

A stylized, light brown map of North West Cambridge is positioned on the left side of the page, partially overlapping the light blue background. The map shows the irregular coastline and internal land features of the area.

NORTH WEST **cambridge**

Environmental Statement - Appendix 15.2
Addendum to Level 3 Flood Risk Assessment
March 2012



North West Cambridge
**Addendum to Level 3 Flood Risk
Assessment**
ES Appendix 15.2

March 2012



Prepared for



**UNIVERSITY OF
CAMBRIDGE**

Definition

For the purposes of this Flood Risk Assessment (FRA) Addendum, references to the Application Site are to Zone B of the Application Site

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1 Introduction

In September 2011, the University of Cambridge submitted an application for planning permission to Cambridge City Council and South Cambridgeshire District Council relating to development proposals at North West Cambridge. The planning application was accompanied by a Level 3 Flood Risk Assessment (FRA) (included as Appendix 15.1 of the Environmental Statement), which included details of a flood alleviation strategy that would enable the peak flows downstream of the Application Site to be reduced for a range of return periods and for floodwater to be stored within the landscaped areas on the Western Edge of the Proposed Development.

Following post application consultation with the planning authorities and Environment Agency concerning flood risk considerations, landscape and ecology, with particular reference to the Western Edge, it was agreed that an Addendum would be prepared to the Level 3 FRA in order to provide further information with respect to the proposed works to the Washpit Brook and to demonstrate how the flood risk, landscape, ecological and maintenance objectives may be jointly achieved.

Landscape architects, ecologists and engineers have worked collaboratively in order to refine the design of the Western Edge and thereby maximise the potential for the existing landscape to be enhanced, for ecological opportunities to be created and for maintenance access to be improved. Specifically, the flood alleviation strategy has been refined in order to:

- Preserve existing features, including mature trees along the northern half of the Washpit Brook;
- Improve the visibility and accessibility of the Washpit Brook;
- Create new ecological habitats for water voles, amphibians and invertebrates in the form of steep banks and linear ponds along the edge of new low flow channels that will enable floodwater to be distributed within the two stage channel.

This Addendum is provided to describe how the Western Edge design has evolved in order to enhance the existing landscape, create ecological opportunities and improve maintenance access. The flood alleviation scheme is directly influenced by the proposed enhancements and a new hydraulic model has been developed. This hydraulic model has been used to determine whether the refined flood alleviation scheme will be capable of reducing flood risk as proposed within the original Level 3 FRA. Use of the model has demonstrated that the refined flood alleviation scheme offers the same opportunities as that outlined in the original Level 3 FRA concerning reductions in peak flow discharged from the site and opportunities to develop the Application Site outside the areas at risk of fluvial flooding.

This Addendum demonstrates one way in which the Western Edge can come forward in landscape, ecological and drainage terms within the parameters set out in the Parameter Plans and Statements, particularly Plans 07 and 10.

2 The Western Edge Flood Alleviation Scheme

2.1 Context

The Western Edge comprises Open Land between the M11 motorway and the built development edge (defined in Parameter Plan NWC/OPA/PAR/03 as Primary Open Land 5). The area is approximately 200 metres wide and 1450 metres long, and is currently used as farmland within the University Farm.

The Washpit Brook is an award watercourse and a 5m wide riparian zone is currently provided to enable South Cambridgeshire District Council to perform maintenance works. A high pressure gas main passes through the Western Edge and a 20m wide easement is to be maintained in order to ensure that this existing service is not affected.

2.2 Evolution of the Scheme Parameters

The flood alleviation scheme outlined within the Level 3 FRA retained the existing watercourse geometry and involved installing an online flow control structure to promote floodwater storage within the Western Edge and thereby reduce the downstream peak flow. A two stage channel was to be constructed by reducing the level of the area of floodplain that is situated beyond the gas main easement to increase the volume of floodwater storage available. A minimum depth of 0.5m from bed to bank of the Washpit Brook was to be retained on its existing alignment to form a low flow channel. This approach satisfied the flood risk reduction objectives. However, it also introduced a requirement for existing vegetation to be removed, where it was situated directly adjacent to the existing watercourse.

Following the post application consultation with the planning authorities and Environment Agency, the parameters for the Western Edge have been developed by layering together a series of practical parameters that combine to enable a multi-functional piece of green infrastructure. The resulting solution preserves existing vegetation, creates new and improved ecological habitats, provides improved maintenance access and reduced flood risk downstream. The process of this evolution is outlined in the parameter-compliant indicative plans and sections that are presented within Annex A. Indicative design drawings have been provided within Annex B. The drawings within Annexes A and B indicate one way that the required geometry and flood containment can be achieved in a parameter-compliant manner, via a proposed low flow channel and two stage channel. The principles inherent in the proposals shown on the drawings include the following:-

- The southern section of the maintenance access track has been repositioned within the easement of the high pressure gas main in order to ensure that it may be used to maintain the existing utility and the watercourse. Ramps will be provided outside the easement to enable maintenance access vehicles to gain access to the existing riparian zone from the maintenance access track.

- The position of the easement for the high pressure gas main constrains the width of the two stage channel at the southern end of the Washpit Brook and creates a barrier between the proposed retention ponds that are situated on the eastern side of the proposed landforms and the Washpit Brook, as it will not be practical to reduce the ground level over the gas main. To overcome this constraint, a new low flow channel will be provided along the western edge of the earthwork landforms to intercept the attenuated discharge from the retention ponds and to connect with the existing reach of the Washpit Brook located upstream. Flow will be conveyed downstream to the eastern side of the easement. A 1m diameter pipe culvert allows the new low flow channel to discharge into the existing reach of the Washpit Brook, beneath the maintenance access track. The cross section of the new watercourse will incorporate a second stage channel that will be capable of storing floodwater in order to maximise the effectiveness of the flood alleviation scheme.
- The central section of the Washpit Brook has been retained where it currently intercepts runoff from the culverts that pass below the M11 to allow conveyance of flow generated off site. This extends until it meets with the culvert beneath the maintenance access track.
- The proposed online flow control structure has been repositioned further upstream (i.e. south) to preserve existing mature trees alongside the northern half of the Washpit Brook.
- Downstream of the flow control structure there are no significant alterations to the Washpit Brook, except for the removal of an access culvert, which is no longer required, and the formalisation of the maintenance access.

2.3 Landscape Character and Use

The Western Edge has been designed to provide a range of landscape characters and uses. The overarching principle is to establish a new parkland to the west of the Proposed Development. This can be achieved by partially shielding the Proposed Development from the M11 through a modified landform utilising the arisings from on site construction activity. This gentle separation creates parklands that relate to the development to the east and a more natural landscape that echoes the bucolic landscape of Cambridgeshire to the west and reinforces historical field patterns running along the Washpit Brook.

The existing alignment of the Washpit Brook creates a breach in the landform which is then overlapped for acoustic and visual containment purposes. The landform is further refined into a series of scalloped profiles that connect to the green finger within the Proposed Development. This also protects the Proposed Development in stages before the Western Edge is complete.

Surface water drainage running down the green fingers is captured behind the landforms before discharging into the Washpit Brook. The creation of areas of flood storage adjacent to the Washpit Brook creates opportunities to enhance the landscape character of the watercourse. The watercourse would be expanded to create two flood plains either side of the gas main, parallel to the M11. It is proposed that the detailed landscape proposals for new banks of the watercourse will include marginal planting and steep sections to create water vole habitats,

whilst areas of the channel will expand into meadows, ponds and wetland habitats. The final landform would be sculpted to create a landscape designed to manage views into and out of the Application Site and to disaggregate the landform into a series of layered ridges.

The southern end of the Western Edge is to be used for allotment gardens and formal sports facilities, including a flood lit all weather pitch.

To the south east, landforms embrace a series of interconnected parkland pockets with gently south facing lawns and areas for informal recreation. An elevated promenade - located against the built development edge - runs the length of the parklands offering views over the landscape and access to the various courtyards and building lining it. To the north east the Washpit Brook and topography combine to create a gentle valley full of small scale allotment gardens, which it is envisaged will be bordered by low hedges. It is also envisaged that the flow control structure on the watercourse will create a crossing point between the allotment gardens, offering views along the Brook.

To the west the landscape comprises the expanded watercourse, ponds and tributary set amongst swaths of grassland which become inundated during heavy rainfall. To motorists travelling along the M11, the Western Edge will offer an attractive foreground to a new view of Cambridge. From further afield the Western Edge helps to minimise any adverse effect of the Proposed Development on long distance views.

The intention is that the whole Western Edge will be explored via a network of paths that integrate with the varied topography and planting, offering visitors a constantly changing experience of views and unfolding landscape characters. Embedded within the network will be seating areas and informal bike routes, jogging paths and nature trails, details of which will come forward as part of the reserved matters applications.

2.4 Ecological Enhancement

The parameters for the Western Edge have been refined to create new and improved ecological habitats, delivering benefits for biodiversity, whilst retaining the most valuable existing features.

The central section of the existing channel (immediately downstream of the culverts that pass below the M11) has been retained as part of the design; this section of the watercourse supports marginal wetland vegetation which is largely absent from other sections (either because they are prone to dry out or because they are heavily shaded by mature trees). The habitat provided by the central section represents the most suitable habitat for water voles currently present. The design has therefore retained this section as a refuge for water voles during the works to the remaining (less suitable) sections of the Washpit Brook. In the unlikely event that water voles are present on affected section of the channel at the time of the modifications they would be 'displaced' into this retained section. Further details are provided in the Biodiversity Strategy (Appendix 7.4 of the Environmental Statement).

New low flow channels have been designed to follow a sinuous alignment (gently meandering), with new linear ponds and 'backwaters'. Overall this will significantly increase the length of watercourse habitat within the Application Site. It will also increase the diversity of bank side habitat in terms of bank profile and aspect, and water depths, leading to the watercourse supporting a greater diversity of plants and invertebrates.

The new channels have also been designed with steep banks on one side, and a planting shelf below water level to support wetland vegetation. This will increase the amount of valuable habitat for water voles in comparison with the existing situation. This will be particularly important in providing a refuge for water voles during periods of flood.

Linear ponds will be constructed along the route of the new channels to create valuable new ecological habitats for amphibians and invertebrates (as well as water voles). These linear ponds will be positioned immediately downstream of the Sustainable Drainage Systems retention ponds, which will ensure that they are topped up frequently and may therefore act as refuges for wildlife. Outfalls from retention ponds will be designed, where possible, to release water gradually in dry periods to support ecology.

2.5 Maintenance Access

The parameters for the Western Edge provide opportunities for the maintenance access to be improved.

Currently a 5m wide riparian zone is provided to enable South Cambridgeshire District Council to perform maintenance works. However, maintenance vehicles are required to travel along an informal grass track that is situated directly adjacent to the watercourse bank. This track has evidence of rutting that has occurred due to the ground softening when floodwater breaches the top of the bank of the watercourse.

The remodelling of the Western Edge enables floodwater to be contained within a two stage channel in order to reduce the frequency that the sections of the maintenance access will be submerged.

3 Fluvial Flood Hydraulic Modelling of the Refined Flood Alleviation Scheme

The Level 3 FRA was informed through hydraulic modelling that was used: initially to establish the baseline flooding regime for the existing Washpit Brook; and, subsequently, to design a flood alleviation scheme to help enable development of the Application Site and quantify the reduction in flood risk downstream of the Application Site.

A new hydraulic model has been constructed of the refined flood alleviation scheme, which includes enhancing of existing landscape, creating improved ecological opportunities, and improving maintenance access. This hydraulic model has been used to determine whether the refined flood alleviation scheme will be capable of reducing flood risk as proposed within the original Level 3 FRA.

Design drawings have been provided within Annex B, which indicate one way that the refined flood alleviation scheme can be achieved in a parameter compliant manner.

3.1 Constraints

The refined flood alleviation scheme has been designed to provide compatibility with the following three constraints, which were identified within the original Level 3 FRA:-

1. Effect upon peak flows and the flood hydrograph downstream of the Application Site;
2. Effect upstream of the Application Site, via the M11 culverts and,
3. Effect upon flood extent within the Application Site.

Girton and other settlements downstream of the Proposed Development are vulnerable to flooding resulting from a range of flood return periods. The flood alleviation scheme has been designed to help reduce the peak flow discharged from the Application Site towards Girton, including flood events with a return period of 1 in 20, 1 in 100 and 1 in 1000 years, rather than focusing purely on the most extreme events.

Two culverts pass below the M11 and allow the passage of water into the Application Site from land to the west. These culverts discharge directly into the Washpit Brook within the Application Site. The refined flood alleviation scheme has been designed to ensure that water levels will not be increased in the vicinity of the M11 culverts.

The storage of floodwater within the Application Site will cause water levels to be elevated downstream of the M11 culverts. Earthwork landforms are proposed on the western edge of the Proposed Development to balance cut and fill across the site, complement the landscape design, and provide sheltered areas of open land that may be less affected by noise from the M11. These landforms have been designed geometrically to assist in the storage of floodwater and thus to manage flood risk.

3.2 Proposed Flow Control and Floodwater Storage Area

3.2.1 Flow Control

One way of meeting the constraints would be to incorporate a flow control structure, which consists of a 1.3m diameter low flow pipe with a crest level set at 12.90m AOD. The position of the flow control structure within the Application Site is shown on Drawing Reference D127313-SK-054, which is contained within Annex B. The position of the flow control structure has been moved approximately 260m upstream when compared to the position proposed as part of the original level 3 FRA in order to preserve existing mature trees to the north.

3.2.2 Floodwater Storage Area

The parameters allow a flood storage area to be constructed upstream of the flow control structure through the excavation of material adjacent to the existing brook and /or additional low flow channels in order to form a two stage channel.

A 20m wide easement for a high pressure gas main dissects the southern half of the flood storage area. In places the 20m easement has been increased to offer some curvature to the feature, allowing a more natural shape. A maintenance access track will be positioned within easement zone. Ground levels will be retained within the easement zone and under extreme conditions floodwater may spill across it from one channel to another.

3.3 Model Construction

The baseline hydraulic model has been amended to include the features contained within the refined flood alleviation scheme.

The changes made to the baseline model are summarised below:

- Landscape landforms have been included between node WSH-2437 and WSH-1400.
- The flow control structure, which comprises a culvert and raised spill level, has been included at WSH-1660 to locally restrict the hydraulic capacity of the watercourse and promote the storage of floodwater upstream;
- A 1m diameter pipe culvert has been included at WSH-1901 to allow the new channel to pass beneath of maintenance access track;
- Ground levels on banks of Washpit Brook and the newly created channels have been lowered to increase storage volume between nodes WSH-2437 and WSH-1660;
- The level of the right (i.e. east) bank has been raised to 13.15m AOD between node WSH-1901 and WSH-1660 to ensure the floodwater does not encroach upon built areas within the Proposed Development.

A model summary sheet is included with Annex C.

3.4 Hydrology

The hydrology from the baseline modelling has been retained for the proposed flood modelling. This applied the ReFH method, rather than the statistical method and was considered a conservative approach. However, the manner in which it has been applied to the hydraulic model has been altered slightly in the refined flood alleviation scheme. Due to the redistribution of the two stage channel, connectivity to the upstream catchment has been altered, which has resulted in the slight modification to the hydrological input. Catchment 1 (as defined within the Level 3 FRA) has been split into two sub-catchments and applied to the refined flood alleviation hydraulic model based upon the upstream contributing area of the catchment.

A sensitivity test has been undertaken with respect to the hydrological flows used within the refined flood alleviation model and is discussed within Section 3.5.4.

3.5 Model Results

3.5.1 Reduction in Downstream Peak Flows

Table 4-1 provides a comparison of the peak flows downstream of the Proposed Development by considering the existing baseline and proposed (i.e. refined flood alleviation scheme) scenario. It also defines the approximate percentage reduction in peak flow discharged from the Application Site that may be obtained through its implementation.

Table 4-1: Impact upon Peak Flows Downstream of the Application Site

DOWNSTREAM IMPACT ON PEAK FLOW (M ³ /S)			
1 IN 20 YEAR			
NODE	BASELINE	PROPOSED REV 2	IMPACT (% reduction)
WSH-0939	1.85	1.34	28
1 IN 100 YEAR			
NODE	BASELINE	PROPOSED REV 2	IMPACT (% reduction)
WSH-0939	2.57	2.22	14
1 IN 100 YEAR + CC			
NODE	BASELINE	PROPOSED REV 2	IMPACT (% reduction)
WSH-0939	3.00	2.70	10
1 IN 1000 YEAR			
NODE	BASELINE	PROPOSED REV 2	IMPACT (% reduction)
WSH-0939	4.22	4.11	3

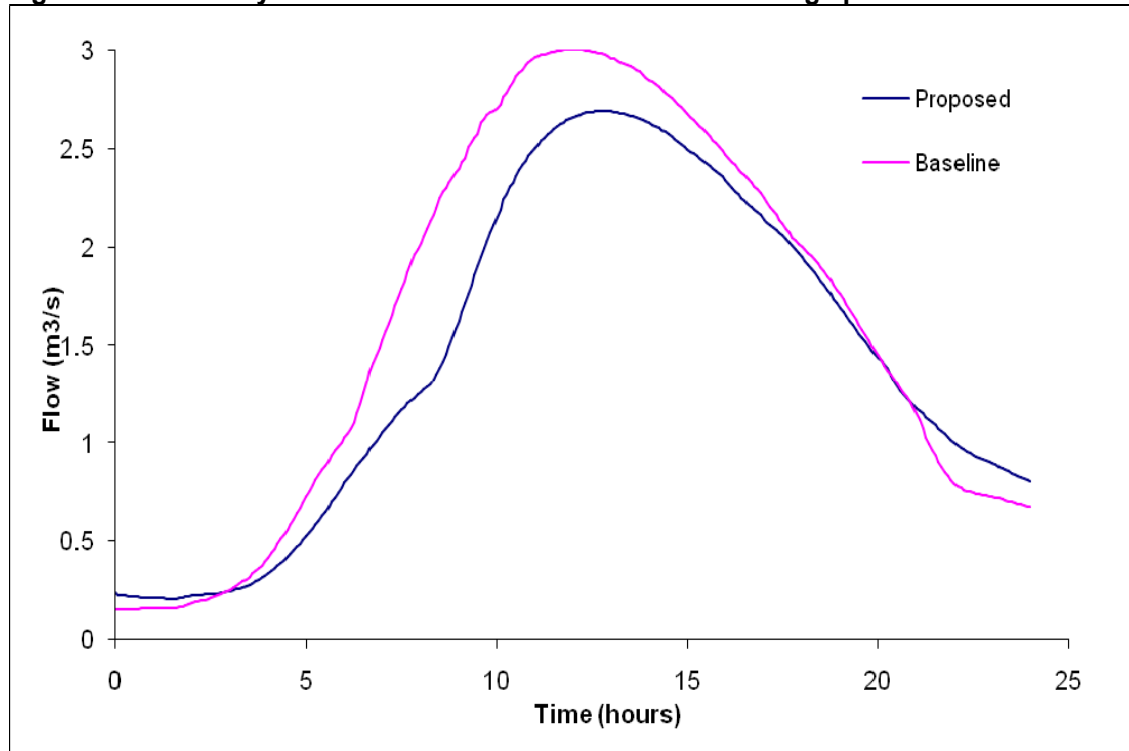
Table 4-1 indicates that the refined flood alleviation scheme would still provide a significant reduction in peak flows downstream for a range of flood return periods, which will reduce flood risk for Gorton when compared to the existing baseline situation. For example, under the 1 in 20 year event a reduction in flow of 28% is observed. The percentage reduction in peak flow is reduced as the flow return period increases because the positive impact is diluted by the higher flows. Under the 1 in 1000 year event, the peak flow is reduced by 3%. The positive impact has

been reduced marginally under the larger events for the refined flood alleviation scheme compared to the proposals outlined within the original Level 3 FRA, which is a result of the reduced storage volume introduced by repositioning the flow control structure further upstream to permit existing mature trees to be preserved.

Figure 4-1 is provided to graphically illustrate the effect that the refined flood alleviation scheme would have on the downstream hydrograph. This figure indicates that these measures would permit the peak flows to be reduced from 3.0 to 2.7 m³/s for a 1 in 100 year event including a 20% allowance for climate change. The volume of floodwater discharged would be the same; however, it would be discharged over a longer period of time.

Downstream of the Application Site the Washpit Brooks meets with Beck Brook. Appropriate checks have been undertaken which confirm that the flood alleviation scheme would also benefit flood risk downstream of this confluence.

Figure 4-1: 1 in 100 year event+20% allowance for climate change peak flow at WSH-0939



3.5.2 Water Levels at face of the M11 Culverts

Table 4-2 shows the effect upon flood levels within the Application Site, adjacent to the M11 culverts. The fourth column on the table reflects the reduction in peak flood level between the proposed scenario, compared to the baseline scenario.

Table 4-2: Impact upon Peak Flood Level at the M11 Culverts (all levels expressed as AOD)

UPSTREAM IMPACT ON STAGE (m AOD)			
1 IN 20 YEAR			
NODE	BASELINE	PROPOSED REV 2	IMPACT (m)
WSH-2060	12.54	12.35	0.19
1 IN 100 YEAR			
NODE	BASELINE	PROPOSED REV 2	IMPACT (m)
WSH-2060	12.68	12.58	0.10
1 IN 100 YEAR + CC			
NODE	BASELINE	PROPOSED REV 2	IMPACT (m)
WSH-2060	12.76	12.70	0.06
1 IN 1000 YEAR			
NODE	BASELINE	PROPOSED REV 2	IMPACT (m)
WSH-2060	13.00	13.00	0.00

Table 4-2 indicates that the refined flood alleviation scheme would not cause the peak water level adjacent to the M11 culverts to be increased, as it allows the peak flood level at the culverts to be reduced by 0.19m for a flood event with a return period of 20 years. The reduction in peak water level is reduced as the flood return period increases because the positive impact is diluted by the higher flows. Under the 1 in 1000 year event, no impact is observed.

