment Generating Development
- Retained County Wildlife Site
- Proposed Recreational Use
- Land Safeguarded for Connecting Railway Line
- Proposed New or Improved Road
- Strategic Footpath
- Proposed Railway Station
- Proposed Multi Modal Transport Interchange

Note: The four plan extracts show the progression of the Local Plan.

N

0 100 200 300 400 500metres

Drawing Title: **Figure 6.2 : Planning Context**

Client: Gallagher Estates Ltd & London and Metropolitan

Project: Land North of Gavray Drive, Bicester, Oxfordshire

Scale: 1:10,000

Drawing No: CPM2172/54

Date: 12/04 SC/LS

Checked: JB.

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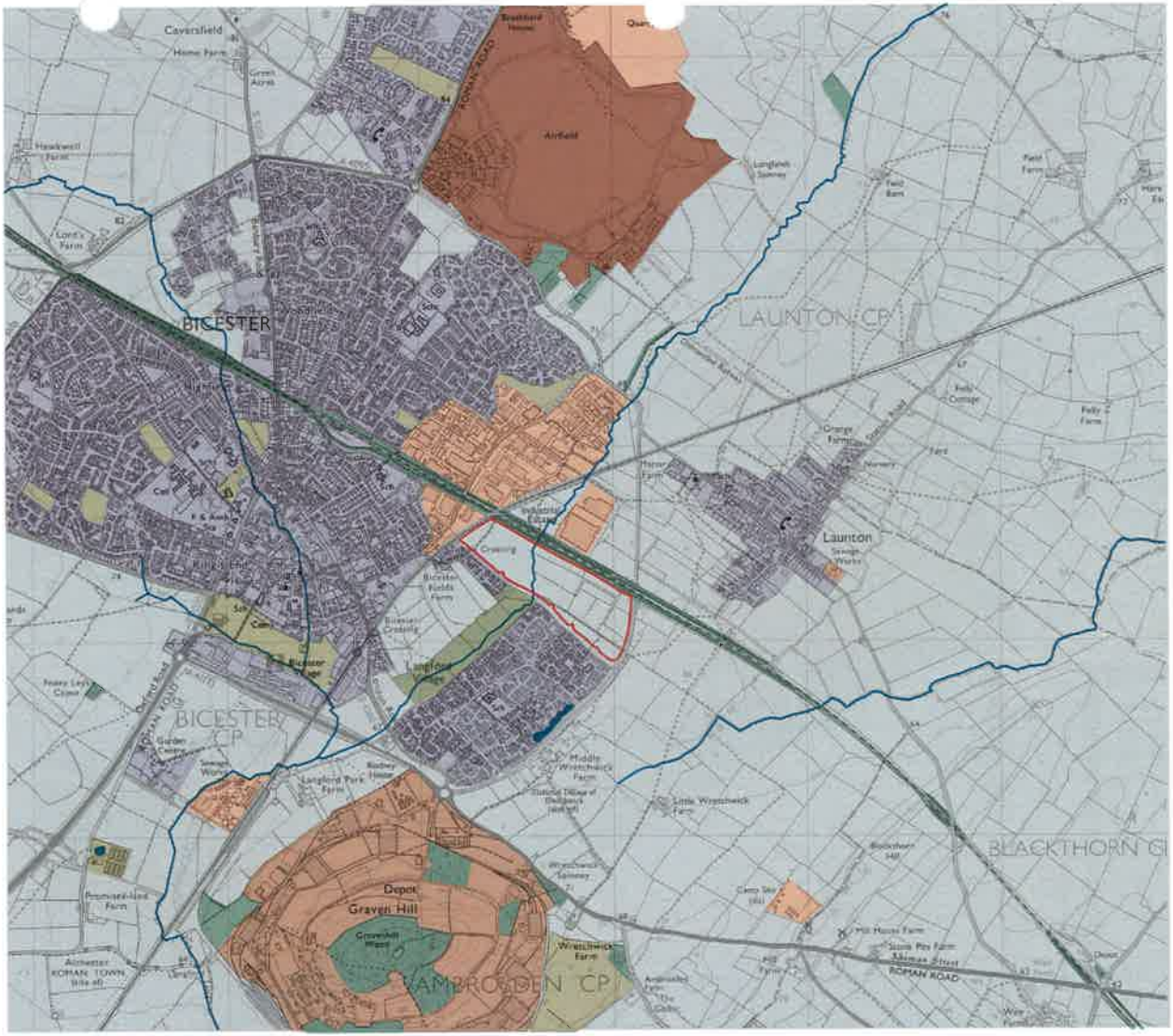

Application area
Arable and pastoral fields
Public open space and recreational land use
Broadleaved woodland blocks and primary tree belts
Urban built form
Industrial and employment areas
MOD land
Disused airfield
Principal rivers, streams and waterbodies

0 1Km

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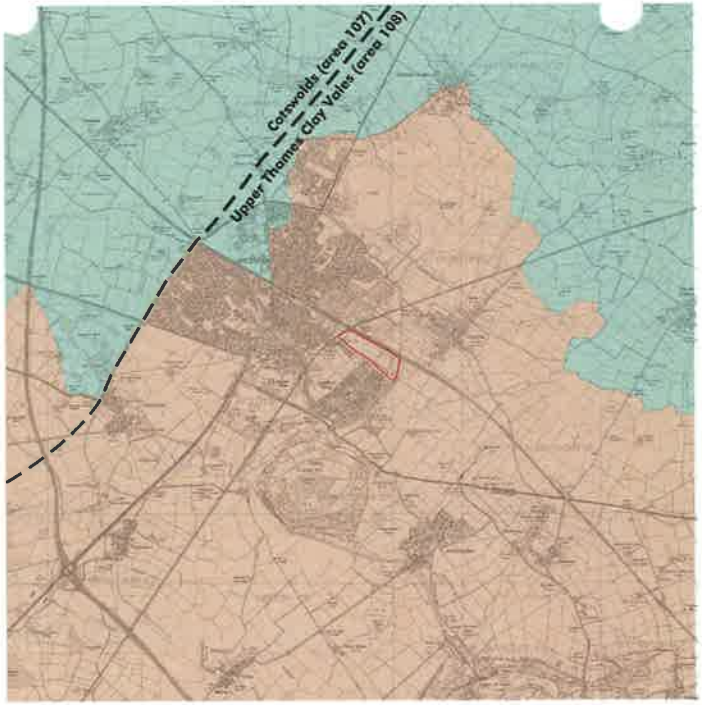

Application area
Character area boundary, Countryside Agency
Otmoor lowlands
Oxfordshire estate farmlands

ref: Cherwell District Landscape Assessment, Cobham Resource Consultants, Nov. 1995

0 2Km

N

Drawing Title: **Figure 6.3 : Landuse and Landscape Character**

Client: Gallagher Estates Ltd & London and Metropolitan

Project: Land North of Gavray Drive, Bicester, Oxfordshire

Scale: As shown

Drawing No: CPM2172/55

Date: 12/04 SC/LS

Checked: JB.