3.5.3 Flood Maps

The hydraulic modelling of the refined flood alleviation scheme has resulted in the identification of revised flood zones within the Application Site. Updated flood maps have been provided within Annex D in order to define the extent of flooding that would occur within the Application Site following the implementation of the revised flood alleviation scheme.

The revised flood maps indicate that the refined flood alleviation scheme result in a reduction in flood extent downstream. Consequently, no development blocks are affected up to and including the 1 in 100 year including 20% climate change event.

The refined flood maps also indicate that the entire built development will be located outside Flood Zone 1, with the exception of part of a single block in the northwest corner of the Application Site, which is partially located in Flood Zone 2. The type of Proposed Development is classified in general terms of Flood Vulnerability as 'More Vulnerable' under Table D2 of PPS25, which is shown as Table 9-1 in Appendix 15.1. Table D3 of PPS25, which is shown as Table 9-2 in Appendix 15.1, defines the relationship between Flood Vulnerability and Flood Zone Compatibility and states that all uses of land are appropriate in Flood Zone 1, and all but 'Highly Vulnerable' land use is appropriate in Flood Zone 2. As none of the Proposed Development is classified as 'Highly Vulnerable', the Proposed Development is considered to be in compliance with the requirement of PPS25 and an Exception Test will not be required for the development proposals. More importantly, land use within each development block will be sequentially located to steer all 'More Vulnerable' and 'Less Vulnerable' development (i.e. buildings) into Flood Zone 1, to ensure that the site is safe.

This is the same conclusion as that outlined in the original level 3 FRA.

3.5.4 Sensitivity Testing

A sensitivity analysis is included within Annex E, which considers the effect of blockage upon the flow control structure.

The sensitivity analysis also investigates the impact of the application of different peak flow estimates of the Washpit Brook, which were provided by the Environment Agency, prepared for the Cottenham Load Flood Alleviation Scheme modelling undertaken by Halcrow in 2003. The peak flows estimates prepared by Halcrow are based upon an out of date methodology, but were found to be larger compared to the hydrology discussed above.

The sensitivity test has not identified any issues or concerns and the benefits identified above remain with the inclusion of the Halcrow hydrology.

A full table of output results for some of the storm events discussed in this chapter is provided within Annex F.

The proposed flood alleviation scheme is subject to detailed design.

4 Conclusions

In September 2011, the University of Cambridge submitted an application for planning permission to Cambridge City Council relating to proposals for the construction of a mixed use community at North West Cambridge. The planning application was accompanied by a Level 3 FRA, which included details of a flood alleviation strategy that would enable the peak flows downstream of the Application Site to be reduced for a range of return periods and for excess flow to be stored within the landscaped areas on the Western Edge of the Proposed Development. This Addendum to the Level 3 FRA has been prepared to provide further information with respect to the proposed works to the Washpit Brook and to demonstrate how the flood risk, landscape, ecological and maintenance objectives may be jointly achieved.

Landscape architects, ecologists and engineers have worked collaboratively in order to refine the design of the Western Edge; firstly, to enable existing mature trees to be retained; secondly, to maximise the potential for the existing landscape to be enhanced; thirdly, to realise significant beneficial biodiversity effects; and finally, to improve maintenance access. The benefits for biodiversity would be achieved through an increase in the length of watercourse within the Application Site, created to provide a greater diversity of form and habitats in comparison with that currently present, whilst more valuable sections of watercourse are retained intact. The new and retained habitat has been designed specifically to deliver significant beneficial effects for water voles, amphibians and invertebrates.

The flood alleviation scheme is directly influenced by the proposed enhancements and a new hydraulic model has been developed to determine if the refined flood alleviation scheme offers the same opportunities as that outlined in the original Level 3 FRA concerning reductions in peak flow discharged from the site and opportunities to develop the Application Site outside the areas at risk of fluvial flooding.

The results of the new hydraulic model indicate that the refined flood alleviation scheme would still provide a significant reduction in flood risk downstream for a range of flood return periods, as a 28%, 14% and 3% reduction in peak flow is observed under the 1 in 20, 1 in 100 and 1 in 1000 year events. Revised flood maps have been produced, which indicate that the entire built development will be located outside Flood Zone 1, with the exception of a single block in the northwest corner of the Application Site that is partially located in Flood Zone 2. Land use within this development block will be sequentially located to steer all 'More Vulnerable' and 'Less Vulnerable' development (i.e. buildings) into Flood Zone 1, to ensure that the site is safe. Hence, the refined flood alleviation scheme will still effectively mitigate flooding across the Application Site and the Proposed Development is considered to be in compliance with the requirement of PPS25.

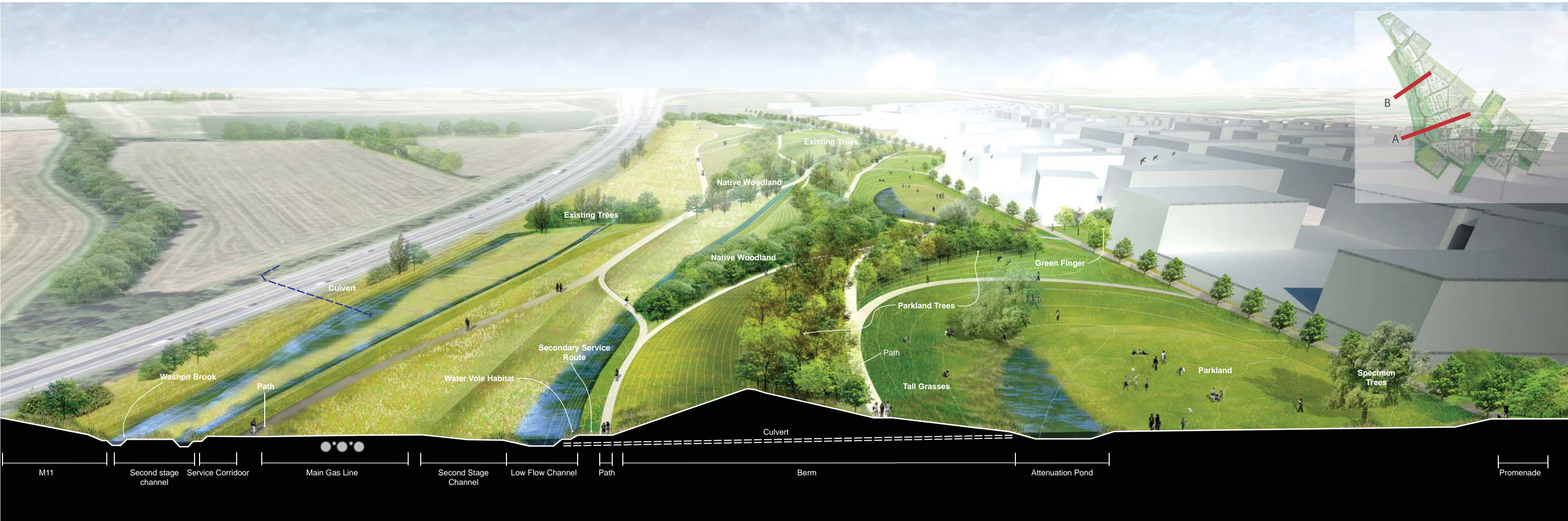
This Addendum demonstrates one way in which the Western Edge can come forward in landscape, ecological and drainage terms within the parameters set out in the Parameter Plans and Statements, particularly Plans 07 and 10.

This Addendum to the Flood Risk Assessment therefore supports the conclusions of the original Level 3 FRA and demonstrates that the Western Edge may be designed to create opportunities for the existing landscape, ecology and maintenance to be enhanced without causing flood risk to and from the Proposed Development to be increased.

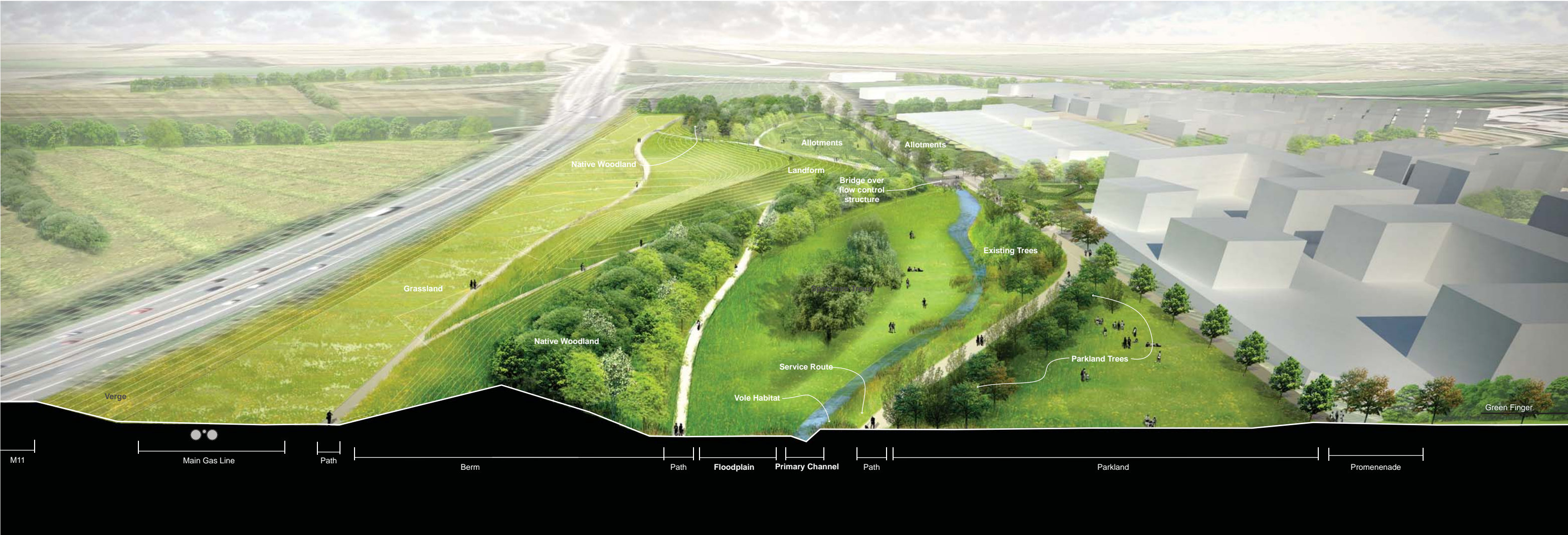
5 Annexes

Annex A – Landform Plans Sections

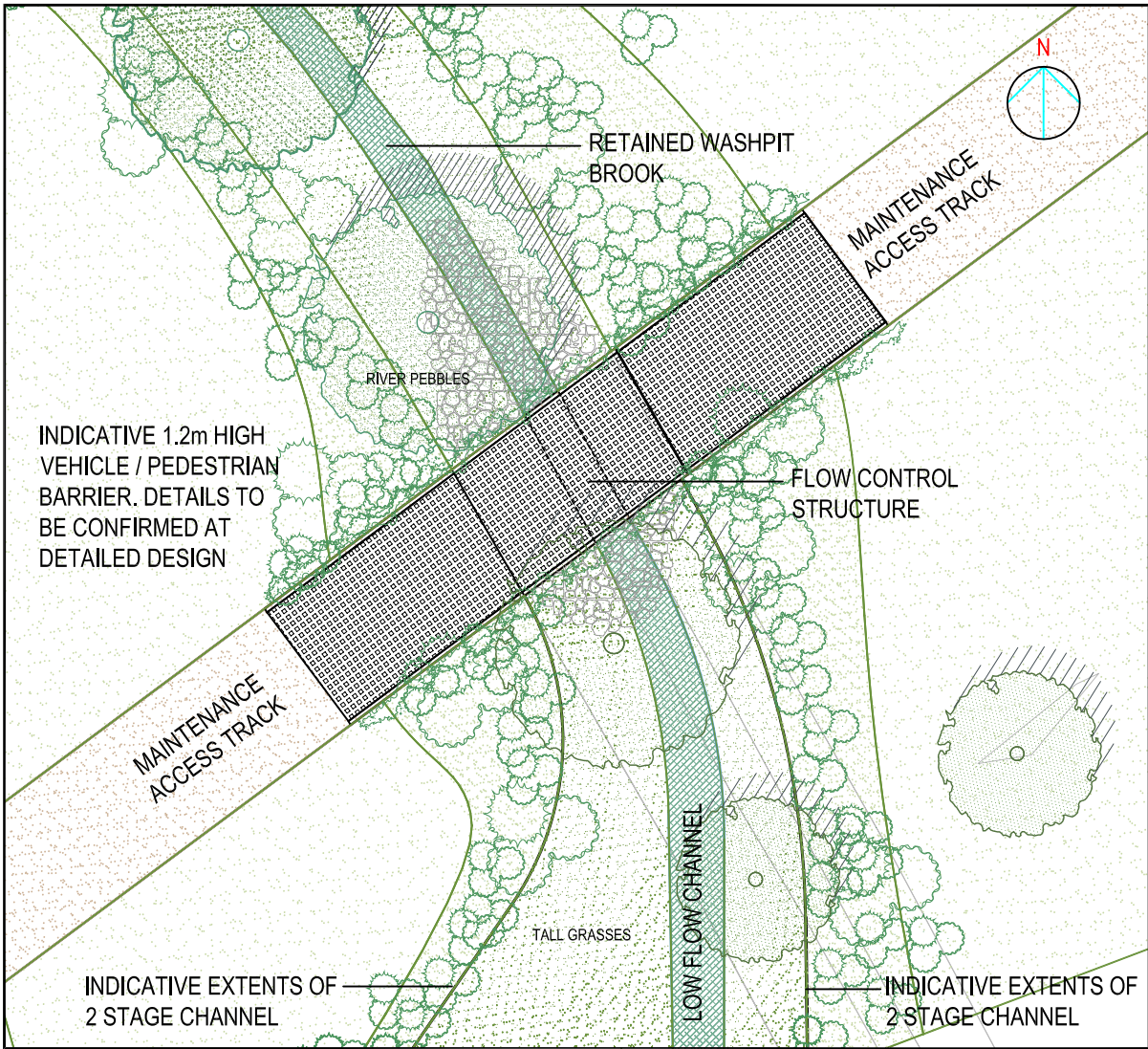
Buildings are shown purely to indicate the juxture position to the Western Edge. The attached images are not intended to articulate the scale, form or elevation details of the buildings.



Section A

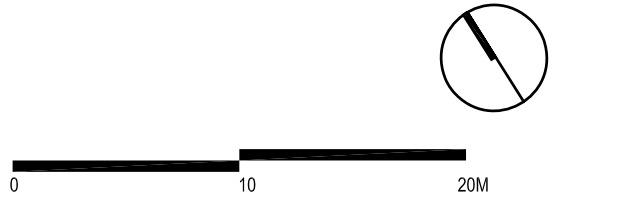


Section B



01 ENLARGED VIEW ON FLOW CONTROL STRUCTURE
SCALE: 1:250

CLIENT UNIVERSITY OF CAMBRIDGE	
PROJECT NORTH WEST CAMBRIDGE	
DRAWING TITLE FLOW CONTROL STRUCTURE	
DATE 22 FEBRUARY 2012	SCALE AS SHOWN@A3

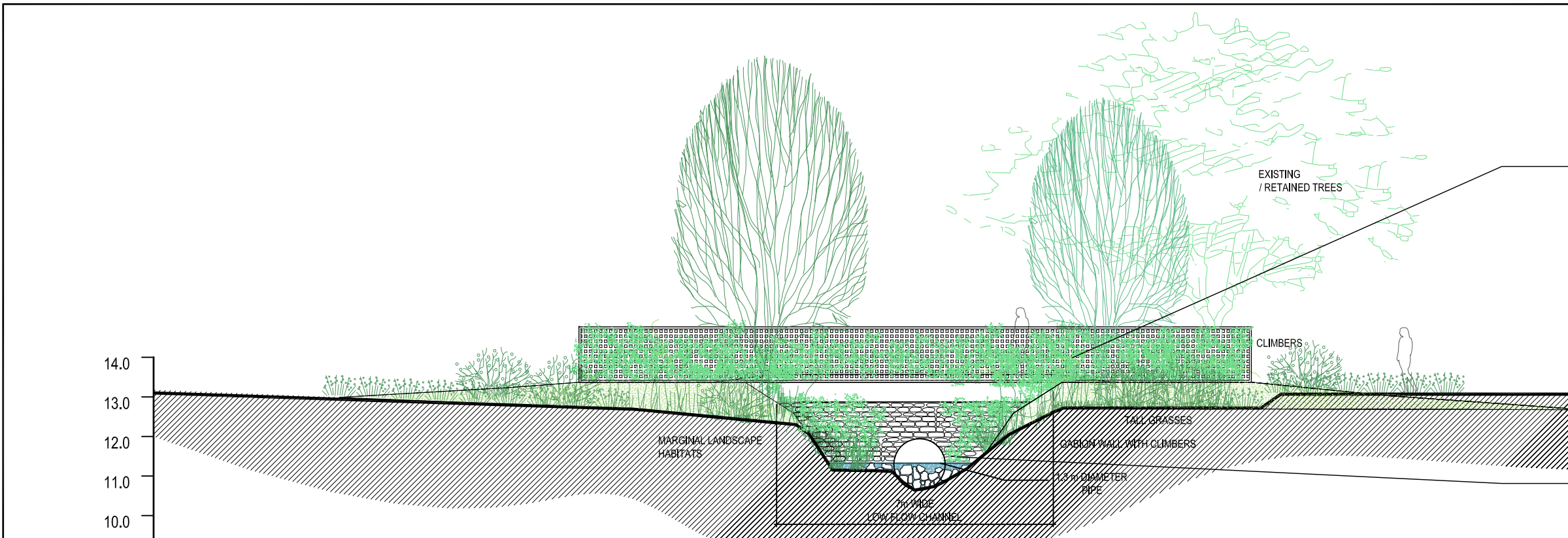


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NOTES :

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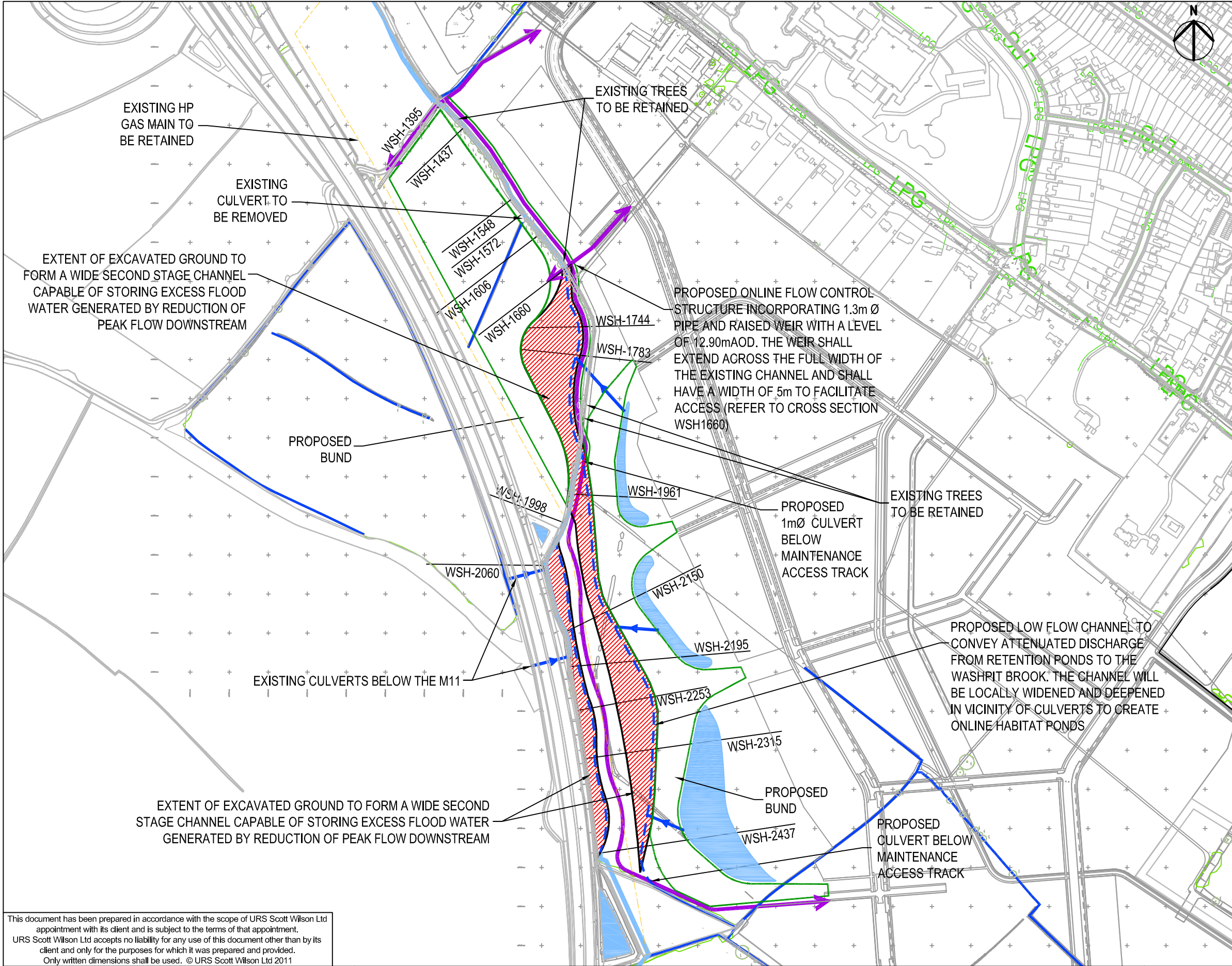
PERFORATED METALIC RAILING



GABION WALL WITH CLIMBERS

02 TYPICAL SECTION THROUGH FLOW CONTROL STRUCTURE
SCALE: 1:125

Annex B – Engineering Plans and Cross Sections



- NOTES :**
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 5. THIS DRAWING SHOWS ONE, BUT NOT THE ONLY, METHOD OF DELIVERING A PARAMETER COMPLIANT SOLUTION.

- KEY :**
- WASHPIT BROOK TO BE RETAINED
 - PROPOSED LOW FLOW CHANNEL
 - EXISTING OR PROPOSED POND
 - PROPOSED SECOND STAGE CHANNEL TO STORE FLOODWATER
 - PROPOSED BUND
 - PROPOSED MAINTENANCE ACCESS TRACK
 - EXISTING TREE
 - HPG EXISTING HIGH PRESSURE GAS MAIN AND 20m WIDE EASEMENT TO BE RETAINED

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Client



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CAMBRIDGE

Drawing Title

NORTH WEST CAMBRIDGE

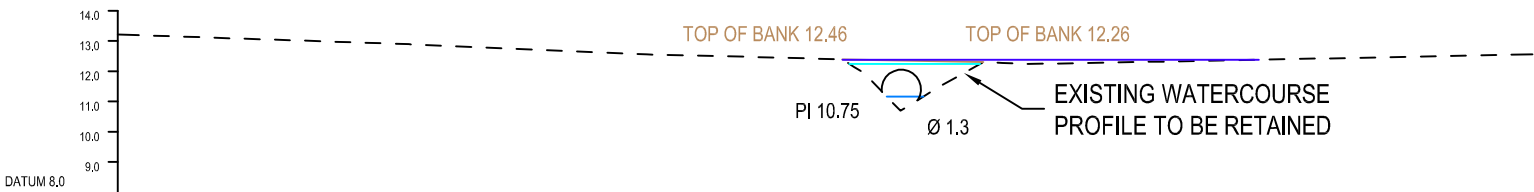
ILLUSTRATIVE PROPOSALS FOR THE WASHPIT BROOK

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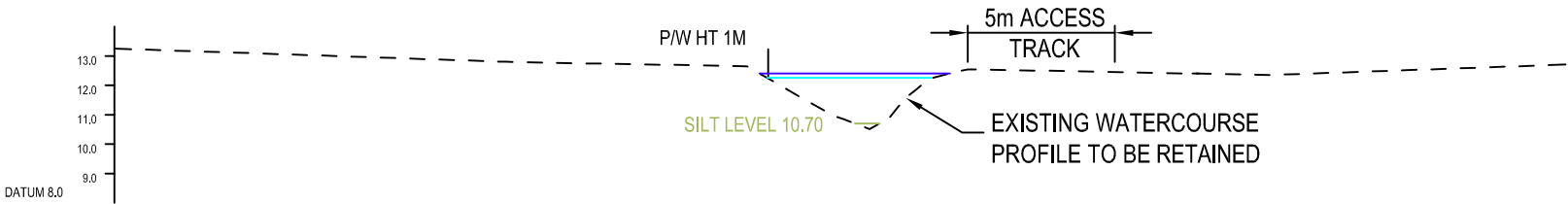


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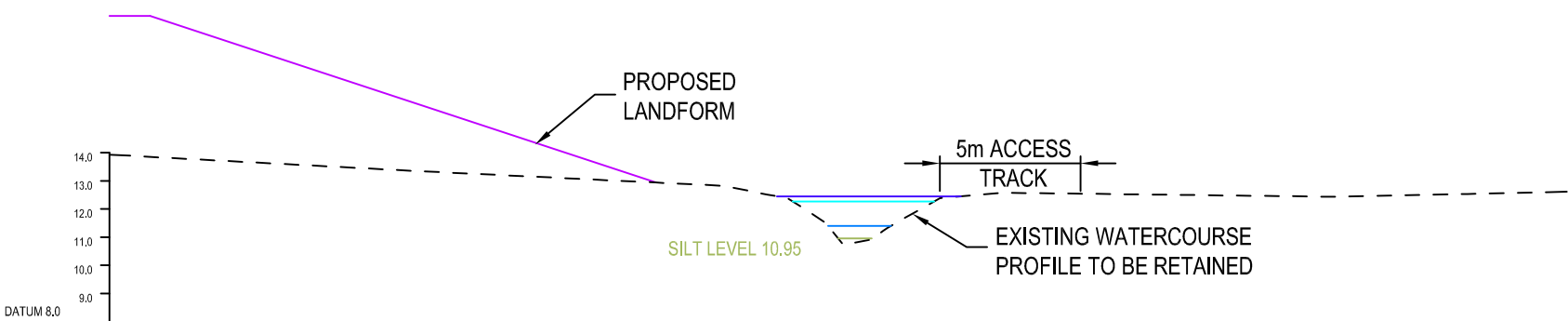
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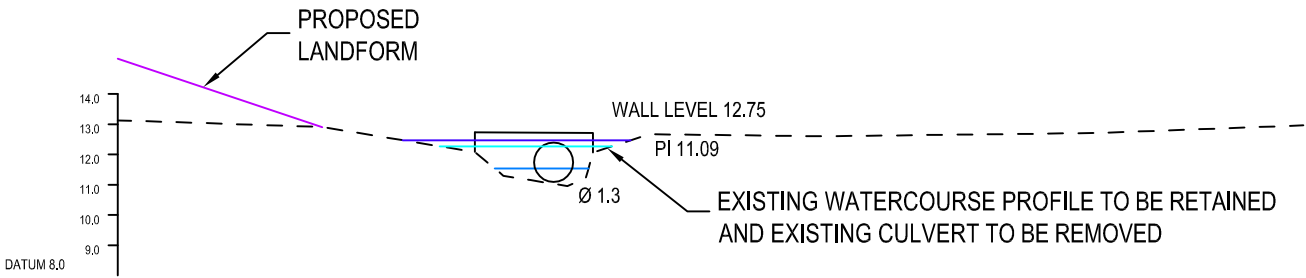
WSH_1395



WSH_1437



WSH_1548



WSH_1572

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KEY

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- 1:20 YEAR WATER LEVEL
- 1:100 YEAR WATER LEVEL

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Drawing Title

NORTH WEST CAMBRIDGE
ILLUSTRATIVE PROPOSALS FOR THE WASHPIT BROOK
CROSS SECTIONS
(SHEET 1 OF 4)

D127313-SK-055

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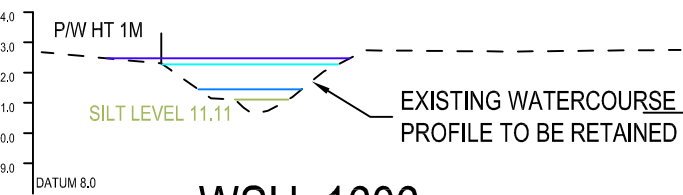
Drw SH	App BM	Rev E
Chk JR	Date 24.11.11	Date 22.03.12

URS

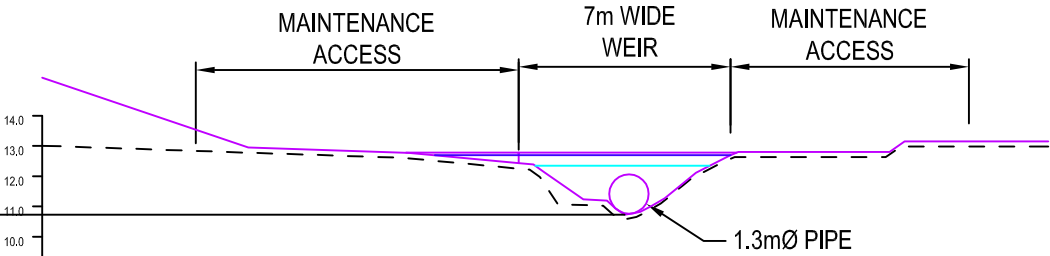

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Plot Date :
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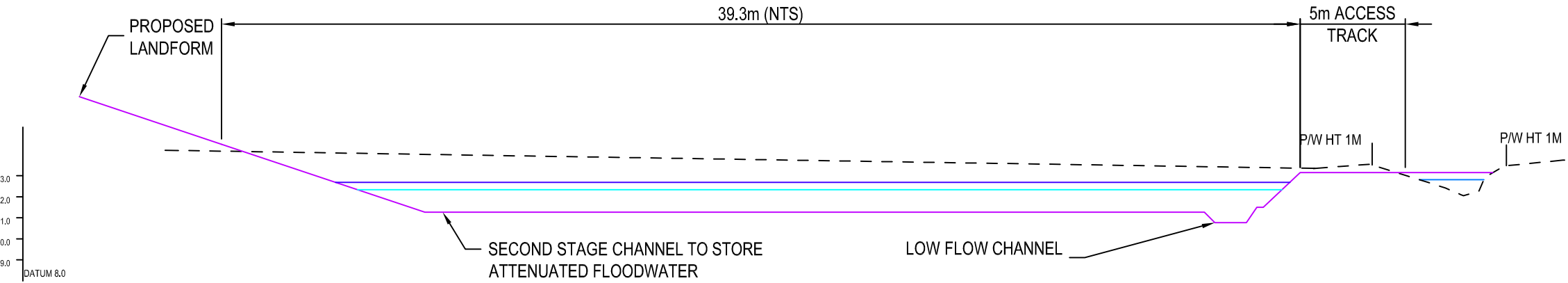
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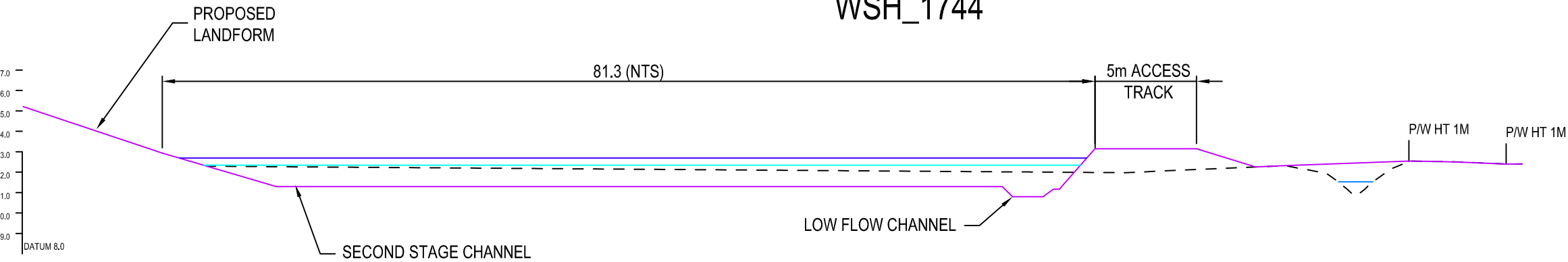
WSH_1606



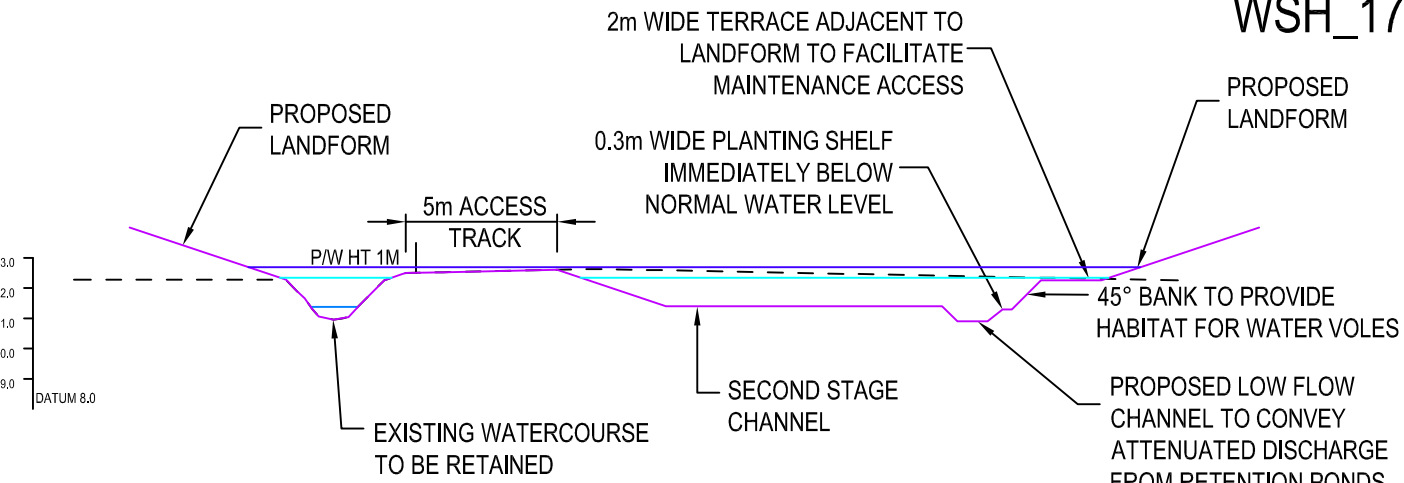
WSH_1660 FLOW CONTROL STRUCTURE



WSH_1744



WSH_1783



WSH_1961

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KEY

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Drawing Title
NORTH WEST CAMBRIDGE
ILLUSTRATIVE PROPOSALS FOR THE WASHPIT BROOK
CROSS SECTIONS
(SHEET 2 OF 4)

D127313-SK-056

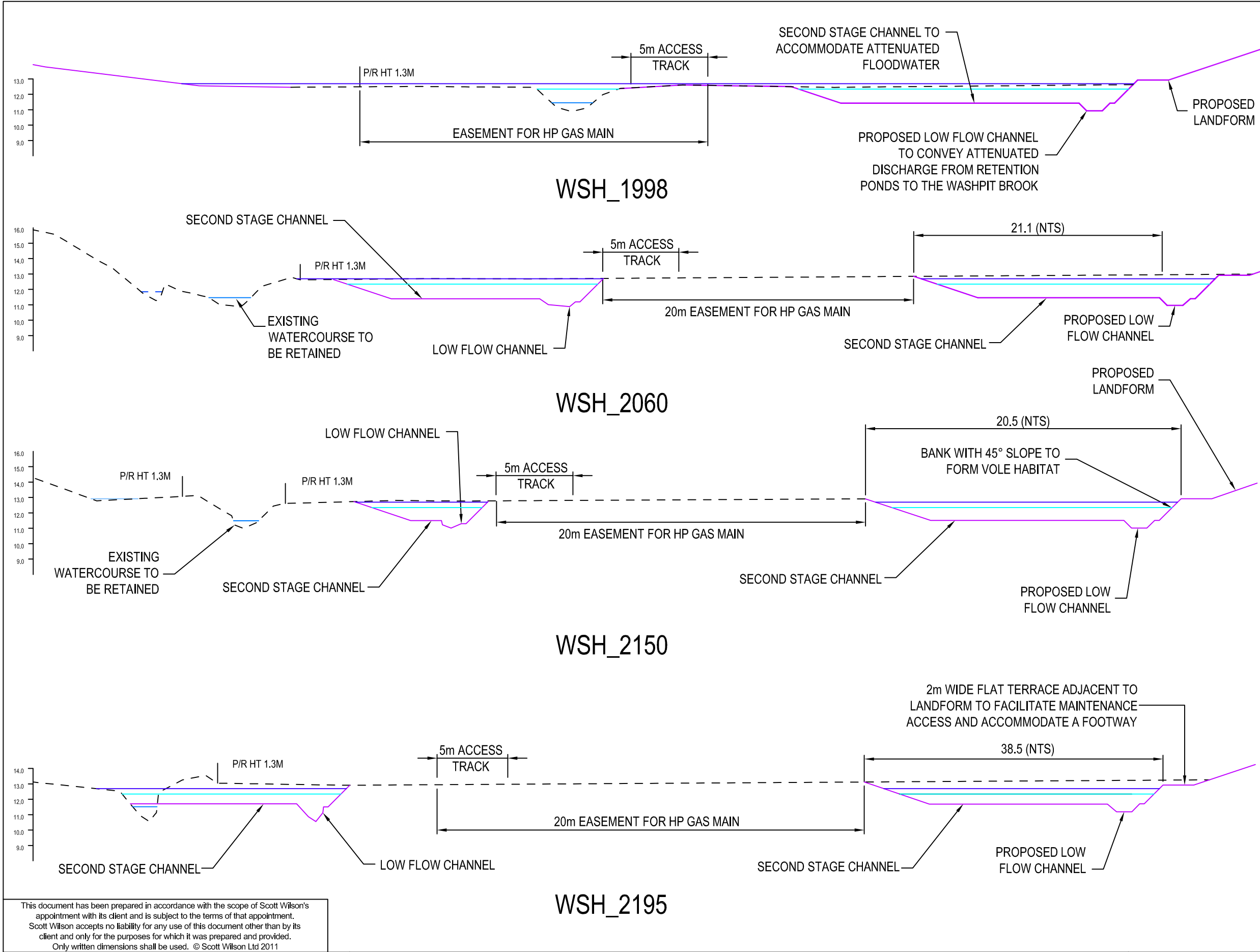
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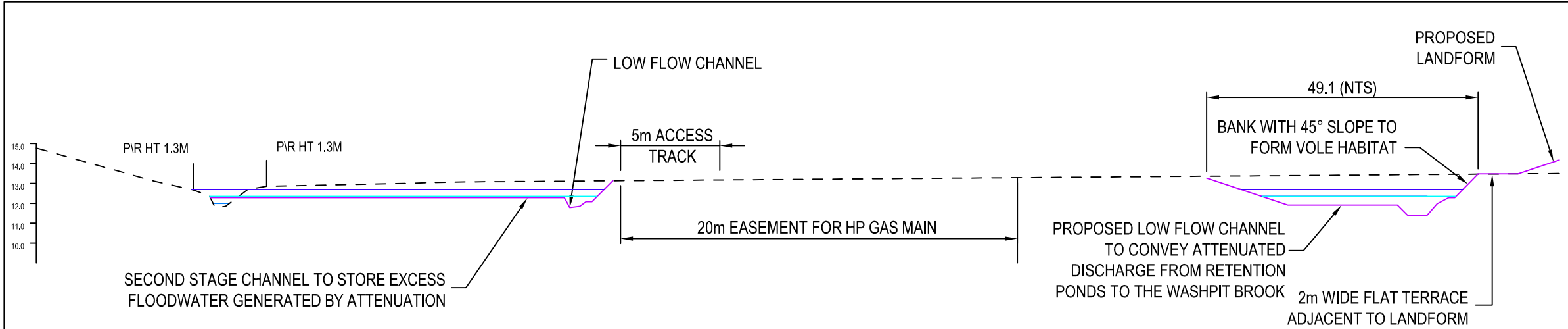
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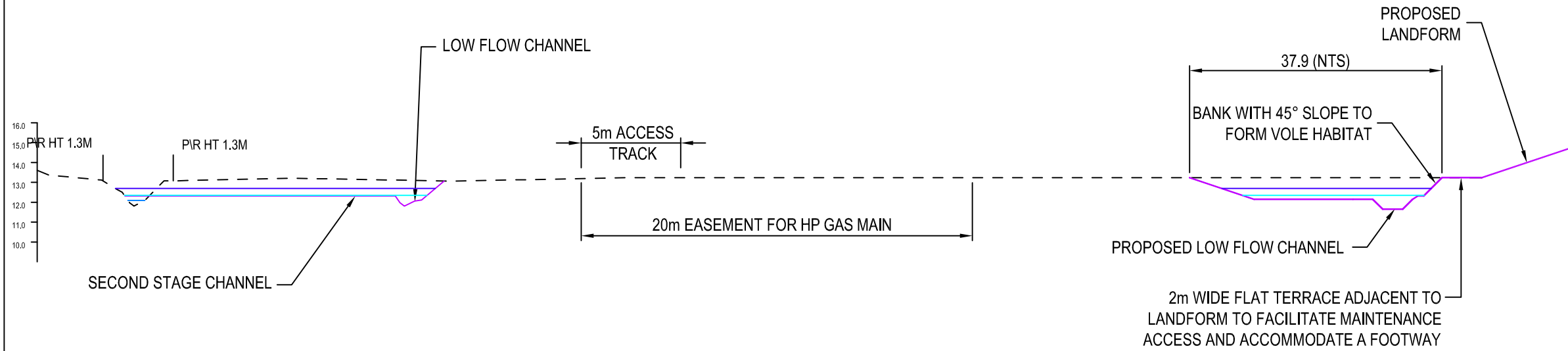
KEY

- - - - EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATER LEVEL
- 1:20 YEAR WATER LEVEL
- 1:100 YEAR WATER LEVEL

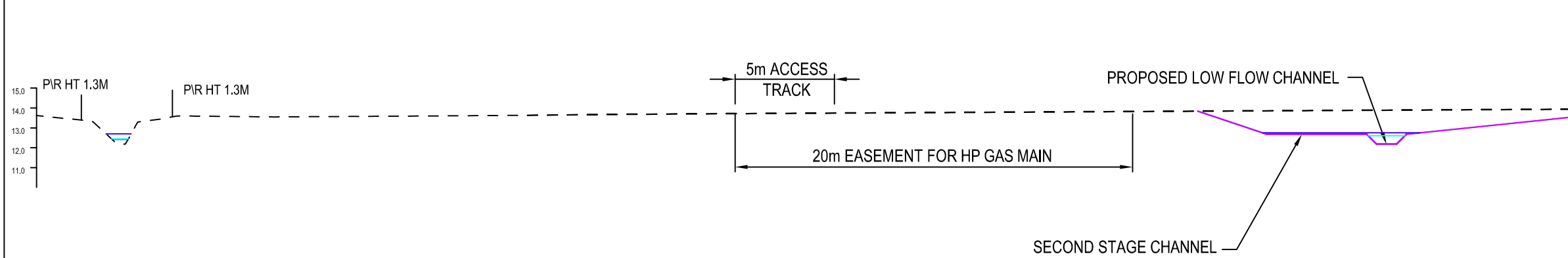
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WSH_2253



WSH_2315



WSH_2437

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Drawing Title
NORTH WEST CAMBRIDGE
ILLUSTRATIVE PROPOSALS FOR THE WASHPIT BROOK
CROSS SECTIONS
(SHEET 4 OF 4)

D127313-SK-058		
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Chk JR	Date 24.11.11	Date 22.03.12



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Annex C – ISIS Model Summary Sheet