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Note: Glimpsed/partial views available from private dwellings to the south of Gavray Drive though these are limited/filtered due to the existing mature vegetation.

- Application area
- Private dwellings with largely clear views of the site from some private windows (14 No. approximately)
- Private dwellings with glimpsed/partial or oblique views of the site (1 No. approximately)
- Approximate extant of principal vegetative visual barriers
- Roads/footpaths/rail links/bridleways with some views to site
- Visual Envelope
- Distant glimpsed views to the application area
- 1 Land parcels enclosed by vegetation, limiting views across the application area

N

0 50 100 150 200 250metres

Drawing Title: **Figure 6.4 : Visual Envelope**

Client: Gallagher Estates Ltd & London and Metropolitan

Project: Land North of Gavray Drive, Bicester, Oxfordshire

Scale: 1:5000

Drawing No: CPM2172/56

Date: 12/04 SC/LS

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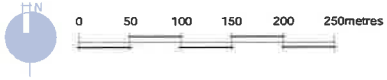
Application area

Photoviewpoints



Drawing Title: **Photoviewpoint Location Plan**

Client: Gallagher Estates Ltd & London and Metropolitan

Project: Land North of Gavray Drive, Bicester, Oxfordshire

Scale: 1:5000

Drawing No: CPM2172/16a

Date: 11/04 SC/JTF

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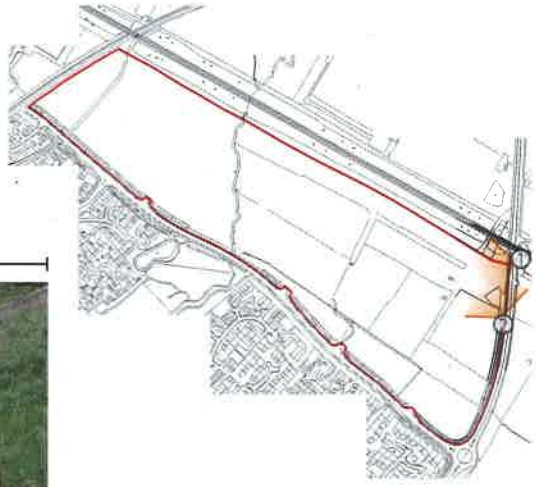
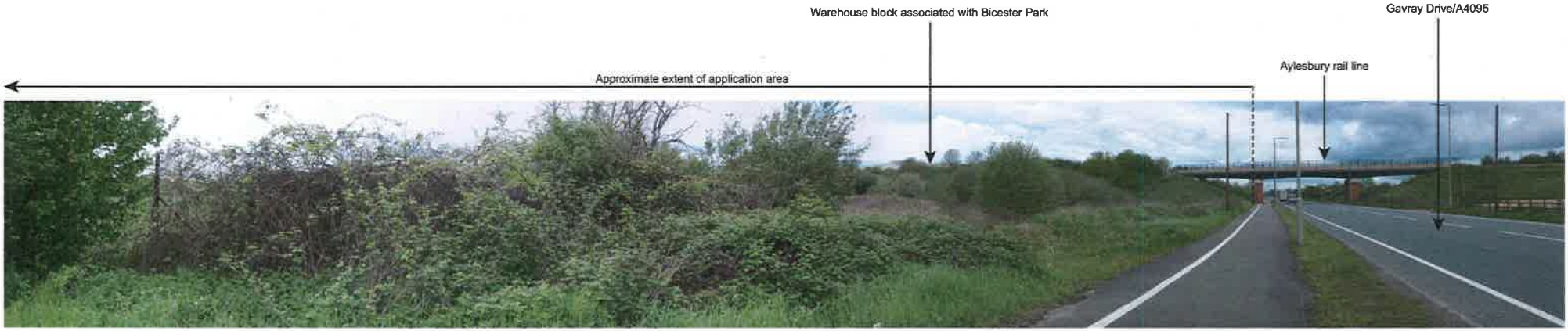


Photoviewpoint 1: From Gavray Drive views are available south west across the site, though these are interrupted and filtered by existing dense vegetation.



Photoviewpoint 2: Looking in a north westerly direction from Gavray Drive, glimpsed views available to the application area.

Photoviewpoints 1 & 2 | Drawing Title

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Land North of Gavray Drive, Bicester, Oxfordshire | Project

SC/JTF 11/04 CPM2172/17a | Drawing No.

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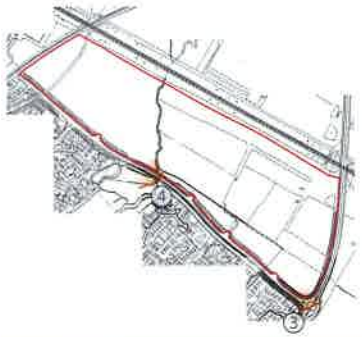
Photoviewpoint 3: From the corner of Gavray Drive, looking northwards towards the site, the dense boundary vegetation is evident.

Three storey residential dwellings associated with Bicester Fields Farm

Photoviewpoint 4: From the bridge crossing the Langford Brook, looking west along Gavray Drive, clear views are available across the western portion of the application area.



Photoviewpoints 3 & 4 | Drawing Title

Gallagher Estates Ltd & London and Metropolitan | Client

Land North of Gavray Drive, Bicester, Oxfordshire | Project

SC/JTF 11/04 CPM2172/18a | Drawing No.

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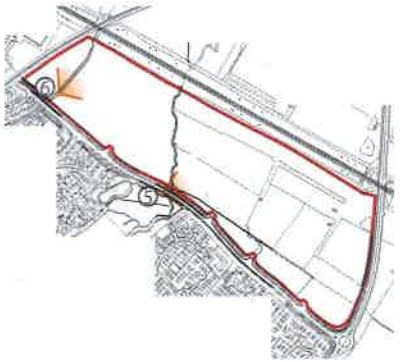

Photoviewpoint 5: From the bridge crossing the Langford Brook, looking west along Gavray Drive, clear views are available across the western portion of the application area.

Photoviewpoint 6: Looking northeast from within the application area, on footpath ref. 3, large industrial blocks exist adjacent to the site, to the north and west.

Photoviewpoints 5 & 6 | Drawing Title

Gallagher Estates Ltd & London and Metropolitan | Client

Land North of Gavray Drive, Bicester, Oxfordshire | Project

SC/JTF 11/04 CPM2172/20a | Drawing No.