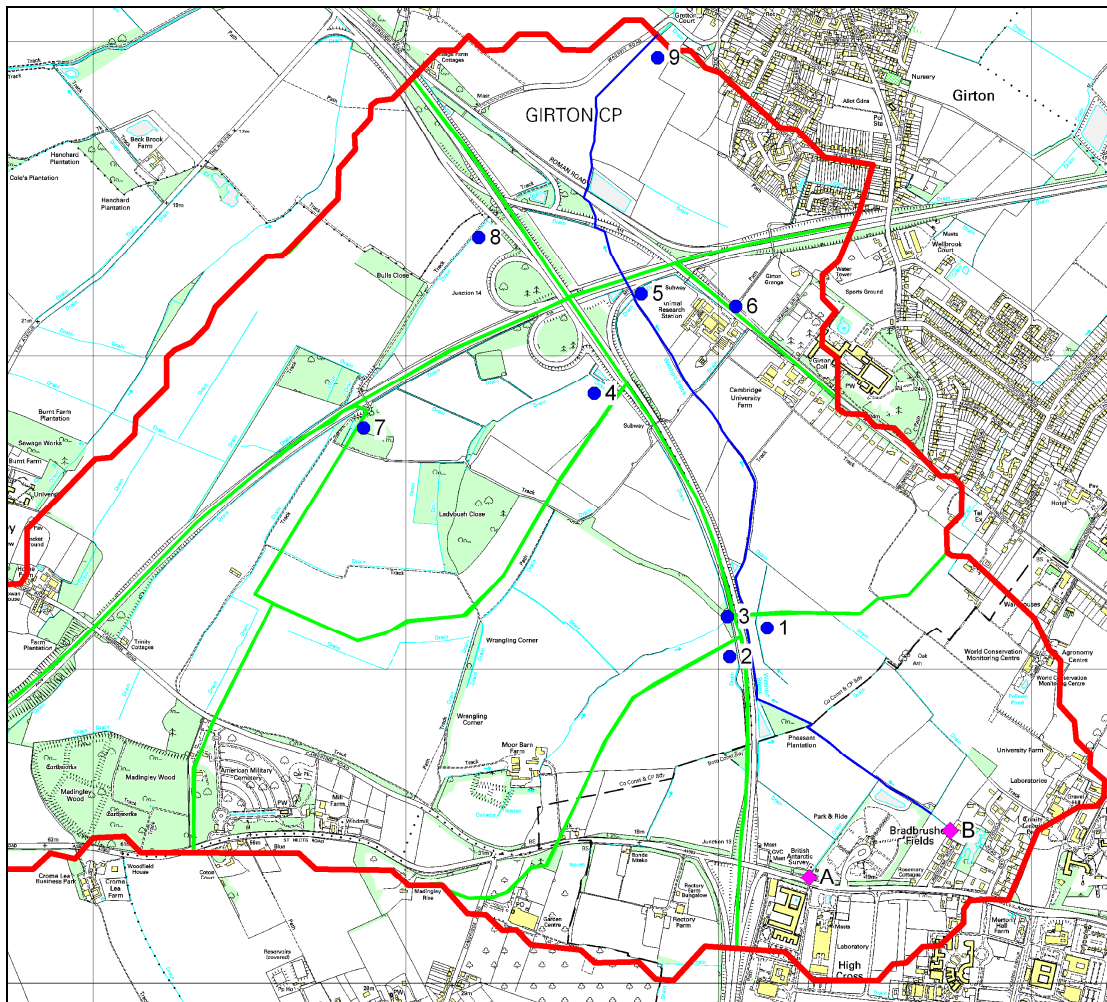
North West Cambridge ISIS Model Summary Sheet

URS Scott Wilson have constructed a baseline and proposed model of the Washpit Brook, which flows through the NW Cambridge site. This document is intended to provide the key information for ease of review by the Environment Agency. Further information is included within the Level 3 Flood Risk Assessment.

Baseline Model

Hydrology

The Washpit Brook flows through the site, as shown on Figure 1 below (blue line). This blue line also defines the extent of the brook that has been included in the model. Figure 1 also shows the entire catchment (red outline) that contributes flow into the brook throughout the modelled reach. The sub-catchment area of each source of flow has been identified by green polygons. The extent of each sub-catchment was used to calculate the hydrological estimates for input into the hydraulic model



The hydrological estimates were entered into the model based upon the sub-catchments. Where appropriate, flows were entered using lateral flow nodes, to proportion inflow equally down the particular reach, such as catchment 1. Some catchments were found to flow into another, such as catchment 7 and 8 and therefore, the hydrographs were combined and entered as a point source because flow joins the Washpit Brook via a culvert.

Hydrographs were calculated using ReFH.

An ISIS model of the Washpit Brook was purchased from the Environment Agency, which overlapped with our model in the lower reaches (approximately 600m overlap). The EA model is approximately 10 years old and used the FEH rainfall-runoff method for the calculation of hydrographs. This method has been revised by the ReFH. Flows calculated in the EA model were larger i.e. 1 in 100 year event, EA flows approximately $7\text{m}^3/\text{s}$ and URS Scott Wilson flows were $5\text{m}^3/\text{s}$. A sensitivity analysis was undertaken using the EA flows and no impact was observed in terms of the conclusions made using the URS Scott Wilson hydrographs.

Naming convention

Cross sections were named based upon the chainage or distance from the model downstream extent.

Topographic survey

A topographic survey of the Washpit Brook was commissioned by URS/Scott Wilson following a site visit. The survey was undertaken by Greenhatch Group in August 2010.

URS/Scott Wilson undertook a site visit to identify specific cross section locations of the Washpit Brook and its tributaries. This included information at all key structures in the model reach.

Within the site, cross sections were extended through the floodplain where necessary using the site topographic survey. Beyond the site, cross sections were extended using 1m resolution LiDAR data (airborne topographic information).

Model construction

Interpolates nodes were used to improve model stability. A notional weir was also included at the upstream extent of the model for the same purpose. Structures were modelled using conduits, orifices or bridges.

A manning's 'n' value of 0.05 was applied to the entire model.

The model is geo-referenced, except where extended beyond the original watercourse survey extent.

Some cross sections were copied and levels adjusted accordingly, using interpolation, where new cross section (rather than interpolate) nodes were needed, such as at junctions.

The downstream boundary condition applied normal depth and a sensitivity test found that the model was extended sufficiently far downstream, so that any uncertainties associated with this would have no impact on flooding at the site.

Sensitivity analysis

A sensitivity analysis was undertaken on the manning's, flow (including $\pm 20\%$ and application of EA hydrographs), structure blockage and downstream boundary condition.

Proposed Model – Rev2 2012

The description below referred to the refined proposed model, which has been amended to reflect to revised proposals for the Washpit Brook. All components of the proposed model are the same as the baseline model, except for the geometry of the watercourse, within a certain reach of the Washpit Brook through the site. The hydrological input has also been changed slightly.

The changes made to the proposed model have been summarised below:

- Included landscaping bunds between node WSH-2437¹ and WSH-14000, based upon 1 in 3 side slopes.
- The geometry of the Washpit Brook has been adjusted in various locations. This incorporates:
 - Repositioning the Washpit Brook along the edge of the two stage channel, adjacent to the maintenance access track and associated 20m High Pressure Gas Main Easement Zone. This connects to the M11 balancing pond and the ditch that flows around its perimeter.
 - A new low flow channel along the western toe of the earthwork landforms to intercept the attenuated discharge from the retention ponds and to connect with the existing reach of the Washpit Brook located upstream.
 - Retaining the central section of the Washpit Brook downstream of the culverts that pass below the M11, until the confluence with a new culvert beneath the maintenance access track (to allow passage of the new channel described above).
 - Realignment of a reach of the Washpit Brook between the new culvert and the flow control structure. The reach has been offset to the west and has included removal of the culvert at node WSH-1579.
- Included new flow control structure (culvert and raised spill level) at WSH-1660 intended to promote storage of floodwater upstream.
- Ground levels on banks of Washpit Brook and the newly created channels have been lowered to increase the storage volume between nodes WSH-2437 and WSH-1660;
- Ground levels within the 20m High Pressure Gas Main Easement Zone have been retained, but spill units have been included to allow water to flow over the 20m High Pressure Gas Main Easement Zone from one channel to another.
- Included a 1m diameter pipe culvert at WSH-1901 to allow passage of the new channel beneath the maintenance access track.
- Re-profiled Washpit Brook upstream of WSH-1660 to maximise the storage volume.

¹ Landscaping bunds extend a little further upstream but all scenarios are in bank at this location and the landscaping bunds are of no impact

- Raised right bank level to 13.15m AOD from the flow control structure to the adjoining landscape bund upstream, to ensure the floodwater does not encroach upon built areas within the Proposed Development..

Hydrology

The hydrology from the baseline modelling has been retained for the proposed flood modelling. However, the manner in which it has been applied to the hydraulic model has been altered slightly in the proposed model. Due to the realignment of the Washpit Brook, connectivity to the upstream catchment has been altered, which has resulted in the slight modification to the hydrological input. Catchment 1 (as defined within the Level 3 FRA) has been split into two sub-catchments, i.e. Catchment 1A and Catchment 1B. Catchment 1A accounted for approximately 91% of the original catchment area and the hydrographs were therefore reduced by 9%. The remainder of the hydrograph (i.e. approximately 9%) was applied to Catchment 1B. Catchment areas were estimated based upon topographic data.

Sensitivity analysis

A sensitivity analysis was undertaken on the application of EA hydrographs, to confirm if the use of larger flows made any difference to the conclusions i.e. does the proposed development result in any detrimental impact on the basis of these larger flows. No significant difference was observed.

A second sensitivity analysis was undertaken to examine the impact of blockage on the proposed flow control structure.

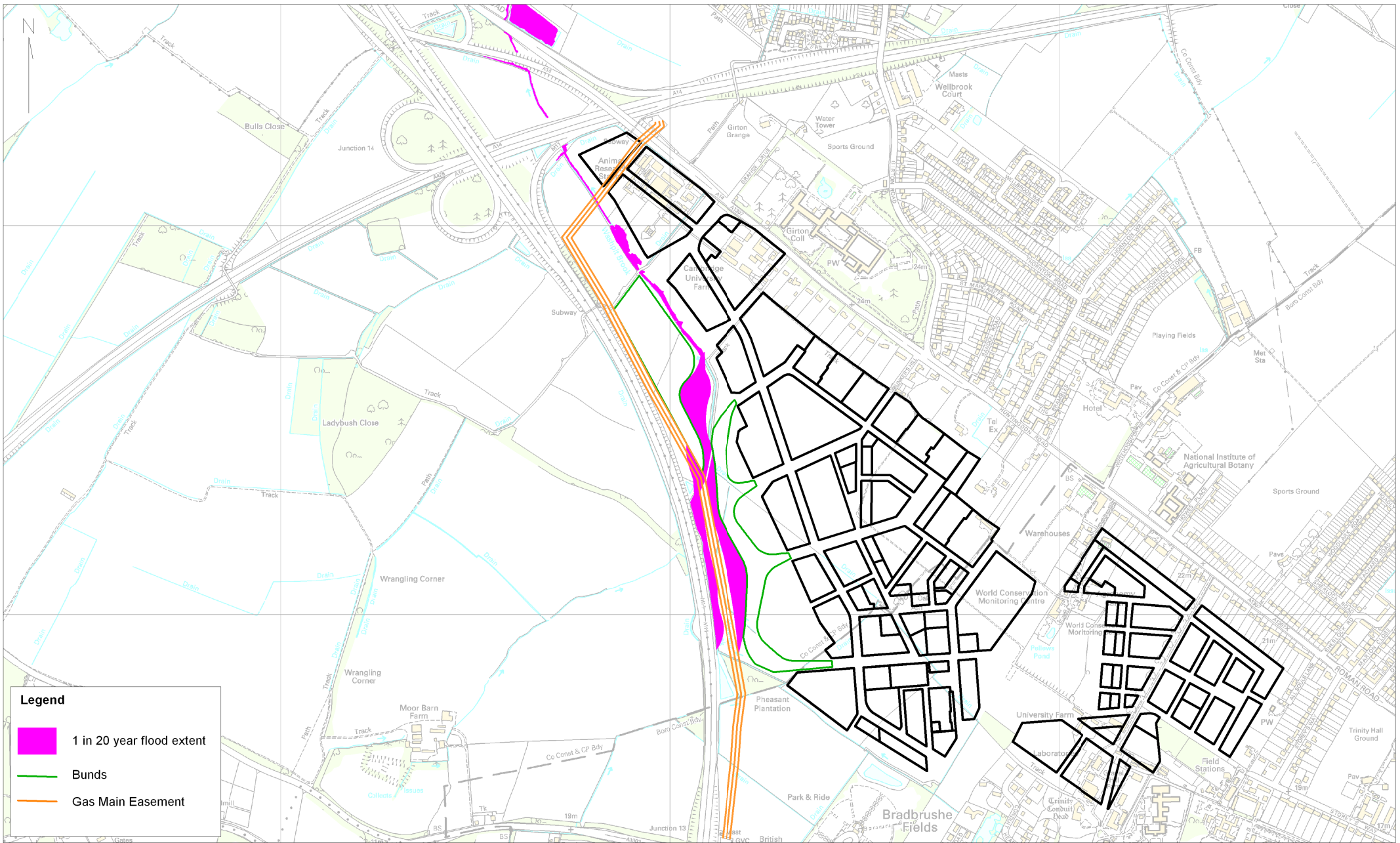
Model Summary

A single .dat file was used for various scenarios, using .ied files to represent different design hydrographs.

Model	Event type	.dat file
Baseline 1 in 20 year event	Design	WASHPIT_BASELINE_FINAL
Baseline 1 in 100 year event	Design	WASHPIT_BASELINE_FINAL
Baseline 1 in 100+CC year event	Design	WASHPIT_BASELINE_FINAL
Baseline 1 in 1000 year event	Design	WASHPIT_BASELINE_FINAL
Baseline 1 in 20 year event Halcrow Flows	Sensitivity	WASHPIT_BASELINE_FINAL
Baseline 1 in 100 year event Halcrow Flows	Sensitivity	WASHPIT_BASELINE_FINAL
Baseline 1 in 100+cc year event Halcrow Flows	Sensitivity	WASHPIT_BASELINE_FINAL
Baseline 1 in 1000 year event Halcrow Flows	Sensitivity	WASHPIT_BASELINE_FINAL
Baseline 1 in 100 year event 50% Blockage (WSH-2657)	Sensitivity	WASHPIT_BASELINE_FINAL_BLOCKAGEB1-50%
Baseline 1 in 100 year event 50% Blockage (WSH-1579)	Sensitivity	WASHPIT_BASELINE_FINAL_BLOCKAGEB2-50%
Baseline 1 in 100 year event 50% Blockage (WSH-1395)	Sensitivity	WASHPIT_BASELINE_FINAL_BLOCKAGEB3-50%
Baseline 1 in 100 year event 50% Blockage (WSH-1255)	Sensitivity	WASHPIT_BASELINE_FINAL_BLOCKAGEB4-50%
Baseline 1 in 100 year event 50% Blockage (WSH-1014)	Sensitivity	WASHPIT_BASELINE_FINAL_BLOCKAGEB5-50%
Baseline 1 in 100 year event 95% Blockage (WSH-1014)	Sensitivity	WASHPIT_BASELINE_FINAL_BLOCKAGEB5-95%
Baseline 1 in 100 year event minus 20% Manning's n value	Sensitivity	WASHPIT_BASELINE_FINAL_MAN-20%

Model	Event type	.dat file
Baseline 1 in 100 year event plus 20% Manning's n value	Sensitivity	WASHPIT_BASELINE_FINAL_MAN+20%
Baseline 1 in 100 year event downstream boundary condition plus 0.5m	Sensitivity	WASHPIT_BASELINE_FINAL_DSBC+0.5m
Baseline 1 in 100 year event minus 20% flow	Sensitivity	WASHPIT_BASELINE_Q100_FINAL_FLOW-20%
Proposed 1 in 20 year event	Design	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 100 year event	Design	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 100+CC year event	Design	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 1000 year event	Design	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 20 year event Halcrow Flows	Sensitivity	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 100 year event Halcrow Flows	Sensitivity	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 100+cc year event Halcrow Flows	Sensitivity	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 1000 year event Halcrow Flows	Sensitivity	WASHPIT_PROP_REV2_FINAL.DAT
Proposed 1 in 100 year event 50% blockage (WSH- WSH-1406)	Sensitivity	WASHPIT_PROP-REV2_FINAL_FLOW CONTROL 50%BLOCK

Annex D – URS Scott Wilson Flood Maps for Refined Flood Alleviation Scheme



Project: **North West Cambridge**

Title: **Proposed Fluvial Flood Extent of a 1 in 20 Year Event**

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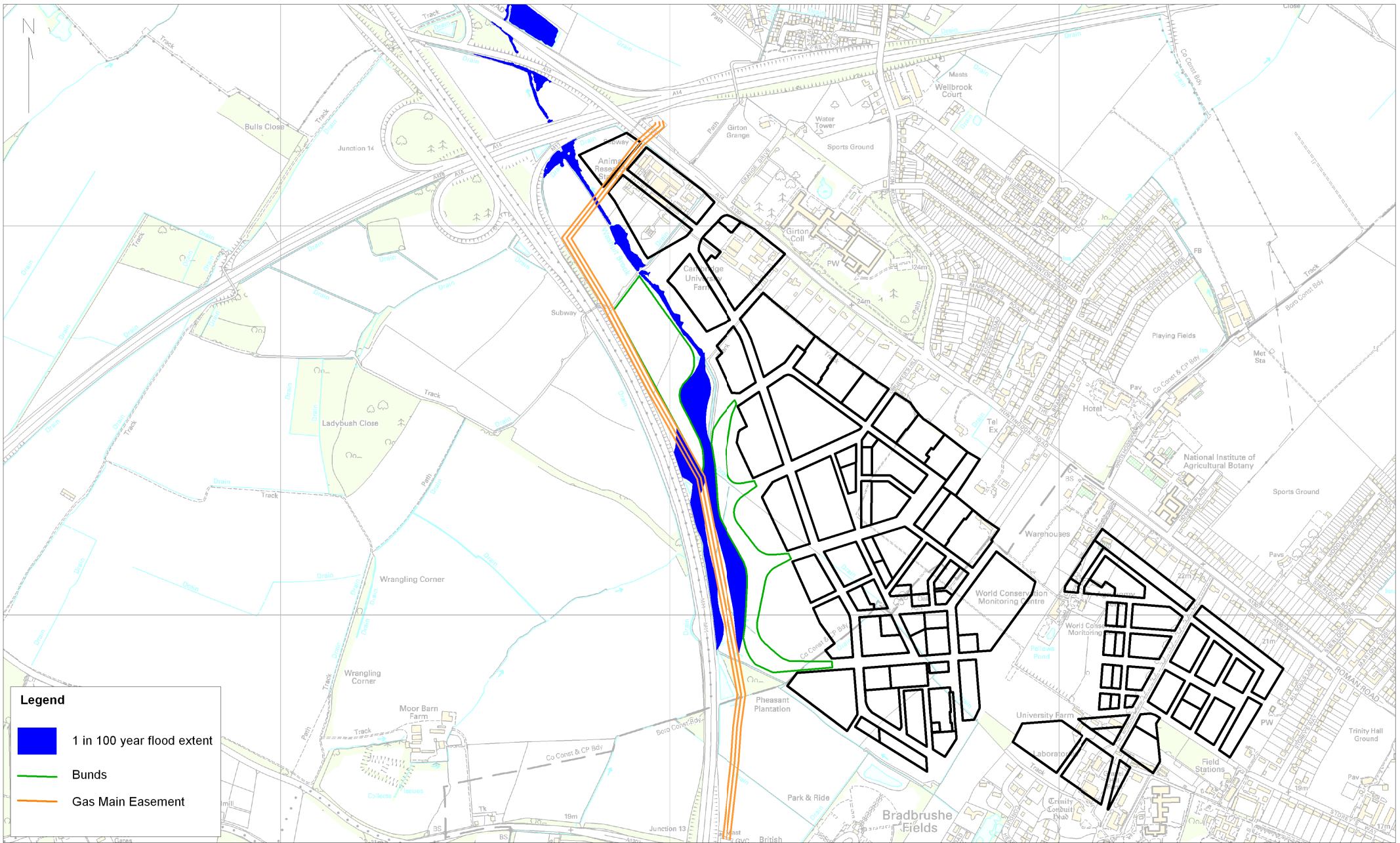
Figure A

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Chk	NB	Date	08/08/11	Date	16/02/12

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Project: **North West Cambridge**

Title: **Proposed Fluvial Flood Extent of a 1 in 100 Year Event**

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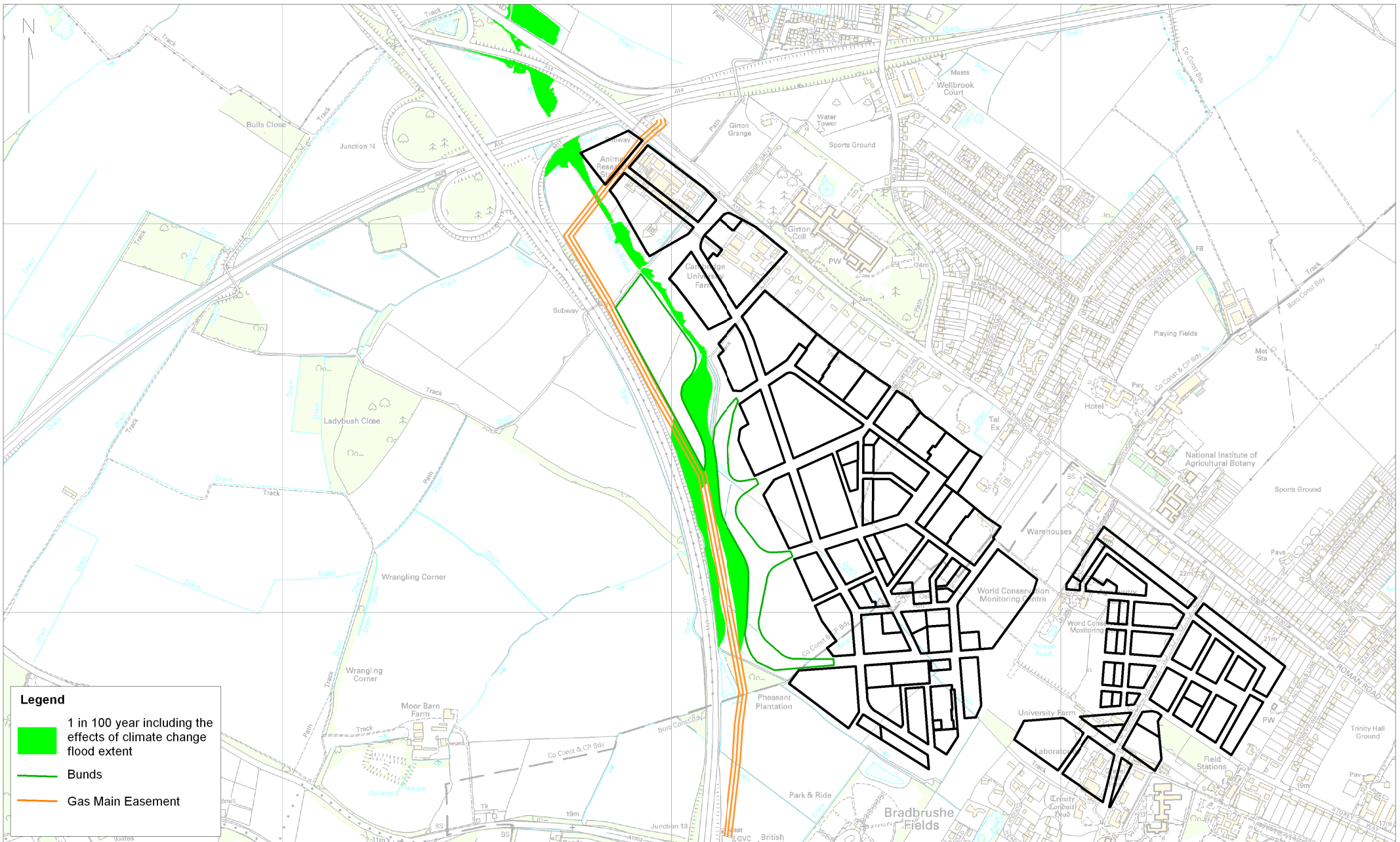
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Project: **North West Cambridge**

Title: **Proposed Fluvial Flood Extent of a 1 in 100 Year Plus Climate Change Event**

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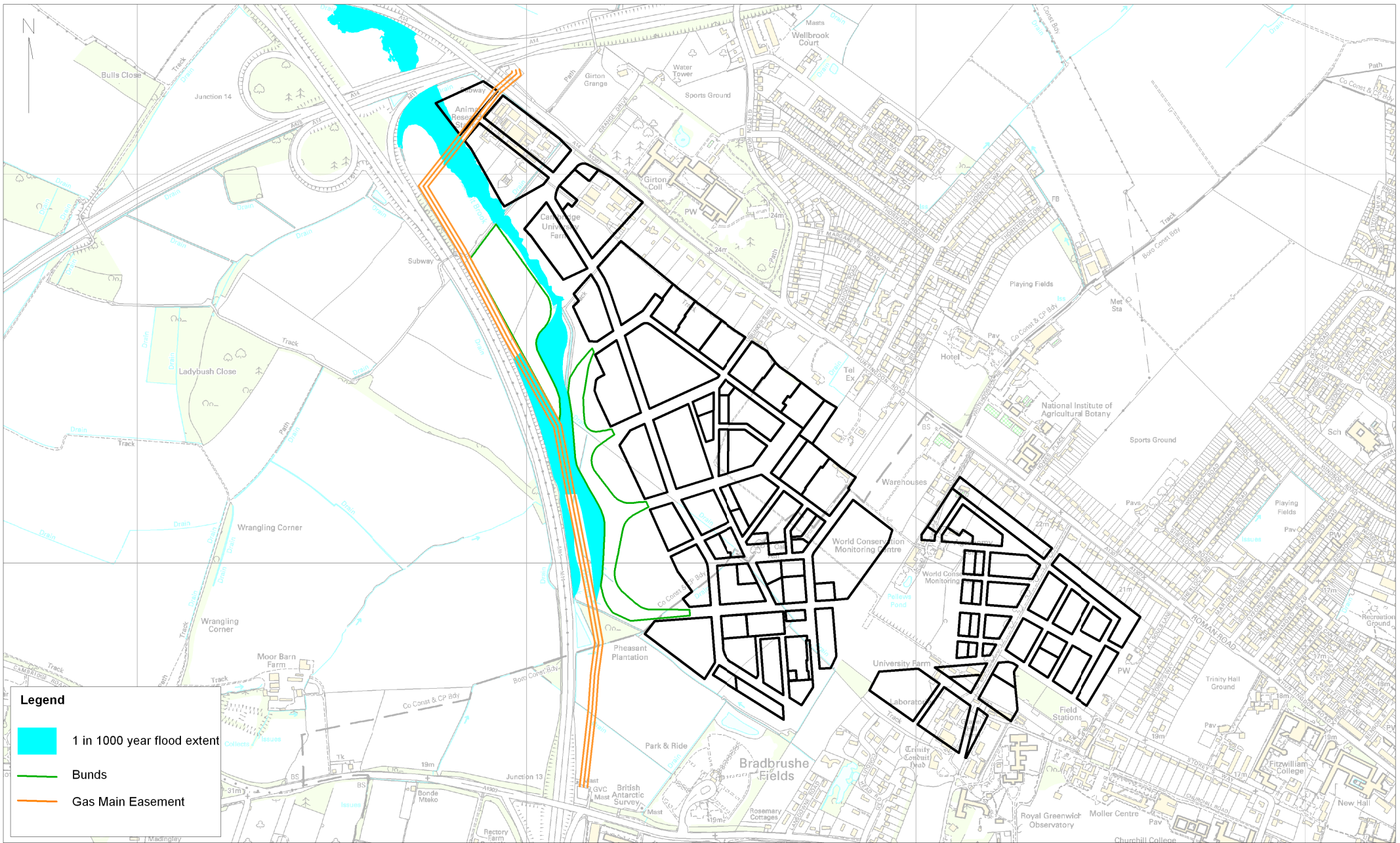
Figure C

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Chk	NB	Date	08/08/11	Date	16/02/12

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Project: **North West Cambridge**

Title: **Proposed Fluvial Flood Extent of a 1 in 1000 Year Event**

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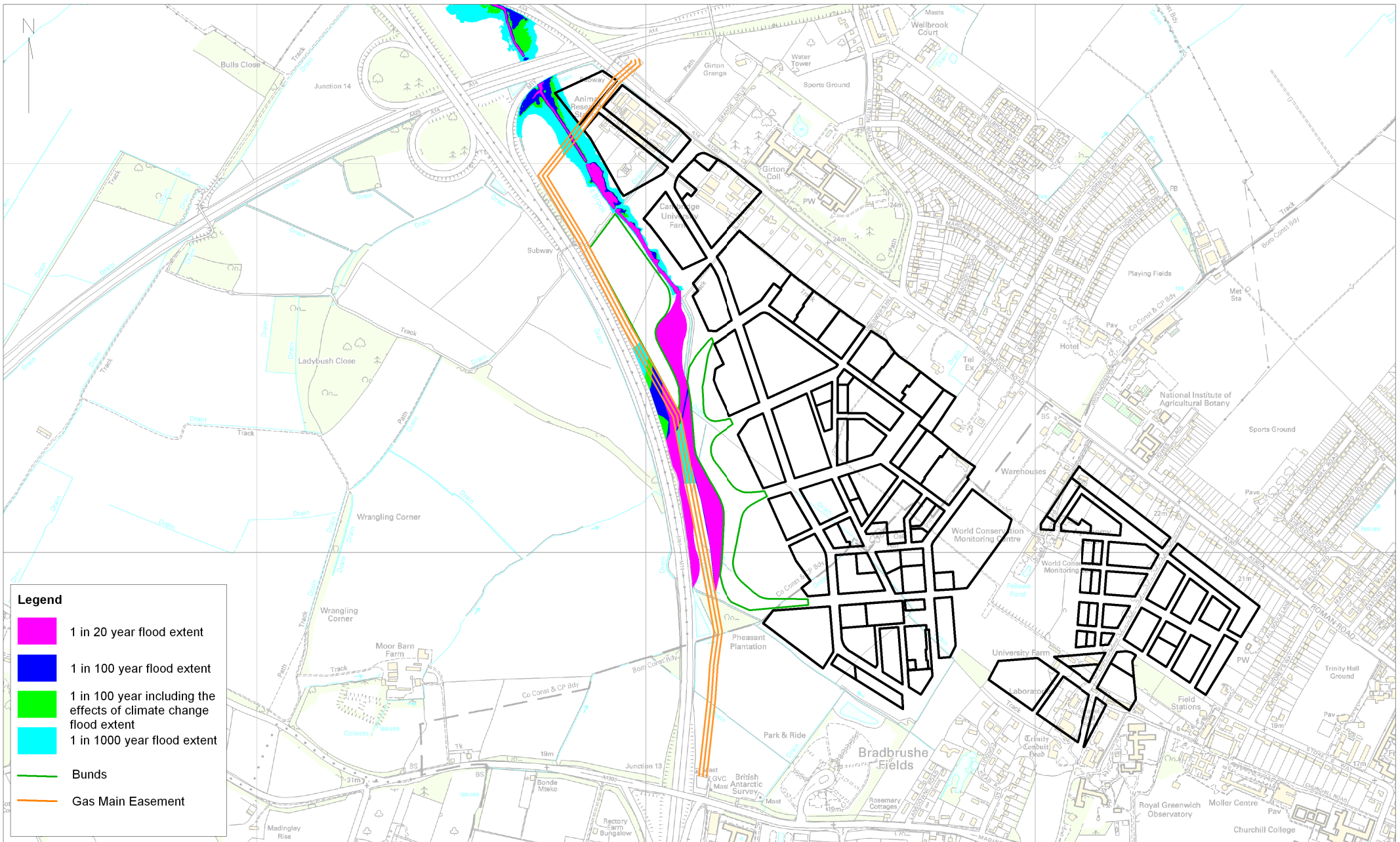
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Chk	NB	Date	08/08/11	Date	16/02/12

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Project: **North West Cambridge**

Title: **Proposed Fluvial Flood Extent**

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Figure E

Scale at A3: 1:9,000

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Chk	NB	Date	08/08/11	Date	16/02/12

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Annex E – Sensitivity Analysis

Sensitivity Analysis – Refined Flood Alleviation Model

Sensitivity testing has been undertaken on the refined flood alleviation hydraulic model. This was to assess the effect of the hydrology calculated as part of the hydraulic modelling prepared by Halcrow in 2003 as part of the Cottenham Load Flood Alleviation Scheme pre-feasibility assessment. A blockage scenario of the proposed flow control structure has also been investigated to test the effect upon the likely flood extents.

Halcrow Hydrology

Hydrographs and peak flows were available for all of the events investigated within this study, except for the 1 in 1000 year return period, which was extrapolated. The Halcrow peak flows were larger than those calculated by URS Scott Wilson, but applied the FEH rainfall runoff method, which has now been superseded by the ReFH method, as used by URS Scott Wilson.

The hydrographs were entered into the model split based upon the proportion of sub-catchment area, as undertaken for baseline modelling (see Section 5.3.5 of Appendix 15.1). The effect observed both upstream and downstream of the Application Site are illustrated in Table 1 and Table 2 below. The same format of table is used as presented within Section 3.5, but the peak flows or stage illustrated below are based upon the Halcrow flows, for both baseline and proposed models.

The same conclusions can be drawn as that identified in Section 3.5. The sensitivity test shows that the proposed flood alleviation scheme still offers significant betterment upstream and downstream, using either the Halcrow flows or the URS Scott Wilson flows. This is achieved under all of the scenarios investigated. The only difference is that the betterment offered is slightly reduced. For example, on the basis of the URS Scott Wilson flows and under the 1 in 20 year event (i.e.Q20) a 28% reduction in flow downstream of the Application Site is observed. However, based upon the results identified in Table 1, a reduction of 14% is observed.

Table 1: Effect upon Peak Flows Downstream of the Application Site (Halcrow Flows)

Q20		
Node	BASELINE	PROPOSED
WSH-0939	2.52	2.16
Q100		
Node	BASELINE	PROPOSED
WSH-0939	3.5	3.24
Q100+CC		
Node	BASELINE	PROPOSED
WSH-0939	4.05	3.91
Q1000		
Node	BASELINE	PROPOSED
WSH-0939	4.52	4.41

Table 2: Effect upon Stage Upstream of the Application Site

Q20		
Node	BASELINE	PROPOSED
WSH-2060	12.67	12.57
Q100		
Node	BASELINE	PROPOSED
WSH-2060	12.86	12.84
Q100+CC		
Node	BASELINE	PROPOSED
WSH-2060	12.97	12.97
Q1000		
Node	BASELINE	PROPOSED
WSH-2060	13.06	13.05

1.1.1 Flow Control Blockage Scenario

Table 3 illustrates the effect of a 50% blockage scenario of the proposed flow control structure, on the basis of the 1 in 100 year event.

Table 3: Sensitivity testing of blockage of proposed structure

Node/Cross Section	Q100 Water Level (mAOD)	50% Blockage at WSH-1406
WSH-2947	14.99	14.99
WSH-2598	13.61	13.61
WSH-2150	12.58	12.94
WSH-1961	12.57	12.94
WSH-1606	12.42	12.35
WSH-1297	12.31	12.27
WSH-1014	11.85	11.58
WSH-0588	10.74	10.69
WSH-0124	10.46	10.43

Node WSH-2947 and WSH-2598 are located sufficiently far upstream not to experience any effect associated with blockage of the proposed flow control structure. Therefore, the cells are un-shaded. With distance downstream towards the flow control structure an increase in water level is observed, as would be expected.

Under this scenario a peak water level of 12.94m AOD is observed at the flow control structure. With the spill level set at 12.90m AOD, a limited rate of flow spills over the high level spill structure. This blockage scenario is not considered to introduce any additional flood risk to the Proposed Development, because the peak water levels observed are less than that under the 1 in 1000 year event, which the Proposed Development will be protected from. Downstream of the flow control structure, peak water levels are significantly reduced. This is a result of the additional floodwater stored upstream due to the reduction in conveyance through the culvert. Therefore, the effect of structure blockage is considered to be beneficial for third parties downstream.

Annex F – Peak Flood Levels

BASELINE			PROPOSOED		
Label	Q100	Q100+CC	Label	Q100	Q100+CC
WSH-3132*	15.9	15.91	WSH-3132*	15.88	15.89
WSH-3075	15.81	15.82	WSH-3075	15.8	15.81
WSH-3047	15.73	15.75	WSH-3047	15.72	15.73
WSH-3018	15.65	15.66	WSH-3018	15.64	15.65
WSH-2995	15.54	15.56	WSH-2995	15.53	15.54
WSH-2984	15.5	15.51	WSH-2984	15.49	15.5
WSH-2973	15.37	15.38	WSH-2973	15.36	15.37
WSH-2973*-DS	15.15	15.19	WSH-2973*-DS	15.12	15.15
WSH-2960	15.1	15.14	WSH-2960	15.08	15.1
WSH-2947	15.01	15.05	WSH-2947	14.99	15.02
WSH-2922	14.91	14.95	WSH-2922	14.88	14.92
WSH-2914	14.85	14.89	WSH-2914	14.83	14.86
WSH-2873	14.76	14.81	WSH-2873	14.73	14.77
WSH-2832	14.65	14.69	WSH-2832	14.62	14.66
WSH-2783	14.52	14.57	WSH-2783	14.49	14.53
WSH-2763	14.49	14.54	WSH-2763	14.45	14.5
WSH-2743	14.47	14.52	WSH-2743	14.43	14.49
WSH-2723	14.46	14.52	WSH-2723	14.42	14.48
WSH-2703	14.46	14.51	WSH-2703	14.42	14.47
WSH-2657	14.37	14.42	WSH-2657	14.33	14.39
WSH-2650	14.14	14.18	WSH-2650	14.12	14.15
WSH-2641	13.82	13.87	WSH-2641	13.78	13.83
WSH-2631	13.78	13.84	WSH-2631	13.73	13.78
WSH-2598	13.67	13.73	WSH-2598	13.61	13.66
WSH-2551	13.52	13.58	WSH-2574	13.51	13.56
WSH-2505	13.4	13.46	WSH-2551	13.41	13.46
WAS-2488	13.35	13.41	WSH-2528	13.31	13.36
WSH-2471	13.27	13.34	WSH-2505	13.04	13.07
WSH-2437	13.15	13.23	WSH-2195	12.58	12.69
WSH-2376	13	13.08	WSH-2150	12.58	12.69
WSH-2345	12.93	13	WSH-2060	12.58	12.69
WSH-2315	12.88	12.95	WSH-1998	12.58	12.69
WSH-2284	12.81	12.88	WSH-1961	12.57	12.69
WSH-2268	12.78	12.85	WSH-1911	12.57	12.69
WSH-2253	12.74	12.82	NEW-1998	12.57	12.69
WSH-2224	12.72	12.8	CAT3	12.58	12.7
WSH-2200*	12.71	12.79	WB-2060*	12.58	12.7
WSH-2195	12.71	12.79	NEW-2060	12.57	12.69
WSH-2150	12.69	12.78	NEW-1961	12.57	12.69
WSH-2065*	12.68	12.76	NEW-1906	12.57	12.69
WSH-2060	12.68	12.76	NEW-1911-DS	12.57	12.69
CAT3	12.68	12.76	NEW-1911-SUS	12.57	12.69
WSH-1998	12.67	12.76	NEW-1911-SDS	12.57	12.69
WSH-1961	12.67	12.76	WSH-1901	12.57	12.69
WSH-1901	12.67	12.76	WSH-1842	12.57	12.69
WSH-1842	12.67	12.76	WSH-1783	12.57	12.69
WSH-1783	12.67	12.75	WSH-1744	12.57	12.69
WSH-1744	12.66	12.75	WSH-1698	12.57	12.69

WSH-1698	12.66	12.75	WSH-1660	12.56	12.68
WSH-1652	12.66	12.75	WSH-1655	12.43	12.5
WSH-1606	12.65	12.74	WSH-1606	12.42	12.48
WSH-1592	12.64	12.73	WSH-1592	12.42	12.48
WSH-1584	12.64	12.73	WSH-1584	12.41	12.47
WSH-1579	12.64	12.73	WSH-1579	12.41	12.47
WSH-1579-CUS	12.64	12.73	WSH-1572	12.41	12.47
WSH-1579-CDS	12.46	12.51	WSH-1566	12.41	12.47
WSH-1579-SUS	12.64	12.73	WSH-1560	12.4	12.46
WSH-1579-SDS	12.46	12.51	WSH-1548	12.4	12.45
WSH-1572	12.46	12.51	WSH-1492	12.37	12.42
WSH-1566	12.45	12.5	WSH-1437	12.36	12.4
WSH-1560	12.45	12.5	WSH-1416	12.35	12.39
WSH-1548	12.44	12.49	WSH-1410	12.35	12.39
WSH-1492	12.41	12.45	WSH-1405	12.35	12.39
WSH-1437	12.39	12.43	WSH-1400	12.34	12.38
WSH-1416	12.38	12.42	WSH-1395	12.34	12.38
WSH-1410	12.38	12.41	WSH-1386	12.33	12.36
WSH-1405	12.38	12.41	WSH-1356	12.32	12.35
WSH-1400	12.37	12.41	WSH-1326	12.31	12.35
WSH-1395	12.37	12.4	WSH-1297	12.31	12.34
WSH-1386	12.36	12.39	WSH-1255	12.3	12.33
WSH-1356	12.34	12.37	WSH-1255-CUS	12.3	12.33
WSH-1326	12.34	12.37	WSH-1255-CDS	11.94	12.1
WSH-1297	12.34	12.36	WSH-1255-SUS	12.3	12.33
WSH-1255	12.32	12.34	WSH-1255-SDS	11.94	12.1
WSH-1255-CUS	12.32	12.34	WSH-1249	11.94	12.1
WSH-1255-CDS	12.06	12.18	WSH-1189	11.89	12.05
WSH-1255-SUS	12.32	12.34	WSH-1131	11.87	12.03
WSH-1255-SDS	12.06	12.18	WSH-1075	11.85	12.02
WSH-1249	12.06	12.18	WSH-1049	11.85	12.02
WSH-1189	12.01	12.15	WSH-1036	11.85	12.02
WSH-1131	12	12.13	WSH-1014	11.85	12.02
WSH-1075	11.98	12.13	WSH-1014-C1	11.85	12.02
WSH-1049	11.98	12.13	WSH-1014-C2	11.81	11.97
WSH-1036	11.98	12.12	WSH-1014-C3	11.78	11.93
WSH-1014	11.98	12.12	WSH-1014-C4	11.75	11.88
WSH-1014-C1	11.98	12.12	WSH-1014-C5	11.73	11.84
WSH-1014-C2	11.93	12.06	WSH-1014-C6	11.7	11.8
WSH-1014-C3	11.89	12.01	WSH-1014-C7	11.67	11.76
WSH-1014-C4	11.85	11.95	WSH-1014-SUS	11.85	12.02
WSH-1014-C5	11.82	11.9	WSH-1014-SDS	11.67	11.76
WSH-1014-C6	11.78	11.85	CAT4	11.85	12.02
WSH-1014-C7	11.74	11.79	WSH-0942	11.67	11.76
WSH-1014-SUS	11.98	12.12	WSH-0939	11.66	11.75
WSH-1014-SDS	11.74	11.79	WSH-0930	11.29	11.44
CAT4	11.98	12.12	WSH-0891	11.26	11.43
WSH-0942	11.74	11.79	WSH-0849	11.23	11.41
WSH-0939	11.73	11.78	WSH-0828	11.21	11.4
WSH-0930	11.4	11.55	WSH-0808	11.2	11.4