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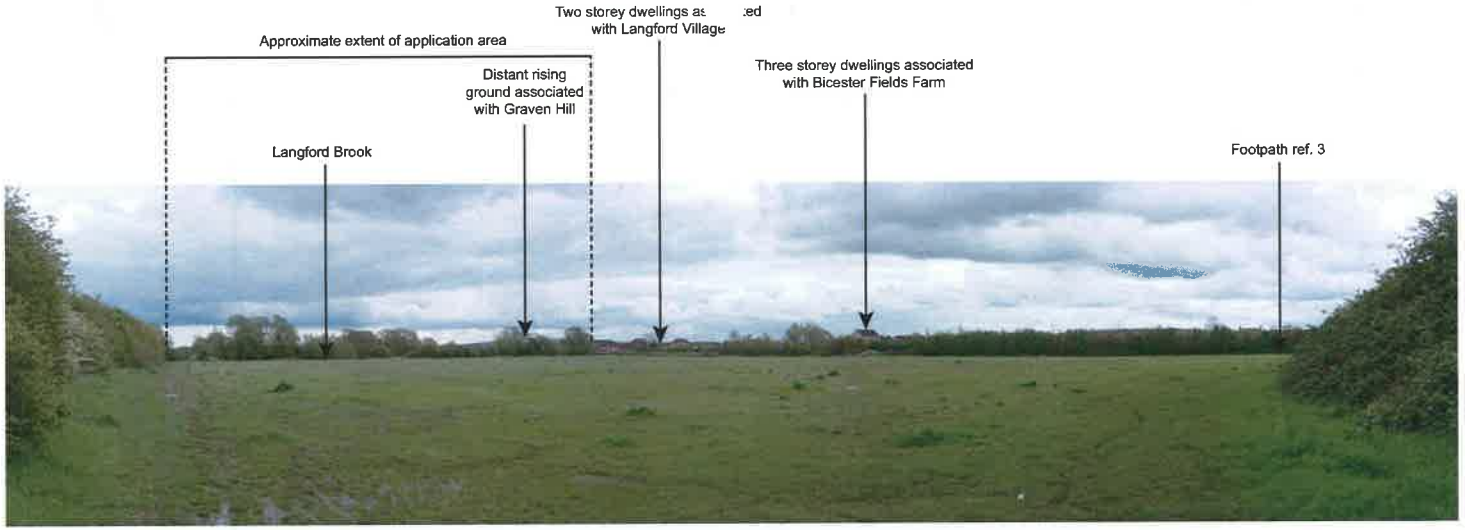

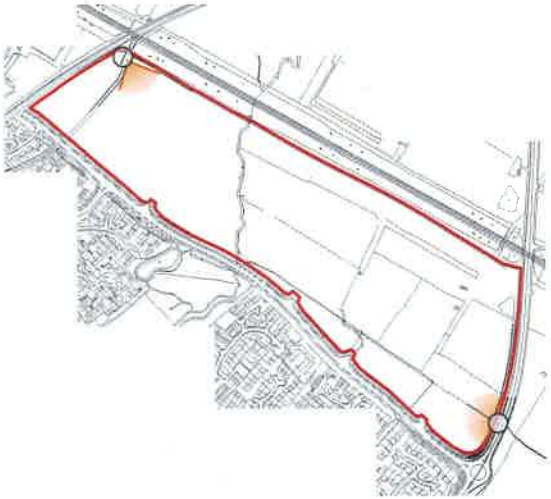

Photoviewpoint 7: From the northwest corner of the site from footpath ref. 3, looking towards Gavray Drive, views to residential dwellings are available, though limited/filtered.

Photoviewpoint 8: Looking west upon entering the site on footpath ref. 4, hedgerows filter views in all directions.

Photoviewpoint 7 & 8 | Drawing Title

Gallagher Estates Ltd & London and Metropolitan | Client

Land North of Gavray Drive, Bicester, Oxfordshire | Project

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Photoviewpoint 9: Distant views are available from Blackthorn Hill from bridleway ref. 9.

Photoviewpoint 9 | Drawing Title

Gallagher Estates Ltd & London and Metropolitan | Client

Land North of Gavray Drive, Bicester, Oxfordshire | Project

SC/JTF 11/04 CPM2172/22a | Drawing No.

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FIGURE 6.11 - LANDSCAPE AND VISUAL IMPACT IDENTIFICATION MATRIX

X = Impact will occur (beneficial, neutral or adverse).
- = No impact

	Direct Impacts (Temporary)	Protective / security fencing	Site clearance	Site access and haulage routes	Mobile construction plant such as cranes	Soil / vegetation stripping	Stock pile and material storage areas	Site huts, utilities and parking	Direct Impacts (Permanent)	Residential development and associated infrastructure	Hedgerow and tree removal	Indirect Impacts	Upgrading of local highway and rail infrastructure, new signage
LANDSCAPE RECEPTORS													
Langford Brook		X	X	-	-	X	-	-		-	-		-
Public Footpath ref. 3 and ref. 4		X	X	X	X	X	X	X		X	X		-
Field Boundary Hedgerows		X	X	X	-	X	-	-		X	X		-
Individual trees		X	X	X	-	X	-	-		X	X		-
Pasture Fields and Riverside Meadows		X	X	X	X	X	X	X		X	X		-
VISUAL RECEPTORS													
Public Footpath ref. 3 and ref. 4		X	X	X	X	X	X	X		X	X		-
Properties south of Gavray Drive		-	X	X	X	X	X	X		X	-		X
Gavray Drive		-	-	-	X	-	-	-		X	-		X
Aylesbury Railway Line and Oxford & Thames Valley Railway Line		-	X	-	X	-	-	-		X	X		-