WSH-0891	11.38	11.53	WSH-0798*	11.19	11.39
WSH-0849	11.35	11.53	WSH-0758*	11.08	11.23
WSH-0828	11.34	11.52	WSH-0728	11.03	11.18
WSH-0808	11.34	11.52	WSH-0699*	11.03	11.18
WSH-0798*	11.33	11.52	WSH-0699-SUS	11.03	11.18
WSH-0758*	11.18	11.32	WSH-0699-BUS	11.03	11.18
WSH-0728	11.14	11.28	WSH-0699-BDS	10.89	10.97
WSH-0699*	11.13	11.27	WSH-0699-SDS	10.89	10.97
WSH-0699-SUS	11.13	11.27	CAT7&8	11.19	11.39
WSH-0699-BUS	11.13	11.27	WSH-0798-C1	11.19	11.39
WSH-0699-BDS	10.95	11.01	WSH-0798-C2	11.16	11.35
WSH-0699-SDS	10.95	11.01	WSH-0798-C3	11.13	11.31
CAT7&8	11.33	11.52	WSH-0798-C4	11.1	11.27
WSH-0798-C1	11.33	11.52	WSH-0798-C5	11.08	11.23
WSH-0798-C2	11.29	11.47	WSH-0798*SUS	11.19	11.39
WSH-0798-C3	11.26	11.42	WSH-0798*SDS	11.08	11.23
WSH-0798-C4	11.22	11.37	WSH-0654	10.89	10.97
WSH-0798-C5	11.18	11.32	WSH-0588	10.74	10.81
WSH-0798*SUS	11.33	11.52	WSH-0530	10.65	10.69
WSH-0798*SDS	11.18	11.32	WSH-0472	10.6	10.65
WSH-0654	10.95	11.01	WSH-0416	10.57	10.61
WSH-0588	10.79	10.84	WSH-0324	10.52	10.56
WSH-0530	10.68	10.72	WSH-0274	10.5	10.54
WSH-0472	10.63	10.67	WSH-0224	10.48	10.53
WSH-0416	10.6	10.63	WSH-0174	10.47	10.51
WSH-0324	10.55	10.59	WSH-0124	10.46	10.5
WSH-0274	10.53	10.56	WSH-0067	10.44	10.48
WSH-0224	10.51	10.55	WSH-0010	10.42	10.46
WSH-0174	10.5	10.53	WSH-0000	10.37	10.43
WSH-0124	10.49	10.52	WSH-0000-10	10.36	10.43
WSH-0067	10.47	10.51	LAT-2703	14.42	14.47
WSH-0010	10.45	10.48	LAT-2505	13.04	13.07
WSH-0000	10.41	10.46	LAT-1783	12.57	12.69
WSH-0000-10	10.41	10.46	LAT-1386	12.33	12.36
LAT-2253	12.74	12.82	LAT-1188	11.89	12.05
LAT-2195	12.71	12.79	CAT2	12.59	12.7
LAT-2703	14.46	14.51	CAT6	11.85	12.02
LAT-2505	13.4	13.46	LAT-0654	10.89	10.97
LAT-1998	12.67	12.76	LAT-0416	10.57	10.61
LAT-1783	12.67	12.75	LAT-0124	10.46	10.5
LAT-1386	12.36	12.39	WSH-0010C1US	10.42	10.46
LAT-1188	12.01	12.15	WSH-0010C1DS	10.37	10.43
CAT2	12.71	12.79	WSH-0010C2US	10.42	10.46
CAT6	11.98	12.12	WSH-0010C2DS	10.37	10.43
LAT-0654	10.95	11.01	WSH-0010-SUS	10.42	10.46
LAT-0416	10.6	10.63	WSH-0010-SDS	10.37	10.43
LAT-0124	10.49	10.52	LAT-1036	11.85	12.02
WSH-0010C1US	10.45	10.48	WSH-1395-SUS	12.34	12.38
WSH-0010C1DS	10.41	10.46	WSH-1395-C1	12.34	12.38
WSH-0010C2US	10.45	10.48	WSH-1395-C2	12.33	12.36

WSH-0010C2DS	10.41	10.46	WSH-1395-SDS	12.33	12.36
WSH-0010-SUS	10.45	10.48	LAT-1606	12.42	12.48
WSH-0010-SDS	10.41	10.46	WSH-2657-CUS	14.33	14.39
LAT-1036	11.98	12.12	WSH-2657-CDS	14.12	14.15
WSH-1395-SUS	12.37	12.4	WSH-2657-SUS	14.33	14.39
WSH-1395-C1	12.37	12.4	WSH-2657-SDS	14.12	14.15
WSH-1395-C2	12.36	12.39	WSH-2922-CUS	14.88	14.92
WSH-1395-SDS	12.36	12.39	WSH-2922-CDS	14.83	14.86
LAT-1606	12.65	12.74	WSH-2922-SUS	14.88	14.92
WSH-2657-CUS	14.37	14.42	WSH-2922-SDS	14.83	14.86
WSH-2657-CDS	14.14	14.18	LAT-2947	14.99	15.02
WSH-2657-SUS	14.37	14.42	LAT-3018	15.64	15.65
WSH-2657-SDS	14.14	14.18	LAT-2973	15.12	15.15
WSH-2922-CUS	14.91	14.95	LAT-2914	14.83	14.86
WSH-2922-CDS	14.85	14.89	LAT-2832	14.62	14.66
WSH-2922-SUS	14.91	14.95	LAT-2783	14.49	14.53
WSH-2922-SDS	14.85	14.89	LAT-2650	14.12	14.15
LAT-2947	15.01	15.05	LAT-2641	13.78	13.83
LAT-3018	15.65	15.66	LAT-2631	13.73	13.78
LAT-2973	15.15	15.19	LAT-2598	13.61	13.66
LAT-2914	14.85	14.89	WSH-0939-CUS	11.66	11.75
LAT-2832	14.65	14.69	WSH-0939-CDS	11.29	11.44
LAT-2783	14.52	14.57	WSH-0939-SUS	11.66	11.75
LAT-2650	14.14	14.18	WSH-0939-SDS	11.29	11.44
LAT-2641	13.82	13.87	LAT-3132	15.88	15.89
LAT-2631	13.78	13.84	LAT-N-1998	12.57	12.69
LAT-2598	13.67	13.73	NEW-2437	12.71	12.75
LAT-2471	13.27	13.34	LAT-N-2437	12.71	12.75
LAT-2437	13.15	13.23	NEW-2376	12.58	12.69
LAT-2315	12.88	12.95	NEW-2345	12.57	12.69
WSH-0939-CUS	11.73	11.78	NEW-2315	12.57	12.69
WSH-0939-CDS	11.4	11.55	LAT-N-2315	12.57	12.69
WSH-0939-SUS	11.73	11.78	NEW-2253	12.57	12.69
WSH-0939-SDS	11.4	11.55	LAT-N-2253	12.57	12.69
LAT-3132	15.9	15.91	NEW-2195	12.57	12.69
			NEW-2150	12.57	12.69
			LAT-N-2195	12.57	12.69
			NEW-1901	12.57	12.69
			WSH-1901-DS	12.57	12.69
			WB-2150	12.59	12.7
			WB-2060	12.58	12.7
			WB-1198	12.58	12.69
			WSH-2437	12.6	12.7
			WSH-2376	12.58	12.69
			WSH-2345	12.58	12.69
			WSH-2315	12.58	12.69
			WSH-2284	12.58	12.69
			WSH-2268	12.58	12.69
			WSH-2253	12.58	12.69
			WSH-2224	12.58	12.69

WSH-1660-US	12.56	12.68
WSH-1660-SUS	12.56	12.68
WSH-1660-DS	12.43	12.5
WSH-1660-SDS	12.43	12.5
NEW-1911	12.57	12.69
NEW-1911-US	12.57	12.69
WSH-1198-US	12.58	12.69

A stylized, light brown map of the North West Cambridge area is positioned on the left side of the page, partially overlapping the light blue background. The map shows the irregular coastline and internal road network of the region.

NORTH WEST **cambridge**

Environmental Statement - Appendix 2.1
Construction and Environmental Management Plan
March 2012

North West Cambridge **Construction Environmental Management Plan (CEMP)**

September 2011



Prepared for



**UNIVERSITY OF
CAMBRIDGE**

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1 General Environmental Management

1.1 Introduction

Background

- 1.1.1 The North West Cambridge (NWC) project (“the Proposed Development”) has been the subject of an environmental impact assessment and intensive consultation with a wide range of stakeholders, including members of the public, local authorities affected by the scheme and a range of statutory and non-statutory consultees.
- 1.1.2 The Proposed Development will be subject to a number of strict environmental controls and requirements. Measures have been developed through the consultation process with statutory bodies, such as Local Planning Authorities and Natural England.
- 1.1.3 This Construction Environment Management Plan accompanies the application for planning permission for the Proposed Development. It sets out the management measures which the University will require its contractors to adopt and implement for the construction of the Proposed Development to avoid, and manage any construction effects on:
- the environment;
 - existing surrounding communities; and
 - new residents of NWC.
- 1.1.4 The provisions of this plan are intended to be relied upon in preparation of the Environmental Statement to accompany the application for planning permission for the Proposed Development.
- 1.1.5 This Construction Environmental Management Plan outlines how environmental issues that arise will be handled to ensure compliance with relevant legislation. This Plan will be updated as necessary to reflect any more detailed requirements proposed as part of submissions of details of reserved matters.
- 1.1.6 Section 3 of this document includes specifications for particular topic areas. The contractor will be required to deliver these elements as a minimum requirement.
- 1.1.7 Each subsequent version of the Construction Environmental Management Plan and supporting Management Plans will be discussed with relevant qualifying local planning authorities. In addition, for sensitive parts of the Application Site, relevant stakeholders will also be consulted.

Planning Policy context

- 1.1.8 The North West Cambridge Area Action Plan policy NW28: Construction Process states the following:

Where practicable the development will:

a. Recycle construction waste;

b. Accommodate construction spoil within the development, taking account of the local urban and landscape character and avoiding creation of features alien to the topography;

c. Maximise the reuse and recycling of any suitable raw materials currently available on site during construction, such as redundant buildings or infrastructure;

d. Avoid disruption to adjacent parts of the City and Girton.

10.1 The construction process utilises a significant amount of resources and development on this scale will generate a considerable amount of spoil and waste building material. Any existing resources available on the site, such as materials from redundant buildings, can help reduce the amount of materials that have to be imported onto the site.

10.2 It would not be appropriate to transport construction spoil over considerable distances as this would be unsustainable and simply transfer the problem elsewhere. The general principle should be for construction spoil to be treated and utilised on site. However, it would not be acceptable to alter the land forms locally by concentrating the spoil into one or more large mounds as this would introduce an alien character into this area.

10.3 Construction spoil can be used in the construction of sport and recreation facilities provided this is in appropriate locations and will not have adverse implications for landscape character.

10.4 The development of North West Cambridge will take place over a number of years and the construction process can have implications for amenity, public safety, and the landscape setting of Cambridge and Girton if not properly planned. The construction process will therefore need careful management in order to avoid or minimise disruption to the adjacent parts of the City and Girton as well as parts of North West Cambridge which have already been built. Realistically, it will not be possible to avoid any impact when development is being undertaken immediately adjoining existing areas but measures should be undertaken to reduce the impact as far as possible. It will also be important to ensure that there is no adverse impact on the Traveller's Rest Pit Site of Special Scientific Interest (SSSI).

10.5 Haul routes, storage compounds, plant and machinery can all be located in such a way as to minimise any impact and in some cases, it will be appropriate for haul routes to further mitigate their impact through landscaping in locations where the duration and scale of the development is extensive.

10.6 A Construction Environmental Management Plan including a Site Waste Management Plan will be required to support a planning application.

1.2 Phase-specific CEMPs

1.2.1 Phase-specific CEMPs will be prepared for each principal phase of the works. They will be consistent with the CEMP and will describe any environmental obligations pertaining to that part of the Application Site and phase of the Proposed Development which are not already covered in this CEMP.

1.2.2 The phase-specific CEMPs will include the following general documentation:

- a management structure including an organisational chart showing staff responsible for environmental work, setting out roles and responsibilities
- details of the nominated environmental manager
- an internal environmental audit programme, for example ISO 14001
- an Environmental Risk Register and procedures showing how environmental risks will be addressed

-
- procedures for environmental training of site staff
 - procedures for programming, managing and documenting communication of environmental matters
 - procedures for handling external communications, liaison and complaints including the development and maintenance of a clear audit trail
 - procedures for monitoring, recording and disseminating environmental information and performance
 - procedures for addressing non-compliance and corrective actions
 - procedures for managing major incidents, unexpected occurrences or finds during construction, particularly related to: air quality, cultural heritage (including archaeological finds), ecology, ground quality, noise and vibration and water resources.
- 1.2.3 The phase-specific CEMPs will include the following documentation in respect of Construction Works:
- site location and site plan showing site boundaries, position of plant and sensitive receptors
 - description of the works
 - programme of principal construction activities
 - proposed normal working hours
 - outline of works which may require construction activities outside normal working hours
 - equipment and plant to be used
 - vehicular access routes/points including location plan and list of activities for which each access point is to be used
 - method of delivery/removal of materials and plant
 - details of proposed site accommodation
 - personnel access routes/points including location plan and list of activities for which each access point is to be used
 - details of how public right of way and access to property will be retained and managed
 - construction travel plans
 - location of secure storage facilities for tools and equipment
- 1.2.4 Phase-specific CEMPs will include the following documentation in respect of Legal Requirements:
- schedule of appropriate environmental legislation and good practice that will be adhered to
 - list of specific objectives and targets that have been imposed by planning conditions and agreed in consultation with third parties
 - register of permissions and consents required, with responsibilities allocated and programme for obtaining them
- 1.2.5 Phase-specific CEMPs will include the following documentation in respect of Environmental Requirements:
-

- procedures for monitoring construction processes against project environmental objectives and for appropriate action if thresholds have been breached
- procedures for reporting spillages/pollution incidents to the relevant authorities
- procedures for co-ordinating monitoring results to ensure the combined effect of the works in different locations does not trigger threshold levels
- schedule of potential significant environmental effects relating to each activity (this should draw upon the definitions of significant effects used in the Environmental Statement and relate to those effects identified)
- specific Environmental Risk Register relating to each activity
- monitoring proposals including: receptors for which monitoring will be undertaken; frequency; factors against which monitoring results will be analysed; threshold levels, speed of analysis; results distribution list; and actions if thresholds are breached.

1.3 Environmental Monitoring

- 1.3.1 Environmental investigations and monitoring will be undertaken in order to provide information to be taken into account during construction and to evaluate the environmental effects of the construction process.
- 1.3.2 These site investigations provide more detail to the investigations that were undertaken as part of the Environmental Statement but do not broaden the scope of those investigations. They are principally required to establish more precisely where appropriate measures are to be applied.
- 1.3.3 The following table shows the general approach to environmental monitoring and the development stages at which it will be carried out.

Stage	Site Investigations	Monitoring
During construction	Further investigations as the work proceeds	Monitoring against the standards set above
Post construction	None	Monitoring of the success of measures (e.g. habitat creation)

1.4 Environmental Management during Construction

- 1.4.1 The contracts awarded for NWC will include a requirement on the contractor to comply with this CEMP. Contractors will be required to sign up to the 'Considerate Contractor Scheme' (CCS) run by Cambridge City Council, in association with the Cambridge Forum for the Construction Industry.

Management of the Environmental Performance of Contractors

- 1.4.2 Contractors will be required to comply with all relevant environmental legislation and to take account of published standards, accepted industry practice, national guidelines and codes of practice appropriate to the scheme. For the duration of the contract, the environmental performance of the contractor will be monitored through site inspections and audits.
- 1.4.3 Contractors will be required to operate an induction scheme to ensure all employees are aware of the site rules and their environmental responsibilities, to identify training needs for personnel

and to provide appropriate training. The training will include toolbox talks for site operatives to maintain an appropriate level of awareness of environmental issues.

2 General Site Information

2.1 Introduction

- 2.1.1 This section provides general information which will be taken forwards into phase specific Construction Environmental Management Plans.
- 2.1.2 Chapter 3 of this document provides further information which will form base requirements for phase specific Construction Environmental Management Plans.

2.2 Description of the Works

Working Hours

- 2.2.1 Subject to agreement in advance with Cambridgeshire City Council, the core working hours will be 0800 to 1800 on weekdays and 0800 to 1300 on Saturdays. The contractor will obtain consents from Cambridgeshire City Council under the Control of Pollution Act (COPA) 1974 Section 61, which will further define the hours of working on the Application Site. These arrangements may be varied by agreement with the relevant local authority in accordance with COPA 1974.

Layout

- 2.2.2 As far as reasonably practicable and appropriate, the site layout and appearance will be designed using the following principles:
- a) Sites at prominent locations will be screened.
 - b) All sites will be fully secured.
 - c) Existing features will screen the sites where appropriate.
 - d) Storage sites, fixed plant and machinery equipment and temporary offices will be located to limit environmental impacts, as far as reasonably practicable, and having due regard to neighbouring accommodation, as far as allowed by the constraints of each site.
 - e) Site lighting will be located and directed so as not to intrude into occupied residential properties, on sensitive areas or constitute a road hazard.
 - f) Security cameras will be sited and directed so that they do not intrude into occupied residential properties.
 - g) Site plant and facilities will be powered from mains electrical sources.

Hoardings

- 2.2.3 As far as reasonably practicable the visual intrusion of construction sites on nearby residents and users of local facilities and amenities will be contained and limited. The detailed arrangements with regards to the site hoardings will be subject to further approval from Cambridgeshire City Council.
- 2.2.4 The hoardings will accord with the following principles:

- a) The standard hoarding will be of suitable height, plywood faced, timber framed hoarding suitably painted.
- b) The hoarding will be increased in height and possibly altered in form to enhance acoustic performance for specific locations.
- c) Suitable measures will be used for tree protection.
- d) Where reasonably practicable existing walls, fences, hedges and earth banks will be retained.
- e) Notices will be displayed on all site boundaries, to warn of hazards on site such as deep excavations, construction access, etc.
- f) Appropriate sight lines/visibility splays will be maintained to ensure safety of both vehicles and pedestrians is preserved.
- g) Temporary fences may be used in certain areas, such as for short term occupation of sites.

Haul Roads

- 2.2.5 The location of temporary haul routes will be identified. Their location will be considered in terms of impact with regard to noise and disturbance of the local community and the impact on the soils and geology of the Application Site.
- 2.2.6 They will avoid the Traveller's Rest Pit SSSI.

Site Access

- 2.2.7 During the initial scoping process with the highway authorities, the authorities indicated that they may seek a condition to control the construction access route to the proposed Madingley Road Site Access and the M11, to minimise the effect of construction movements upon sensitive areas

Deliveries/compounds

- 2.2.8 Details of the routing of construction vehicles and visitors to the site will be agreed with the Highway Authority, Cambridgeshire County Council.
- 2.2.9 All construction traffic entering and leaving the Application Site will be closely controlled. Vehicles making deliveries to the Application Site or removing spoil material will travel via designated routes, which will have been previously agreed with CCC/SCDC.
- 2.2.10 Measures will be taken to review and reduce where possible the numbers of construction vehicles accessing the site during peak hours, by adopting such measures as 'just in time' deliveries.
- 2.2.11 Details of the contractor's compound and storage areas and car parking arrangements for the contractor's employees and visitors will be provided.

Site Reinstatement

- 2.2.12 On the completion of works, reinstatement plans will be agreed with Cambridgeshire City Council within six months of the completion of the relevant works.

2.3 Contaminated Land

- 2.3.1 A phase 1 Contaminated Land Assessment at the Application Site has been carried out. It is apparent that the previous and recent land use has resulted in only very low levels of contamination present on the Application Site in either soil or groundwater and hence in accordance with the assessment methodology it is assessed that there are unlikely to be any significant effects from the identified sources.
- 2.3.2 The contamination assessment has indicated only low levels of contaminant concentrations present on the Application Site and therefore the potential for excavated materials to be chemically acceptable for re-use, both on-site and off-site is considered high.
- 2.3.3 The gravels within the Mineral Safeguarding Area (MSA) that are excavated for road construction, building foundations or utility trenches will be used as fill on site. Any excavated material from this area will be stockpiled for re-use.
- 2.3.4 Similarly, topsoil arising from the Application will be stockpiled for re-use.
- 2.3.5 Further ground investigations are planned to be undertaken at the worksite and the results will be reviewed to confirm the contamination status of the Application Site. Further soil quality tests may be undertaken as works progress for material and waste management purposes.

Measures in the event of unknown contamination being encountered:

- 2.3.6 To address the potential risk from encountering unexpected contamination a watching brief would be maintained during excavation works. The person assigned would be suitably qualified in identifying indicators of contamination.
- 2.3.7 In accordance with best practice where unexpected contamination is encountered work in the area of concern should be halted until an assessment can be made by a suitably qualified specialist.
- 2.3.8 Where materials that are contaminated are to be disturbed then the following measures should be implemented:
- a) measures to minimise dust generation;
 - b) provision of personal protective equipment (PPE) to construction personnel, such as gloves, barrier cream, overalls, dust masks, respirators etc. to minimise direct contact with soils. The precise requirements should be determined following an appropriate hazard assessment;
 - c) provision of adequate hygiene facilities and clean welfare facilities for all construction site workers; and
 - d) monitoring of confined spaces for potential ground gas accumulations, restricting access to confined spaces, i.e. by suitably trained personnel, and use of specialist PPE, where necessary.
- 2.3.9 Any temporary onsite storage of contaminated material should be on impermeable sheeting, covered and with adequate perimeter leachate collection drains to minimise the potential for leachate and run off from the stockpile being generated.
- 2.3.10 The disposal of soil waste, contaminated or otherwise to landfill sites would be best avoided or reduced by minimisation of the overall quantities of waste generated during construction and by

ensuring that excavated material consigned to landfill cannot, as an alternative, be put to use on the Application Site or at an alternative off site location.

- 2.3.11 The following measures will be adopted for the handling and disposal (if required) of contaminated materials:
- a) Adherence to Site Waste Management Plan;
 - b) Follow best practice to minimise the likelihood of accidental release of contaminated soils during handling and transportation; and
 - c) Selection of the most appropriate disposal route for waste materials, e.g. by avoiding traffic routes that go through residential areas.

2.4 Communication

- 2.4.1 Communication with the local community and Local Planning Authority will be undertaken at an appropriate level and frequency. This will include distribution of information relating to relevant aspects of construction.
- 2.4.2 Appropriate arrangements will be made for monitoring and responding to complaints relating to demolition and construction.
- 2.4.3 The phase specific Construction Environmental Management Plans will include up to date records of those notified about the works (including the date) and arrangements for proposed notifications and dates.

2.5 Phasing

- 2.5.1 The Proposed Development is due to be constructed in a series of phases. Phase specific Construction Environmental Management Plans will be prepared for each phase providing information on how the site is to be prepared, the construction stages and the measures that will be in place to account for the introduction of new receptors to the Application Site.

2.6 Highway and utility works - Huntingdon Road and Madingley Road

- 2.6.1 In addition to the more general measures described above and below, measures will be employed to ensure that traffic is carefully managed to avoid significant disruption to the local highway network which will be agreed with Cambridgeshire County Council, the Highway Authority and the police.
- 2.6.2 Measures will be employed to protect pedestrians and the creation of dust and noise.
- 2.6.3 If short term road closures are required, consent will be obtained from the Highway Authority, Cambridgeshire County Council.
- 2.6.4 Notice regarding planned closures and diversions of existing and/or new roads and footpaths will be given by the contractor to CCC/SCDC, the police, the fire brigade and other emergency services sufficiently in advance of the required closure or diversion dates.

- 2.6.5 There is the potential for the highways and utilities work along Madingley Road and Huntingdon Road to affect the existing traffic flows. To control and manage disruption to traffic flows on the surrounding road network, all contractors (including service utility companies' contractors working for the University) would be required to plan their works in accordance with the agreed Construction Environment Management Plan. The basic measures as summarised below would be included:
- a) design – consideration of alternative service routes to minimise construction work in the local highways;
 - b) co-ordination of development-related works – to undertake all necessary works (such as installing more than one utility company's apparatus simultaneously in one section) to avoid having to re-install the traffic management at any one location;
 - c) co-ordination of these development-related works with works elsewhere on the network being undertaken by other developers and organisations, to prevent two parallel routes being affected simultaneously;
 - d) consideration of working anti-social hours where the number of sensitive receptors is limited (such as to the west of the proposed Site Accesses adjacent the motorway), to reduce the overall duration of the works;
 - e) possible means of removing traffic management during the peak hours, to re-open the road and manage any effects upon the surrounding highway network;
 - f) installing intelligent traffic light controllers or using manually controlled light controllers to minimise any inefficient use of green time.
- 2.6.6 To undertake the highways and utilities work along Madingley Road and Huntingdon Road in a safe manner, the operatives would need a working space free from passing vehicles. This working space would be provided with temporary traffic management regimes which could include single direction running controlled with temporary traffic signals to enable traffic to pass the works area.
- 2.6.7 Sections of Madingley Road and Huntingdon Road towards the M11 / A14 currently operate with a 40mph speed limit. It is likely that a lower temporary speed limit would be sought to minimise the risk to the workforce and members of the public to the extent that the volume of traffic movements does not achieve this effect in practice.

3 Measures to be provided for in phase specific Construction and Environment Management Plans

3.1 Introduction

- 3.1.1 This section includes a variety of minimum requirements to be incorporated into phase specific Construction Environment Management Plans.

3.2 Waste Management

Objectives

- 3.2.1 A robust site waste management plan (SWMP) will commit the project to sustainability through appropriate management of the excavation, demolition and construction phase. Challenging waste minimisation and landfill diversion targets will be set via design codes with the aim of reducing the waste arisings by approximately 45%.

General

- 3.2.2 Surplus or waste materials may arise from either materials imported to site or from those generated on site. However, there are other considerations to waste management such as waste reduction, segregation of waste, disposal of waste, financial impacts of waste disposal and recording, monitoring, education and reviewing. This plan will outline the procedures that will be put into place and demonstrates how they will benefit the environment, how the effects can be measured and how these procedures and practices are sustainable.

- 3.2.3 A draft Site Waste Management Plan (SWMP) will accompany the application for planning permission. This document will be developed further as the project progresses. It provides a framework for the management of site waste generated by the NWC project and covers the following topics:

- 3.2.4 Site inductions

Surplus or waste materials may arise from either materials imported to site or from those generated on site.

However, there are other considerations to waste management such as waste reduction, segregation of waste, disposal of waste, financial impacts of waste disposal and recording, monitoring, education and reviewing. This plan outlines the procedures that have been put in to place and demonstrate how they benefit the environment, how we can measure the effects and how these procedures and practices are sustainable.

Relevant waste and resource management procedures will be communicated to all operatives during the site induction.

- 3.2.5 Segregation

A specific area shall be laid out and labelled to facilitate the separation of materials for potential recycling, salvage, reuse and return. Recycling and waste receptacles are to be kept clean and should be clearly marked in order to avoid contamination of materials. The labelling system

shall be clear and simple. If the relevant receptacles are clearly identified this will aid the bulk of the workforce in depositing the correct materials into the appropriate receptacle.

3.2.6 Site security

Both Client and Principal Contractor must take reasonable steps to ensure site security measures are in place to prevent the illegal disposal of waste at the site.

3.2.7 Training & Communication

The Principal Contractor will provide on-site instruction of appropriate separation, handling, recycling, reuse and return methods to be used by all parties at all appropriate stages of the Project. Toolbox talks will be carried out every month on waste issues and all subcontractors will be expected to attend. The SWMP will also be mentioned in the site induction process. This will ensure that everyone feels they are included and that their participation is meaningful.

3.2.8 Monitoring

A log will be maintained of all materials that come on to site, and details will be obtained from the waste disposal company of the exact amount of waste materials removed from site. Details will also be provided outlining the recovery/disposal actions for the specific waste streams

Waste receptacles will be monitored by the Principal Contractor to ensure that contamination has not occurred, results will be recorded

The Principal Contractor will continually review the type of surplus materials being produced and change the site set up to maximise reuse or recycling and the use of landfill will be the last option.


The Principal Contractor will also visit any waste transfer facility to ensure that we are effectively discharging 'Duty of Care'. They will also periodically follow waste transfer vehicles to their final point of disposal to monitor compliance. Details of these visits will be recorded for audit purposes.

3.2.9 Forecasting of Waste Volumes

In line with Paragraph 6 of the SWMP Regulations, projected waste arisings have been estimated by the design team. These Estimates are included herein. Forecast estimates are based upon details provided by the design team using waste benchmark data for specific building types as produced by the Building Research Establishment (BRE) for consultation with industry.

Planning the reduction, reuse and recycling of waste

3.2.10 Indicative methods of improving resource efficiency in the construction works are outlined in the table below. Wherever possible it is proposed to comply with best practice techniques, only disposing through landfill as a last resort.

Waste type	Waste Materials	Trade Contractor Package	BEST PRACTICE 			
			Waste Minimisation Opportunities	On Site Reuse/Recycling/Recovery	Off Site Reuse/Recycling/Recovery	Disposal
Inert	Concrete	Construction	Retention of concrete on site where possible. Only order what is required.	Use as secondary aggregate on site.	Segregate for reprocessing and reuse as recycled secondary aggregate.	Landfill and cover
	Rubble (hard core)	Construction	Only order what is required.	Opportunities to reuse 'cut' material as 'fill' in proposed noise bund.	Segregate for reprocessing and reuse as recycled secondary aggregate.	Landfill and cover
Non-hazardous	Soils/ Green waste/ vegetation	Construction		Opportunities to reuse 'cut' material as 'fill' in proposed noise bund.		Landfill and cover
	Mixed waste	Construction	Use of standard sizes. Arrange take back of unused materials with the supplier.	N/A	Segregate materials to maximise potential for recycling.	Landfill/ incineration
	Metal	Construction	Made to measure, correct ordering, just in time delivery, store correctly. Arrange take back of unused materials with the supplier.		Segregate waste and send to metal recycler.	Landfill
	Timber	Construction	Avoid over-ordering. Provision of suitable storage to avoid damage. Arrange take back of unused materials with the supplier.		Re-use / Recycle if feasible.	Landfill/ incineration
	Plasterboard	Construction	Avoid over-ordering. Provision of suitable storage to avoid damage. Procure to design specifications. Arrange take back of unused materials with the supplier.	Cannot reuse.	Recycle if feasible.	Landfill
	Packaging	Construction	Ask suppliers to send product with minimal packaging / reusable containers, buy bulk not individually wrapped products.	N/A	Segregate materials to maximise potential for recycling.	Landfill/ incineration

			Return pallet to supplier or use plastic pallets.			
	Cable & wiring	Construction	Avoid over-ordering. Arrange take back of unused materials with the suppliers.	Reuse on site if appropriate.	Segregate and recycle to reclaim plastics and metals.	Landfill
	General Office waste	Site management.	Print double sided, send documents electronically, reusable crockery and cutlery.	Reuse paper, cartridges, plastic cups, tins and cardboard.	Segregate and recycle white paper. Send for composting (food waste only).	Landfill
	Glass	Construction	Avoid over-ordering, appropriate storage to avoid accidents. Arrange take back of unused materials with the supplier.	N/A	Segregate and send for recycling.	Landfill and cover
	WEEE	Construction	N/A	Re-use elsewhere on site.	Send to dedicated recycling facility for recovery and recycling.	Landfill
Hazardous	Asbestos	Construction	N/A	N/A	N/A	Landfill
	Contaminated land	Construction	Avoid excavation where unnecessary.	Consider on-site treatment methods.	Treatment at contaminated land hubs.	Landfill
	Paint tins, line markers, mastic	Construction	Use solvent free paints that are not disposed off as hazardous waste, maximise use of mechanical fitting rather than adhesives. Arrange take back of unused materials with the supplier.	Use a lockable COSHH container for storage.	N/A	Landfill
	WEEE	Construction	N/A	Re-use elsewhere on site.	Send to dedicated recycling facility for recovery and recycling.	Landfill

3.3 Emission Control

Objectives

3.3.1 The objectives will be :

- As far as is reasonably practicable, to control and limit emissions to the atmosphere in terms of gaseous and particulate pollutants from vehicles and plant used on the Application Site and dust from construction activities.
- To identify potential sources of emissions to the atmosphere and apply appropriate control techniques.
- To implement measures to reduce the impact of dust in a timely manner.

General

3.3.2 Activities with the potential to emit particulate matter or oxides of nitrogen to air will be monitored and managed. Liaison meetings will be held with the local authority and local community.

3.3.3 The application of standard dust control measures included in the British Research Establishment guidance (Building Research Establishment, 2003) are normal working practice on all well managed construction sites in the UK. Standard measures will be applied to the construction areas within the Application Site and will be agreed with the local authority air quality/pollution control officer in advance of works starting on site.

Vehicle and plant emissions

3.3.4 Vehicle and plant emissions will be controlled by implementing the following measures:

- a) Engines of all vehicles, mobile and fixed plant on site are not left running unnecessarily.
- b) Using low emission vehicles and plant fitted with catalysts, diesel particulate filters or similar devices.
- c) Using ultra low sulphur fuels in plant and vehicles.
- d) Plant will be well maintained, with routine servicing of plant and vehicles to be completed in accordance with the manufacturer's recommendations and records maintained for the work undertaken.
- e) All project vehicles, including off-road vehicles, will hold current MOT certificates, where required due to the age of the vehicle, (or to be tested to an equivalent standard) and that they will comply with exhaust emission regulations for their class.
- f) Siting haul routes and operating plant away from potential receptors such as houses, schools and hospitals.
- g) Avoiding the use of diesel or petrol powered generators and using mains electricity or battery powered equipment.
- h) Maximising energy efficiency (this may include using alternative modes of transport, maximising vehicle utilisation by ensuring full loading and efficient routing).

- i) All commercial road vehicles used in construction must meet the European Emission Standards pursuant to the EC Directive 98/69/EC (commonly known as Euro standards) of Euro 3 during any works.

Dust management and monitoring

- 3.3.5 Dust control procedures will be implemented to avoid as far as is reasonably practicable the emission of dust and other particulates that would adversely affect the air quality to ensure there is no significant deterioration of current air quality as a result of the works.
- 3.3.6 Dust monitoring will comprise passive deposition monitoring techniques (glass slides/Frisbee gauges/sticky pads) at locations on site boundaries or near to local receptors. Results will be filed and available for inspection upon request.
- 3.3.7 The emission of dust and other particulates will be controlled by implementing the following measures:

Measures controlling the emissions from dust from worksites

- ensure no burning of waste materials takes place on site
- ensure an adequate water supply on the site
- ensure disposal of run-off water from dust suppression activities, in accordance with the appropriate legal requirements
- maintain all dust control equipment in good condition and record maintenance activities
- keep site fencing, barriers and scaffolding clean using wet methods
- provide easily cleaned hardstanding for vehicles
- ensure regular cleaning of hardstandings using wet sweeping methods
- not allow dry sweeping of large areas
- provide and ensure the use of wheel-wash facilities near the site exit wherever there is a potential for carrying dust or mud off the Application Site
- fit wheel-washes with rumble grids to dislodge accumulated dust and mud prior to leaving the Application Site wherever there is a potential for carrying dust or mud off the Application Site and where reasonably practicable
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits
- install hard surfaced long term haul routes, which are regularly damped down with fixed or mobile sprinkler systems and regularly cleaned
- inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable
- record all inspections of haul routes and any subsequent action in a site log book which may be in hard or electronic format
- ensure that un-surfaced haul routes and work areas are regularly damped down in dry conditions
- routinely clean public roads and access routes using wet sweeping methods

- ensure vehicles working on site have exhausts positioned such that the risk of re-suspension of ground dust is minimised (exhausts should preferably point upwards), where reasonably practicable
- impose and signpost maximum speed limits of 5 mph on un-surfaced haul routes and work areas and 10 mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided with the agreement of the local authority, where appropriate)
- ensure all vehicles carrying loose or potentially dusty material to or from the Application Site are fully sheeted
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery
- mix large quantities of cement, bentonite, grouts and other similar materials in designated areas which will be enclosed or shielded
- store materials with the potential to produce dust away from site boundaries where reasonably practicable
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out
- minimise the amount of excavated material held on site
- sheet, seal or damp down unavoidable stockpiles of excavated material held on site, where required
- avoid double handling of material wherever reasonably practicable
- ensure water suppression is used during demolition operations
- ensure that any crushing or grinding plant used on the Application Site, which falls within the definition in Section 3.5 Chapter 3 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973, has an appropriate permit issued and is maintained according to the procedures set out in the Pollution, Prevention and Control Act 1999
- considerate location of grinding and cutting activities
- ensure that any plant, identified above, is operated in accordance with the conditions set out in the permit and a copy of the permit is held on site
- use enclosed rubble chutes and conveyors where reasonably practicable or use water to suppress dust emissions from such equipment
- always use enclosed conveyors where crossing roads, other public areas and property which is not in the ownership or control of the University of Cambridge
- sheet or otherwise enclose loaded bins and skips
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate
- seal or re-vegetate completed earthworks as soon as reasonably practicable after completion
- use design/prefabrication to reduce the need for grinding, sawing and cutting on site wherever reasonably practicable

- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction
- carry out site inspections regularly to monitor compliance with dust control procedures set out above and record the results of the inspections, including nil returns, in the log book detailed
- increase the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
- record any exceptional incidents causing dust episodes on or off the site and the action taken to resolve the situation in the log book
- all loads entering and leaving site will be covered
- use Just in time deliveries outside of peak periods when possible
- strip insides of buildings, as far as reasonably practicable, before demolition
- bag and remove biological debris (such as birds nests and droppings) or damp down such material prior to demolition
- wherever reasonably practicable, retain walls and windows while the rest of the building is demolished to provide a screen against dust
- screen buildings, where dust producing activities are taking place, with debris screens or sheeting
- avoid carrying out earthworks during dry weather if reasonably practicable having regard to programme and contracting arrangements for the relevant works or provide and ensure appropriate use of water sprays to control dust
- seed or seal medium or long term excavated material and soil stockpiles
- ensure slopes on stockpiles are no steeper than the natural angle of repose of the material and maintain a smooth profile
- ensure equipment is readily available on site to clean any spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods
- ensure mixing of cement, bentonite, grout and other similar materials takes place in enclosed areas remote from site boundaries and potential receptors
- where appropriate use increased hoarding height to protect receptors
- consider full enclosure of sites or specific operations where there is a high potential for dust production and the site is active for an extensive period.

3.4 Archaeology and Built Heritage

Objectives

- 3.4.1 The objective is to ensure that works are carried out in such a way as to avoid or minimise, as far as reasonably practicable, potential damage and disturbance to scheduled monuments, archaeological sites and deposits, and buildings of historic interest (both listed buildings and important non-listed above ground features and structural elements).

General

- 3.4.2 The effects of construction activity on listed buildings and their settings and on conservation areas and locally listed buildings will be indirect and temporary. There will be no direct physical effects on any built heritage assets but indirect and temporary effects on them and their settings may arise from construction noise and dust.

Measures to be implemented

- 3.4.3 These resources will be managed in accordance with accepted industry practice guidance and relevant standards. Emission Control and Noise and Vibration management measures described above and below will be implemented to reduce dust, noise and other irritants. The following measures will be employed at the Application Site:
- Full excavation (with separately agreed WSIs) to precede development within any designated site-area.
 - Should landscaping (e.g. tree-planting) and/or services (including temporary haul roads) occur within any site-area prior to their full excavation then these will require either due protection and/or separate excavation beforehand (again, requiring WSIs).
 - There will be no machine movements across, landscaping of or service-related construction within preserved designated site-areas without WSIs (these will all also required agreed long-term management plans).
 - Any development-related service construction occurring upon undisturbed land beyond the border of the Application Site will requires WSIs prior to their commencement (e.g. length of the option 1 water main extension within the West Cambridge land and the field south thereof).
 - As will be formally agreed with the County Council's Heritage Team, the developer will agree to fully fund all necessary archaeological fieldwork (and associated public outreach), post-excavation assessment, analysis and publication, plus long-term artefact and archival storage, arising from the construction programme.

3.5 Geological Site Management

Objectives

- 3.5.1 The Traveller's Rest Pit is a SSSI site. The objective of the Geological Site Management Plan is to document the proposals for the SSSI, including the future management regime, on which Natural England will be consulted. A Geological Site Management Plan accompanies the application for planning permission

General

- 3.5.2 The operations listed below may damage the features of interest within the Traveller's Rest Pit SSSI. Before any of these operations are undertaken Natural England must be consulted as their consent may be required in advance of the operation commencing:
- Cultivation, including ploughing, rotovating, harrowing, and re-seeding
 - Dumping, spreading or discharging of any materials

- Tree and/or woodland management and alterations to tree and/or woodland management (including planting, felling, pruning and tree surgery, thinning, coppicing, changes in species composition, removal of fallen timber).
- Draining (including the use of mole, tile, tunnel or other artificial drains).
- Infilling or digging of ditches, dykes, drains, ponds or pits.
- Extraction of minerals, including hard rock, sand, gravel, silt, clay, topsoil, subsoil, chalk and spoil.
- Destruction, construction, removal, rerouting or regarding of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, including soil and soft rock exposures or the laying, maintenance or removal of pipelines and cables, above or below ground.
- Storage of materials.
- Erection of permanent or temporary structures, or the undertaking of engineering works, including drilling.
- Modification of natural or man-made features, (including cave entrances) and clearance of boulders, large stones, loose rock or scree.
- Battering, buttressing or grading of geological exposures and cuttings (rock and soil) and infilling of pits and quarries.
- Removal of geological specimens, including rock samples, minerals and fossils.
- Recreational or other activities likely to damage or disturb the features of special interest.
- Any reference to animal) in this list includes any mammal, reptile, amphibian, bird, fish, or invertebrate.