FIGURE 6.12 - PREDICTED TEMPORARY LANDSCAPE IMPACTS

LANDSCAPE RECEPTORS	LANDSCAPE VALUE	PROPOSAL	IMPACTS	IMPACT MAGNITUDE	IMPACT SIGNIFICANCE	MITIGATION	RESIDUAL IMPACT SIGNIFICANCE
Langford Brook	**Moderate (Local)**	Retention of grassland paddocks and associated vegetation of areas adjacent to Langford Brook. Construction of residential properties/local facilities/school within 40m of the river corridor. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, soil stripping and removal of vegetation.	Potential change in the setting of the Langford Brook through visual disturbance as a result of construction activity.	**Low**	**Negligible-Low**	Ensure protective fencing is erected in accordance with BS 5837 to protect any retained important vegetation. Protective hoardings and construction setback zones will also ensure that the watercourse is not contaminated or disrupted.	**Low Beneficial**
Public Footpaths ref. 3 & ref. 4	**County**	Construction of residential properties/local facilities/school within 1m of public footpaths. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, flood alleviation works, soil stripping and removal of vegetation.	Potential change in the setting of the footpath through reduced quality and changed character of setting, as a result of construction activity in close proximity and as a result of temporary closure.	**Medium**	**Medium**	Clear signage to alert uses of temporary proposed footpath diversion. Protective fencing erected to ensure site security and safety. Large sections of the existing footpath will be separated by protective fencing from the development works to maintain and control access and prevent potential hazards. Temporary diversions away from construction traffic and activity will be required at various stages in the construction process.	**Medium Adverse**
Field Boundary Hedgerows	**Moderate (Local)**	Construction of residential properties/local facilities/school within 5m of field boundaries. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, flood alleviation works, soil stripping and removal of vegetation.	Clearance of limited sections of tree belts / field boundary hedgerows (approximately 593m). Presence of construction activity and haulage routes. Potential damage to existing hedgerows and ditches to be retained.	**Medium**	**Low**	Ensure protective fencing is erected in accordance with BS 5837 to protect any retained important hedgerows.	**Low Adverse**
Individual trees	**High (Local)**	Construction of residential properties/local facilities/school within 15m of individual trees. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, flood alleviation works, soil stripping and removal of vegetation.	Clearance of a limited number of trees (6no. in total). Presence of construction activity and haulage routes.	**Low**	**Low**	Ensure protective fencing is erected in accordance with BS 5837 to protect any retained important trees.	**Low Adverse**
Pasture Fields and Riverside Meadows	**High (Local)**	Construction of residential properties/local facilities/school within 1m of public footpaths. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, soil stripping and removal of vegetation.	Clearance of areas of existing pasture associated with the development area. Presence of construction activity and haulage routes.	**Medium**	**Low-Medium**	Width of construction area minimised in order to retain larger areas of grassland.	**Low Adverse**

FIGURE 6.13 - PREDICTED PERMANENT LANDSCAPE IMPACTS

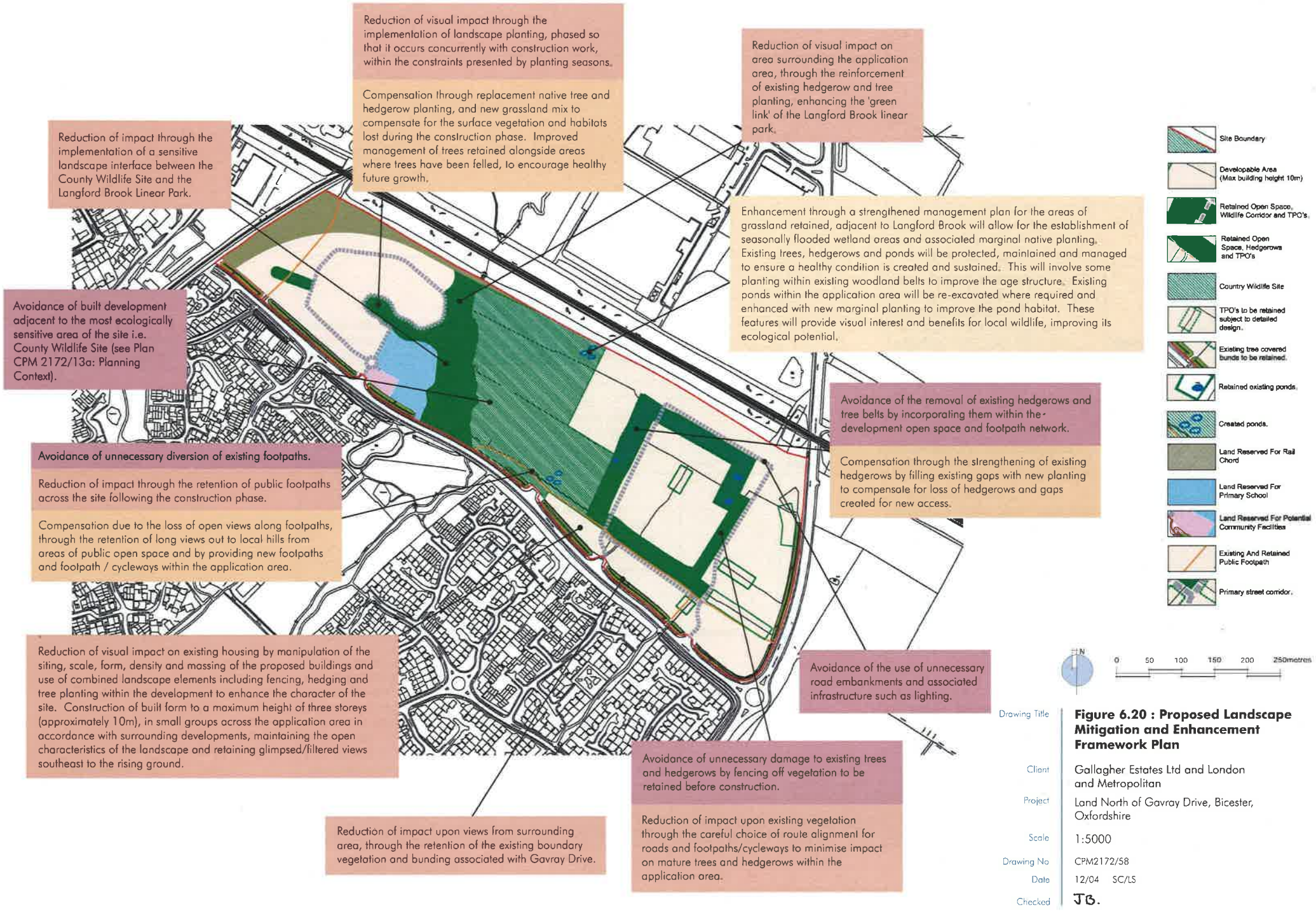
LANDSCAPE RECEPTORS	LANDSCAPE VALUE	PROPOSAL	IMPACTS	IMPACT MAGNITUDE	IMPACT SIGNIFICANCE	MITIGATION	RESIDUAL IMPACT SIGNIFICANCE
Langford Brook	**Moderate (Local)**	Residential, amenity and school use and associated infrastructure including road, footpath and cycleway access. Change of use to public open space as a linear park, including wetland habitats.	Disturbance due to increased human activity in and adjacent to the river and pond habitat.	**Medium**	**Low**	Protection and enhancement of the water environment associated with the Brook, to improve its long-term habitat potential. New belts of linear planting and ecological management in order to improve / enable habitat creation. Benefit in allowing public access onto land previously with limited access.	**Low Beneficial**
Public Footpaths ref. 3 & ref. 4	**County**	Residential, amenity and school use and associated infrastructure including road, footpath and cycleway access. Diversion of footpaths through residential areas.	Change in the setting of the public footpaths due to permanent diversion through the residential area. Change in character of the public footpath routes from principally rural to more urban in character	**Medium**	**Medium**	Retain footpath links to the wider landscape. Planting of trees and hedgerows along footpath routes to soften urban character. Creation of new footpath and footpath / cycleways within new development.	**Medium Adverse**
Field Boundary Hedgerows	**Moderate (Local)**	Residential, amenity and school use and associated infrastructure including road, footpath and cycleway access.	Loss of some 593m of tree belts / hedgerows.	**Low**	**Negligible-Low**	Loss of hedgerow minimised through design layout. Existing retained hedgerows to be strengthened through planting up of gaps. Replacement hedgerow planting to be incorporated into residential edge buffer strips.	**Low Adverse**
Individual trees	**High (Local)**	Residential, amenity and school use and associated infrastructure including road, footpath and cycleway access.	Loss of a limited number of trees, 6no. in total, of high local importance due to the lack of mature trees and woodland cover within the vicinity.	**Medium**	**Low-Medium**	New native tree planting throughout the site in the form of street trees and parkland trees in areas of open space.	**Low Adverse**
Pasture Fields and Riverside Meadows	**High (Local)**	Residential, amenity and school use and associated infrastructure including road, footpath and cycleway access.	Loss of approximately 13 ha. of pastoral land.	**Medium**	**Low-Medium**	Compensation through creation of areas of public open space and community facilities; retention and enhancement of habitats within the County Wildlife Park.	**Low Adverse**

FIGURE 6.14 - PREDICTED TEMPORARY VISUAL IMPACTS

VISUAL RECEPTORS	VISUAL SENSITIVITY	PROPOSAL	IMPACTS	IMPACT MAGNITUDE	IMPACT SIGNIFICANCE	MITIGATION	RESIDUAL IMPACT SIGNIFICANCE
Public Footpath ref. 3 and ref. 4	**High**	Construction of residential properties and associated infrastructure within 1m of public footpaths ref. 3 and ref. 4. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, soil stripping and removal of vegetation.	Clear views of construction vehicles, soil / vegetation stripping excavations and development construction. Tree and hedgerow removal. Temporary diversion / closure of footpath.	**High**	**Medium-High**	Clear signage to alert users of temporary closure / footpath diversion. Protective fencing, erected to ensure site security and safety, will restrict some views. Boundary hedgerows and tree and shrub buffers planted in advance of construction commencing.	**Medium Adverse**
Properties south of Gavray Drive	**Very High**	Construction of residential properties within 40m of existing properties. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, soil stripping and removal of vegetation.	Clear and glimpsed views of construction vehicles, soil / vegetation stripping and development construction. Tree and hedgerow removal will also be visible from some properties.	**Medium**	**Medium-High**	Implementation of hedgerow reinforcement and tree planting along Gavray Drive.	**Medium Adverse**
Gavray Drive	**Medium**	Construction of residential properties within 10m of Gavray Drive. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, soil stripping and removal of vegetation.	Glimpsed and clear views towards the construction vehicles, soil / vegetation stripping and development construction. Tree and hedgerow removal. Visual disturbance created by moving traffic, especially during hours of darkness.	**Low**	**Low**	Implementation of hedgerow reinforcement and tree planting along Gavray Drive.	**Low Adverse**
Aylesbury Railway Line and Oxford & Thames Valley Railway Line	**Low**	Construction of residential properties within 30m of railway line. Associated haulage routes, construction compounds, fixed and mobile plant, excavations, soil stripping and removal of vegetation.	Glimpsed/filtered views of construction vehicles, soil / vegetation stripping and development construction.	**Low**	**Negligible-Low**	New hedgerow / tree planting to the northeast edge of the application area to filter views towards the development. Strengthening of boundary vegetation to the north of the application area.	**Negligible Adverse**

FIGURE 6.15 - PREDICTED PERMANENT VISUAL IMPACTS

VISUAL RECEPTORS	VISUAL SENSITIVITY	PROPOSAL	IMPACTS	IMPACT MAGNITUDE	IMPACT SIGNIFICANCE	MITIGATION	RESIDUAL IMPACT SIGNIFICANCE
Public Footpath ref. 3 and ref. 4	**High**	Residential use and associated infrastructure including road, footpath and cycleway access. Original footpath routes retained unchanged will therefore pass through residential areas. Footpath ref. 4 will also pass through the County Wildlife Park.	Direct change in view from views across pastureland, enclosed by hedgerows, to housing and associated infrastructure for approximately 400m of the existing rights of way. Over 200m of footpath extends through the retained habitat of the County Wildlife Park.	**High**	**Medium-High**	Retain footpath links to the wider landscape. Planting of trees and hedgerows along footpath routes to filter views to residential properties / roads. Creation of new footpath and footpath / cycleways within new development.	**Medium Adverse**
Properties south of Gavray Drive	**Very High**	Residential use and associated infrastructure including road, footpath and cycleway access.	Clear and glimpsed views of housing and associated infrastructure, as well as increased traffic. Visual disturbance of an increased amount of moving traffic through the landscape, particularly the presence of vehicular lighting during hours of darkness.	**Medium**	**Medium-High**	The development, the majority of which is to be built at-grade with the existing landscape allowing retention of some views to the rising higher ground to the south east of the application area. Retention and strengthening of boundary vegetation to filter views towards the residential development from Gavray Drive road corridor and beyond.	**Medium Adverse**
Gavray Drive	**Medium**	Residential use and associated infrastructure including road, footpath and cycleway access.	Glimpsed and clear views towards residential development. Visual disturbance of an increased amount of moving traffic on the roads.	**Low**	**Low**	New hedgerow / tree planting to the northeast edge of the application area to filter views towards the residential development. Strengthening of boundary vegetation facing onto Gavray Drive.	**Low Adverse**
Aylesbury Railway Line and Oxford & Thames Valley Railway Line	**Low**	Residential use and associated infrastructure including road, footpath and cycleway access.	Glimpsed/filtered views of housing and associated infrastructure.	**Low**	**Negligible-Low**	New hedgerow / tree planting to the northeast edge of the application area to filter views towards the residential development. Strengthening of boundary vegetation to the north of the application area.	**Negligible Adverse**



Drawing Title: **Figure 6.20 : Proposed Landscape Mitigation and Enhancement Framework Plan**

Client: Gallagher Estates Ltd and London and Metropolitan

Project: Land North of Gavray Drive, Bicester, Oxfordshire

Scale: 1:5000

Drawing No: CPM2172/58

Date: 12/04 SC/LS

Checked: JB.

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Figures

Redline boundary	
Running water	R+f Ridge and furrow
Standing water	Seasonal/dry ditch
Bank	Wet ditch
Intact hedge	Fence
Mature tree	RG Rough grassland
Continuous scrub	Ig Semi-improved grassland
Xx Scattered scrub	Tree belt
Bare ground/rubble	Woodland tree belt/strip
Damp grassland	Burnt ground with dense regeneration of great burnet

1 etc = Quadrat number
1 etc = Field number

H1 etc = Hedge number
P1 etc = Pond

Species Abbreviations

Fe = Ash (*Fraxinus excelsior*)
Qr = Oak (*Quercus robur*)
Salix sp = Willow (*Salix sp*)

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Drawing Title	**Figure 7.1: Habitat Features**
Client	Gallagher Estates Ltd & London and Metropolitan
Project	Land North of Gavray Drive, Bicester, Oxfordshire
Drawing No	CPM2172/53
Date	11/04 RR/JTF
Checked	

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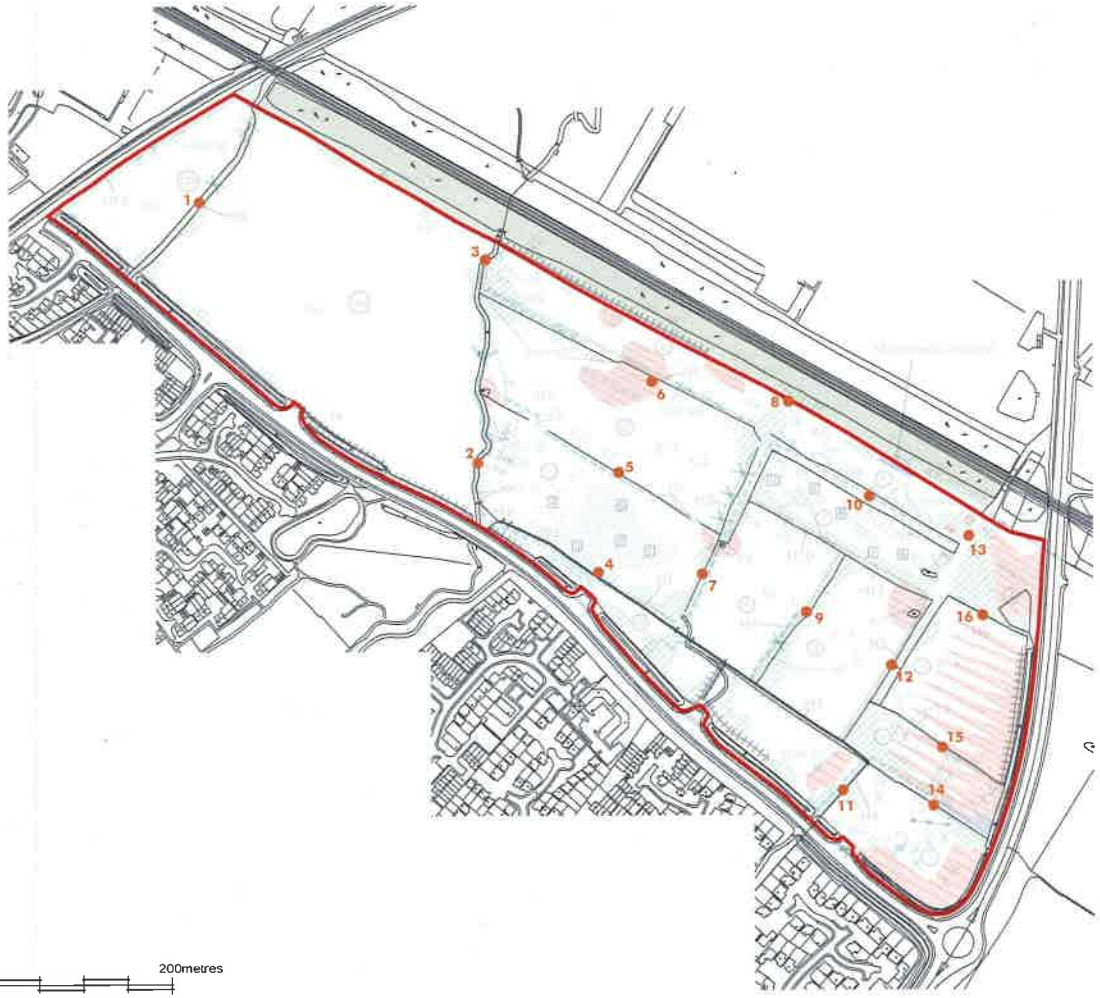

1-16 Sampling locations

Redline boundary

0 200metres

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Drawing Title **Figure 7.2: Bat Survey Sampling Locations**

Client Gallagher Estates Ltd & London and Metropolitan

Project Land North of Gavray Drive, Bicester, Oxfordshire

Drawing No CPM2172/03c

Date 11/04 RR/JTF

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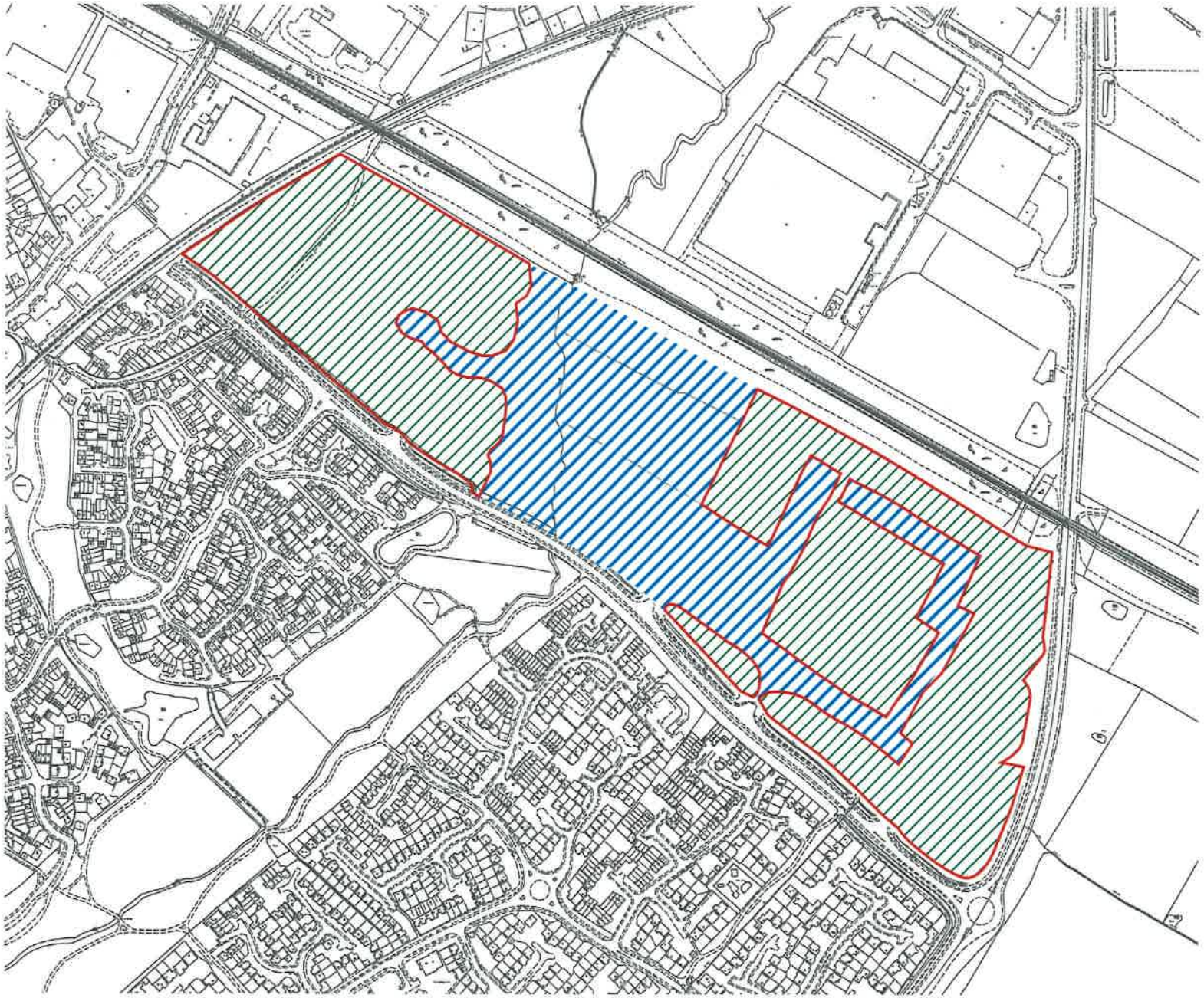

Amphibian fencing / pitfall traps

Great crested newt capture / translocation area

Potential receptor site to include new ponds and refugia

TN

Drawing Title **Figure 7.3: Outline Great Crested Newt Mitigation Strategy**

Client Gallagher Estates Ltd & London and Metropolitan

Project Land North of Gavray Drive, Bicester, Oxfordshire

Scale Not to scale

Drawing No CPM2172/45a

Date 11/04 RR/LS

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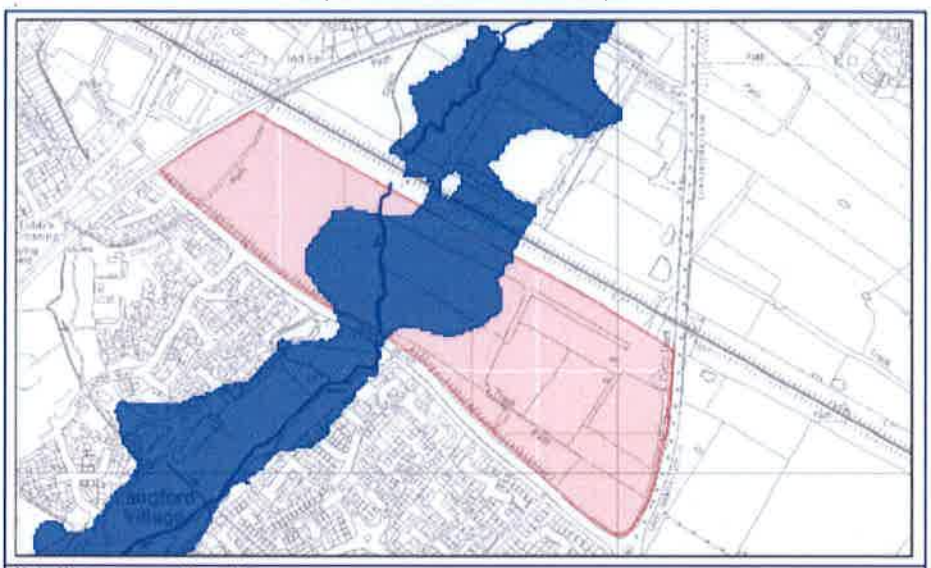
Figures

Figure 6.1 2004 Flood Zone Maps



Note: Watercourses – blue polyline
1% AEP Flood Extent (Zone 3) – blue hatched
Site – red hatched
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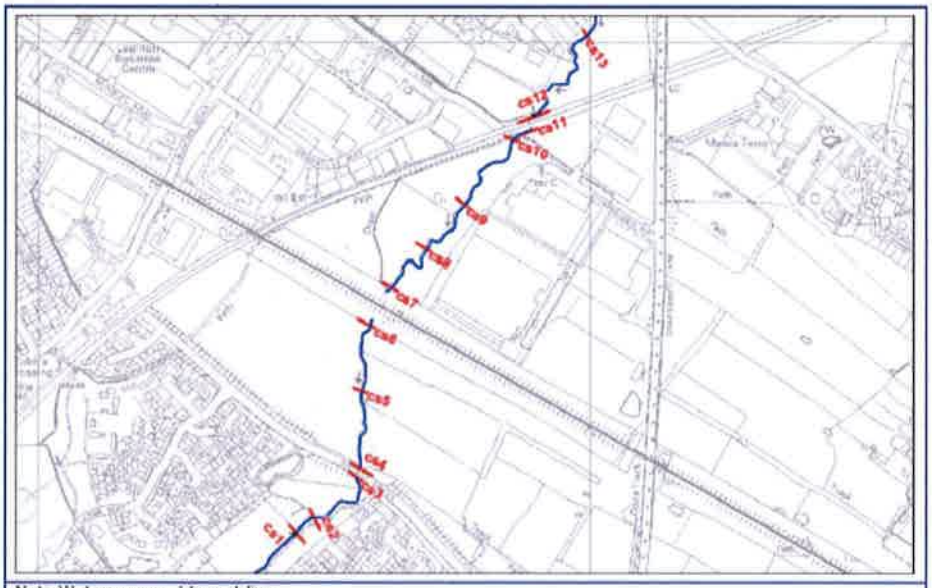
Figure 6.2 Cross-Section Locations in the HEC-RAS Model



Note: Watercourses – blue polyline
Cross-sections – red polyline
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Figure 8.3 Representative Photographs of Modelled Structures

Photograph 8-1 Structure 11.5

Photograph 8-2 Structure 10.5

Photograph 8-3 Structure 6.5

Photograph 8-4 Structure 3.5

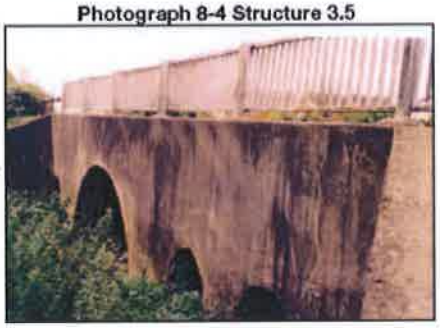
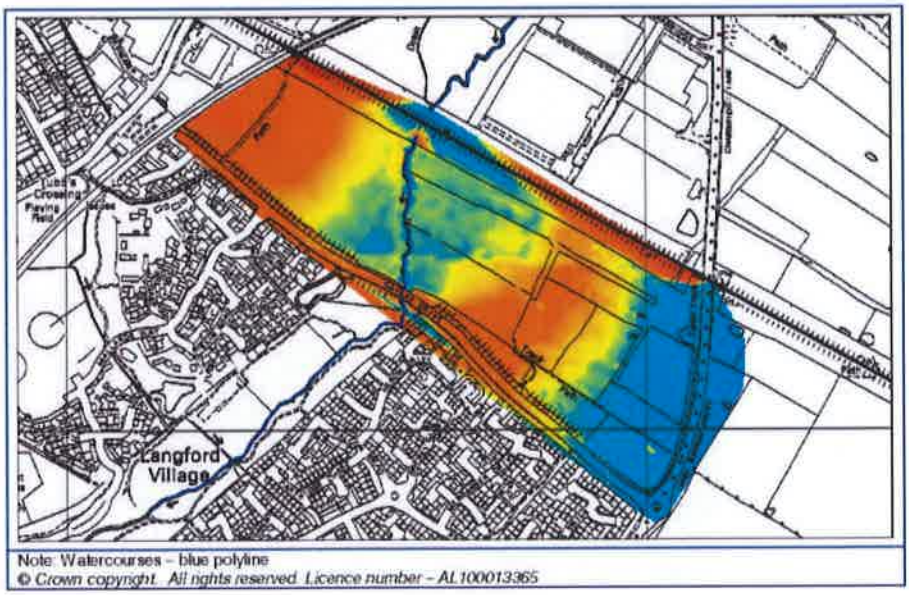


Figure 8.4 Digital Terrain Model of the Site



Note: Watercourses – blue polyline

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Site location

N

Drawing Title **Figure11.3: Extract from the Pre-Ordnance Survey Map of 1812-1814**

Client Gallagher Estates Ltd & London and Metropolitan

Project Land North of Gavray Drive, Bicester, Oxfordshire

Drawing No CPM2172/39a

Date 10/04 SR/SH

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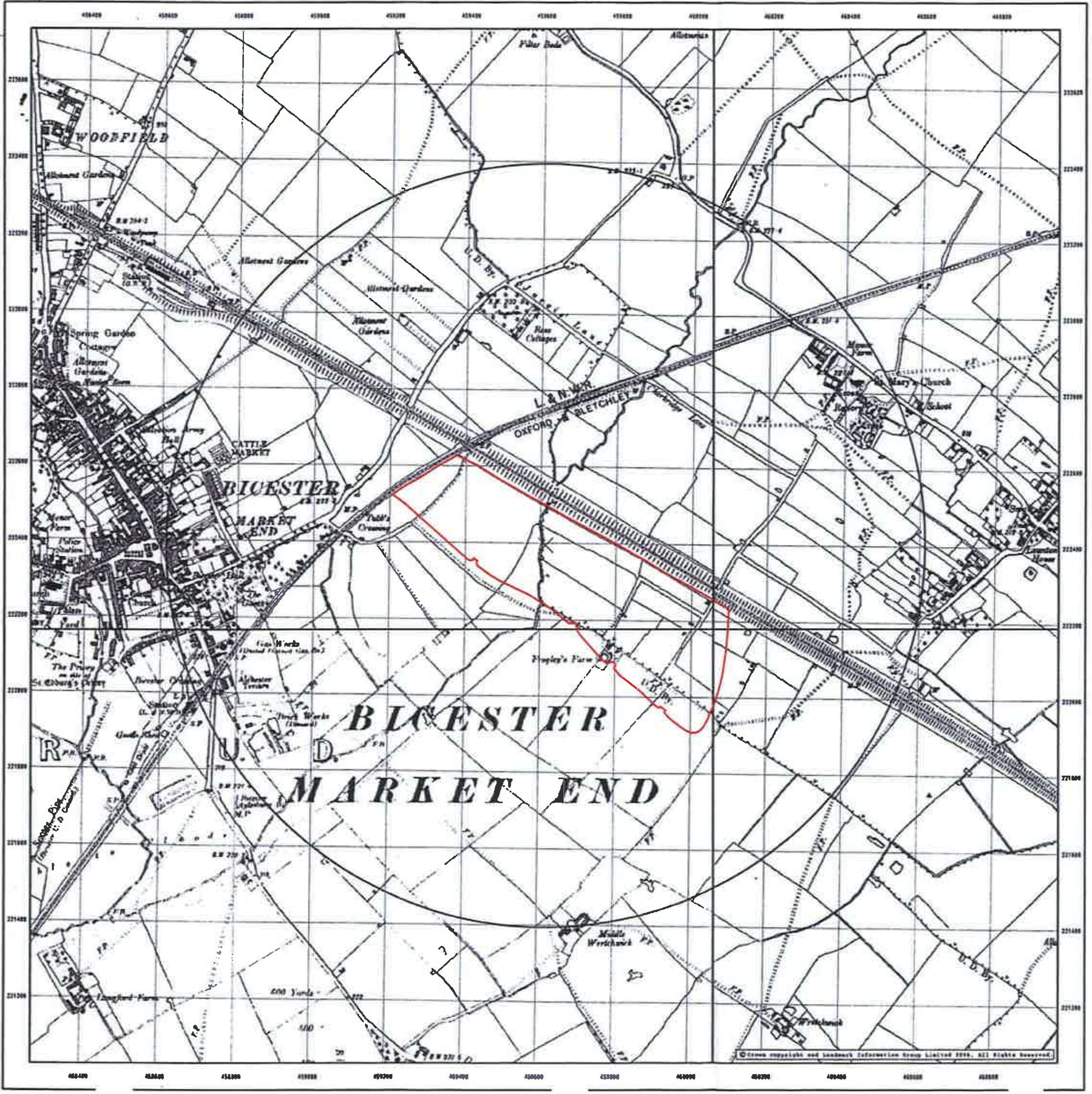

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CLIENT DETAILS Envirocheck Order No. EC3659791_1_1

Customer Ref: MS S Randell,CPM2172
CPM Environmental Planning & Design
Versailles Court 3 Paris Garden
LONDON
SE1 8ND

SITE DETAILS Grid Reference 459610 222390

Gavray Drive, Bicester

Drawing Title: **Figure 11.4: 1923 Ordnance Survey Map**

Client: Gallagher Estates Ltd & London and Metropolitan

Project: Land North of Gavray Drive, Bicester, Oxfordshire

Drawing No: CPM2172/35a

Date: 11/04 SR/CT

Checked

cpm
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