Measures to be implemented

- 3.5.3 The following list of measures are to be implemented at the SSSI site:
- 3.5.4 Everything listed within section 3.5.2 of this document requires the consent of Natural England. No work requiring Natural England's consent will commence within the SSSI without the consent of Natural England, unless it has been established that such consent is not needed.
- 3.5.5 As much as possible access will be made in areas outside the 2010 notified SSSI boundary. Ramps for disabled access will be formed outside the 2010 notified SSSI boundary.
- 3.5.6 Paths will preferentially be located on ground not underlain by Observatory Gravels. Where it is necessary for paths to cross areas underlain by Observatory Gravels, the form of path chosen should enable it to be moveable and/or demountable ('roll-up') to allow future access for research. Paths shall be raised to ensure that they do not introduce a requirement for the Observatory Gravels to be removed during their construction. Concrete or bituminous paths will not be permitted as they would effectively sterilise the ground below and thereby preclude future research.
- 3.5.7 The design of any steps down the quarry slopes, within the Traveller's Rest Pit SSSI boundary, will be discussed and agreed with local planning authorities and relevant consultees, including Natural England, at the detailed planning stage. The use of steps formed by cutting into the slope will not be permitted as they could potentially destroy the local geology. Natural England will not permit Observatory Gravels to be re-used. Before the steps are installed, mitigation measures will be required, including a survey of the geology. Steps down the quarry slopes,

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- within the Traveller's Rest Pit SSSI boundary, will be created by using structures such as wooden steps or localised earthworks which will be designed to ensure that:
- disturbance to the geology will be minimised and
 - access to the underlying geology is not permanently prevented.
- 3.5.8 The details of any steps proposed would be discussed and agreed with local planning authorities and relevant consultees, including Natural England, at the detailed planning stage.
- 3.5.9 Planting of deep rooting shrubs, plants and trees will not be permitted on areas within the Traveller's Rest Pit SSSI or the buffer zone to the Traveller's Rest Pit SSSI underlain by Observatory Gravels as roots penetrating into the Observatory Gravels could have the potential to disturb the sedimentary structures within the geological sequence and toppling trees could significantly disturb the sequence of strata within the root zone. Species outside the Traveller's Rest Pit SSSI and the buffer will be selected and positioned to ensure that their roots are unlikely to penetrate the buffer.
- 3.5.10 Any planting must not prevent access to the Observatory Gravels within the Traveller's Rest Pit SSSI. Planting and landscaping in the Traveller's Rest Pit SSSI or the Traveller's Rest Pit SSSI buffer must be agreed with Natural England.
- 3.5.11 No structures including lighting and street furniture will be constructed within the Traveller's Rest Pit SSSI. Information boards could be located within the buffer to the Traveller's Rest Pit SSSI.
- 3.5.12 Children's play areas and hard surface sports facilities will not be located within the Traveller's Rest Pit SSSI boundary as they would effectively sterilise an area of ground because of the need to break out, and later reinstate, the working areas during geological research.
- 3.5.13 Ponds will not be located within the Traveller's Rest Pit SSSI or in close proximity to the Traveller's Rest Pit SSSI as they have a high probability of disturbing or destroying the geological resource and are likely to restrict access to significant areas of the resource for future research.
- 3.5.14 Drainage pipes and buried services will not be laid within or over the Traveller's Rest Pit SSSI as they have the potential to damage the geological resource during the trenching operation.
- 3.5.15 The boundary of the Traveller's Rest Pit SSSI and the associated 10m buffer zone will be established and physically marked on the ground prior to any construction work commencing.
- 3.5.16 No construction activities (e.g. storage of materials, access for movement of construction traffic) will take place in the Traveller's Rest Pit SSSI without the consent of Natural England.
- 3.5.17 No storage of fluids, waste, soil, construction materials or vehicles will take place within the Traveller's Rest Pit SSSI or the 10m buffer zone.
- 3.5.18 A control strategy will be set up in conjunction with University of Cambridge, Natural England and the World Conservation Monitoring Centre to manage access to the Traveller's Rest Pit SSSI for:
- work on mitigation and enhancement measures and
 - study and research purposes.
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- 3.5.19 If the contractor deems it necessary in order to prevent damage or disturbance to the Traveller's Rest Pit SSSI during construction, the Traveller's Rest Pit SSSI will be securely fenced.
- 3.5.20 Where the Traveller's Rest Pit SSSI is fenced during construction, gates will be provided to ensure access only takes place at designated locations in accordance with the control strategy.
- 3.5.21 Controlled vehicular access into the base of the pit to carry out mitigation and enhancement measures will be provided using the existing access adjacent to the WCMC and Agronomy Centre. This route does not cross the pit slopes within the Traveller's Rest Pit SSSI. The arrangements for access will be included within the specific consent (from Natural England) for each operation.
- 3.5.22 Surveying and recording the geology prior to, or during, construction in order to avoid or reduce potential loss of localised areas of the Observatory Gravels, or locally reduced accessibility for future research.
- 3.5.23 If during enhancement works there is potential to encounter Observatory Gravels within the Traveller's Rest Pit SSSI, a Quaternary Geologist shall be available to survey and record the geology prior to and during this construction. This will help to avoid or reduce risk of potential loss of areas of the Observatory Gravels within the Traveller's Rest Pit SSSI, or to reduce accessibility for future research. The requirements of such surveys shall be agreed with Natural England but are likely to include mapping, sketches, photographs and descriptions of the strata, fossils, sampling, and sedimentary structures.
- 3.5.24 If during enhancement works sands and gravels are encountered at locations where they are not anticipated, the work shall be stopped until the geology and any archaeological deposits have been assessed by appropriate professionals. Where the soil within the Traveller's Rest Pit SSSI is Observatory Gravels it shall be recorded as outlined above. Archaeological deposits should be recorded as outlined in the Archaeology and Built Heritage Management Plan.
- 3.5.25 Where Observatory Gravels are encountered unexpectedly within the Traveller's Rest Pit SSSI, type and locations of the enhancement works will be reviewed.
- 3.5.26 Bona fide scientific access for further research and survey work (e.g. via excavating faces, trenching, trial pits, borehole survey, non destructive survey such as ground penetrating radar) along with any necessary remediation/reinstatement works will be accommodated at the Traveller's Rest Pit SSSI.
- 3.5.27 Vegetation on the SSSI will be managed, in particular removal of trees and shrubs in poor condition from the degraded quarry slopes and regular maintenance of grass and trees/shrubs to ensure that the geological resource is not damaged. Exposed gravels on the slopes will be covered with topsoil and seeded to reduce erosion and help stabilise the slopes.
- 3.5.28 Ongoing maintenance will be required to maintain the grassed surface established during the Proposed Development. Undergrowth, trees and shrubs will not be allowed to re-establish after removal during the Proposed Development.
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3.6 Biodiversity

Objectives

- 3.6.1 The objectives are to control and limit disturbance to areas of nature conservation interest and protected species in accordance with relevant legislative requirements and accepted industry practice.
- 3.6.2 The measures to be implemented will include the monitoring of both on and off-site biodiversity measures to avoid or manage adverse effects or to deliver enhancement measures.
- 3.6.3 Measures from the Biodiversity Action Plan for the Proposed Development which relate to the construction period will be implemented. These include.

Ecological Resources

- 3.6.4 Amphibians, invertebrates, bats and badgers have been recorded at the proposed worksites.
- 3.6.5 Measures from the Environmental Statement are provided below.

Ecological Management

- 3.6.6 The Washpit Brook will be protected within a buffer zone throughout the construction phase of the development. The buffer zone will be fenced off using netlon-type fencing to prevent accidental damage, and to restrict access during the works. Appropriate pollution control measures will be implemented to avoid pollution or increased turbidity in the Washpit Brook during construction operations, to protect adjacent and downstream habitats. This will be of particular importance during the re-modelling works in this part of the Application Site.
- 3.6.7 Construction Site drainage will be designed to include treatment and attenuation of run-off from infrastructure roads and hard surfaces through the use of balancing and pollution control mechanisms. to avoid pollution of the Washpit Brook
- 3.6.8 The retained and new ponds, and the habitat within the open lands, will be managed in accordance with the Biodiversity Action Plan.
- 3.6.9 The retained and new hedgerows will be managed in accordance with the Biodiversity Action Plan.
- 3.6.10 Protective fencing will be provided around retained hedgerows during construction. 5m wide buffer zones will be provided alongside retained hedgerows.
- 3.6.11 Construction of a newt tunnel under the access road to Madingley Road, with associated amphibian resistant fencing alongside the access road to guide the animals into the tunnel.
- 3.6.12 Site clearance within 500m of the Park and Ride pond and Bird Sanctuary ponds to take place under licence to Natural England. Use of temporary one-way newt fencing combined with capture of newts from affected areas by pitfall trapping and artificial refuges, followed by a destructive search. Captured animals relocated to the ponds. Site clearance within this area to take place outside the hibernation period (October to March). In some cases works may need to be restricted to the months of April and May.
- 3.6.13 Relocation of amphibians, invertebrates and wetland vegetation into new and retained ponds within the Application Site during site clearance.

- 3.6.14 Closure of outlying badger setts under licence to Natural England (where necessary). This needs to take place during the period July to November inclusive.
- 3.6.15 Closure of the northern end of sett A (in the NE corner of the pit) to allow access road construction, under licence to Natural England and during the period July to November inclusive.
- 3.6.16 Site clearance (trees/hedgerows and arable fields in particular) outside the nesting bird period where possible (i.e. not during end-Feb to mid-August). Or surveys in advance of clearance to confirm absence of nesting birds (with the associated risk of having to retain areas supporting nests until the chicks have fledged).
- 3.6.17 Demolition of building supporting a bat roost under licence to Natural England, and timed to avoid periods when bats are present (given the status of the roost it is likely that a period of absence could be identified at any time of year).
- 3.6.18 All works carried out in accordance with 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites' (2009).

Surveys and Monitoring

- 3.6.19 Ecological surveys have been undertaken in preparation of the application for planning permission. Further surveys are required, as listed below before construction activities can commence in certain areas.
 - A pre-construction water vole survey will be undertaken to confirm the presence or absence of water voles along the length of the brook within the Application Site. In the event that works need to take place in an area occupied by water voles, the animals will be relocated in advance of works commencing through 'displacement' by strimming the vegetation and undertaking a careful destructive search, in accordance with current best practice guidance (Strachan and Moorhouse, 2006; Natural England, 2008). Any water voles present will be displaced into the retained section of watercourse. It is not considered likely to be necessary to capture and relocate water voles in advance of the works.
 - Survey sections of the Washpit Brook to confirm the continued absence of otter resting sites.
 - Update newt surveys to inform the newt licence application (dependent upon timing of works in this area). Monitoring of newt population post-construction.
 - Update badger survey prior to each construction phase commencing.
 - Update barn owl survey to confirm continued absence of nesting barn owls.

Reinstatement

- 3.6.20 Reinstatement will be undertaken and agreed with suitable consultees in advance.

3.7 Lighting

Objectives

- 3.7.1 The objectives are to provide adequate lighting on construction sites ensuring a safe and secure worksite but avoiding incorrectly positioned site lighting which may cause nuisance or may unnecessarily interfere with local residents or passing motorists.

Lighting Management

- 3.7.2 In determining the lighting arrangements for the worksite, consideration will be given to residents and other sensitive receptors that may experience a nuisance by the light. Where appropriate measures will be implemented to reduce obtrusive light (including consideration of hours of lighting, provisions for dimming or switching off light, equipment to be used and lighting position).
- 3.7.3 Reference to and consideration of the Bat Conservation Trust's best practice guide shall be made (Bats and Lighting in the UK, Bats and the Built Environment Series).
- 3.7.4 Where possible, a daylight only construction schedule will be adopted to minimise adverse lighting effects as different phases are completed. It is unavoidable that construction work may require work during the hours of darkness in consideration of shorter daylight availability during winter months.
- 3.7.5 Where appropriate the following measures will be considered for implementation:
- do not “over” light
 - dim or switch off lights
 - use specifically designed equipment
 - keep glare to a minimum, and
 - position lights sensibly.

3.8 Noise and Vibration

Objectives

- 3.8.1 The objectives are, as far as reasonably practicable, to control and limit noise and vibration levels so that affected properties and other sensitive receptors are protected from excessive noise and vibration levels associated with construction activities.

Context

- 3.8.2 There are numerous residential properties round all the worksites. Listed buildings are potentially more sensitive to vibration than non-listed buildings.

Noise and Vibration Management

- 3.8.3 Consents under Section 61 of the Control of Pollution Act 1974 will be obtained for the construction works. The works will be carried out in accordance with the conditions of the consent.
- 3.8.4 The contractor may agree with the local authority that for certain activities not anticipated to be noise sensitive such as site investigation and site set up, a Section 61 will not be necessary.
- 3.8.5 In any event Best Practicable Means (BPM) as defined under Section 72 of the Control of Pollution Act (CoPA) 1974 will be applied to all activities.

Monitoring

- 3.8.6 Noise and vibration monitoring will be agreed in advance with the local authority, as part of a Section 61 consent application. The results of any noise and vibration monitoring will be made available, as required, to the local authority. Access to the Application Site will be facilitated at all reasonable times for inspection and/or noise measurements by the local authority environmental health personnel, following appropriate site specific induction and/or health and safety training.

Selection and Use of Equipment

- 3.8.7 With regards to general construction activities, it is assumed that the contractor will follow best practicable means to reduce the noise effect on the local community, including some [or all of the following]:

- Each item of plant used on the worksites will comply with the noise limits quoted in the relevant European Commission Directive 2000/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701.
- The recommendations set out in Annex B of Part 1 of BS 5228 and Sections 7.3 and 9.2 of Part 4 of BS 5228 with regard to noise and vibration options will be adopted unless agreed in advance with the relevant local authority.
- Materials will be handled with care e.g. material such as scaffolding and steelwork will be placed rather than dropped.
- Drop heights of materials from lorries and other plant will be kept to a minimum.
- With regards to the piling of foundations, if this is required for any of the proposed buildings, the avoidance of driven piling, for example by using rotary bored piling where possible, will ensure noise and vibration effects during these works will be reduced.
- Fixed and semi-fixed ancillary plant such as generators, compressors and pumps liable to create noise and/or vibration whilst in operation will, as far as reasonably practicable, be located away from sensitive receptors.
- The use of barriers to absorb and/or deflect noise away from noise sensitive areas will be employed where required and reasonably practicable.
- All plant used on site, paying particular attention to the integrity of silencers and acoustic enclosures will be maintained in good and efficient working order and operated such that noise emissions are minimised as far as reasonably practicable.
- As far as reasonably practicable, any plant, equipment or items fitted with noise control equipment found to be defective will not be operated until repaired.
- Where reasonably practicable, fixed items of construction plant should be electrically powered in preference to diesel or petrol driven.
- Vehicles and mechanical plant employed for any activity associated with the construction works will, where reasonably practicable, be fitted with effective exhaust silencers and will be maintained in good working order and operated in a manner such that noise emissions are controlled and limited as far as reasonably practicable.
- Machines in intermittent use should be shut down or throttled down to a minimum during periods between work.

- Static noise emitting equipment operating continuously will be housed within suitable acoustic enclosure.
- As the various phases of the Proposed Development are completed and occupied, ongoing construction works may affect future residents. Some construction works will be carried out in close proximity to occupied buildings. For each phase, and sub-phase, of the Proposed Development, detailed method statements will be developed to demonstrate how these impacts will be managed and disturbance kept to a minimum.
- Provision of noise barriers to the southern access on to Huntingdon Road will reduce the significance of noise increases to negligible for the small number of existing properties which will be affected by noise from traffic entering and leaving the Application Site

Notifications

- 3.8.8 Occupiers of nearby properties will be informed in advance of the works taking place, including the duration and likely noise and vibration impacts. In the case of work required in response to an emergency, the local authority and local residents will be advised as soon as reasonably practicable that emergency work is taking place. Potentially affected residents will also be notified of the Helpline number.

Reversing Alarms

- 3.8.9 As far as reasonably practicable the noise from reversing alarms will be controlled and limited. This will be managed through the following hierarchy of techniques:
- a) The site layout will be designed to limit and where reasonably practicable, avoid the need for the reversing of vehicles. Drivers will be familiar with the worksite layout.
 - b) Banksman will be utilised to avoid, as far as reasonably practicable, the use of reversing alarms.
 - c) Reversing alarms incorporating one or more of the features listed below or any other comparable system will be used where reasonably practicable; i) highly directional sounders; ii) use of broadband signals; iii) self adjusting output sounders; and iv) flashing warning lights.
 - d) Reversing alarms will be set to the minimum output noise level required for health and safety compliance.

3.9 Water Management

Objectives

- 3.9.1 The objectives are to implement working methods to protect surface and groundwater from pollution and other adverse impacts including change to flow volume, water levels and quality.

Water Management

- 3.9.2 Works will be undertaken in accordance with approvals from the Environment Agency where appropriate.
- 3.9.3 Adherence to Environment Agency Pollution Prevention Guidelines.

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- 3.9.4 All hazardous substances (including liquids and solids) will be stored within impermeable, bunded areas, to remove the risk of migration to groundwater or a nearby watercourse to the satisfaction of the Environment Agency. The measures proposed will assist in avoiding or minimising the potential for contaminants and suspended solids to migrate to surface and groundwater, reduce localised flood risk, and protect water quality and the ecosystems the water resources support.
- 3.9.5 The following list shows measures that should be put in place to prevent pollution and would conform to the best practice policy proposed by the Environment Agency (EA) via the Pollution Prevention Guidelines (PPGs):
- the handling, use and storage of hazardous materials to be undertaken in line with the EA's Pollution Prevention Guidelines (e.g. PPG2 Above Ground Oil Storage Tanks);
 - adequately bunded and secure areas with impervious walls and floor for the temporary storage of fuel, oil and chemicals on site during construction;
 - drip trays to collect leaks from diesel pumps or from standing plant;
 - oil interceptor(s) fitted to all temporary discharge points and for discharge from any temporary oil storage/ refuelling areas;
 - development of pollution control procedures in line with the EA's Pollution Prevention Guidelines, and appropriate training for all construction staff;
 - provision of spill containment equipment such as absorbent material on site.
 - restrictions on use of machinery near adjacent water bodies;
 - the treatment of any runoff from development areas with elevated suspended solids prior to discharge. Approval will be obtained from the EA for any discharges to controlled waters. Treatment measures could include perimeter cut-off ditches, settlement lagoons, overland flow and/or settlement tanks;
 - wheel wash facilities should be provided for vehicles moving to and from the Application Site at all entry and exit points. Silty water from wheel-washes will require appropriate disposal to prevent unacceptable levels of suspended solids entering any nearby surface water bodies. As noted above, any disposal of surface water generated on site during construction to controlled waters will require consent from the EA. Wheel washing facilities should be located as far from surface waters as possible;
 - if dewatering is required along any part of the construction corridor, pumped groundwater should be disposed of appropriately according to EA Pollution Prevention Guidelines;
 - the reseeded of cleared land as soon as practicable, to minimise exposed land and the entrainment of sediment by overland flow; and this can be managed by ensuring construction plant/ materials are stored on hardstanding surfaces where possible. Where this is unavoidable, the Contractor will ensure any compacted soil is loosened as soon as possible following completion of the works;
 - Attenuation ponds within each identified drainage catchment to be constructed first and used to attenuate and store run-off from the Application Site during construction to prevent contamination of the surface and groundwaters.
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Drainage

- 3.9.6 Site drainage, including surface runoff and dewatering effluents, will be discharged to sewers where reasonably practicable and relevant permissions will be obtained from the sewerage or statutory undertaker. Site drainage will meet the requirements for effluent and flood risk standards required by the sewerage undertaker.
- 3.9.7 The relevant sections of BS6031: Code of Practice for Earthworks for the general control of site drainage will be followed.
- 3.9.8 Reference should be made to SuDS best practice during construction, especially Site handbook for the construction of SUDS (C698).

Protection of Watercourses

- 3.9.9 During construction protection measures to control the risk of pollution to surface water will be adopted. These will include:
- Any containers of contaminating substances on site will be leakproof and kept in a safe and secure building or compound from which they cannot leak, spill or be open to vandalism. The containers will be protected by temporary impermeable bunds with a capacity of 110% of the maximum stored volume. Areas for transfer of contaminating substances will be similarly protected.
 - All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and watercourses and away from drains as far as reasonably practicable. Vehicles will not be left unattended during refuelling.
 - Only construction equipment and vehicles free of oil/fuel leaks which could cause material contamination will be permitted on site. Drip trays will be placed below static mechanical plant.
 - All wash down of vehicles and equipment will take place in designated areas and washwater will be prevented from passing untreated into watercourses and will comply with EA's Pollution Prevention Guidance (PPG) note PPG13.
 - EA note PPG 23 will be followed when carrying out maintenance of structures over water. As far as reasonably practicable, only biodegradable hydraulic oils will be used in equipment working in or over watercourses.
 - Appropriate measures to be taken to protect erodable earthwork surfaces.

Control of Pollution of Groundwater

- 3.9.10 The aforementioned Pollution Prevention Measures and good construction practices will ensure that any oils, hydrocarbons or hazardous materials stored on site will not leak onto the ground surface and thereby ensure that there is no pathway for contaminants to affect the aquifer contained within the Head and Observatory Gravels and Chalk Marl that underlie the eastern and northern portions of the Application Site. These techniques will also ensure that surface water bodies and associated ecosystems are protected as there is a hydraulic connectivity between these bodies and the groundwater.
- 3.9.11 Protection measures to control the risk of pollution to groundwater will be consistent with the Groundwater Regulations 1998. Where reasonably practicable, the use of materials that could pollute groundwater will be avoided. This will include special consideration for the use of

substances contained within List I and II of the Groundwater Regulations SI 1998/2746 (Groundwater Directive: 80/68/EEC).

Dewatering

- 3.9.12 The potential presence of a local perched water table within the Terrace Gravel will be confirmed through geotechnical investigations. If present the perched water table may require some dewatering and approval from the Environment Agency for the arrangements to manage and monitor the dewatering process.

3.10 Landscape and Visual

General

- 3.10.1 Visual effects on external receptors may arise from construction operations and associated components such as the installation of visible plant, temporary site lighting, temporary screening and security fencing, visible security measures, and the erection of temporary buildings on site.

Measures

- 3.10.2 Measures will be employed during the construction period to limit night time working, stipulate working hours, consider appropriate visual screening of the operations and ensure the careful siting of construction compounds away from the most sensitive visual receptors.
- 3.10.3 Phasing the implementation of the landscape framework in advance of, or concurrently with, the development as far as practicable / viable.
- 3.10.4 Where the proposal includes the retention of existing trees, the provisions in BS5837: 2005 (Trees in Relation to Construction) will be followed during construction.
- 3.10.5 All temporary material storage will be located wherever practical at adequate distances from tree cover to avoid physical damage. Where tree roots may be subject to potential vehicle compaction, additional temporary protection of the ground surface may be introduced.

3.11 Arboricultural Method Statement

- 3.11.1 The principal protection for the retained trees (above and below ground) and associated soils within the site is through the maintenance of a Construction Exclusion Zone (CEZ) in the vicinity of such trees. The CEZ will be sacrosanct throughout development and no access will be allowed to the area other than operations specified in this AMS document or those agreed with the Local Planning Authority (LPA) at a later date.
- 3.11.2 The positioning of each CEZ should be on the edge of a defined Root Protection Area (RPA). The shape of the RPA and their exact location will depend upon arboricultural considerations and ground conditions. In the majority of cases they are adjusted to include tree crowns to prevent damage by construction machinery.
- 3.11.3 Prior to any onsite demolition or construction in the vicinity of any retained tree protective measures and the CEZ for that tree must be in place. The installation of tree protection will be undertaken before work commences.

- 3.11.4 The tree protection fence/barrier once erected will not be moved or relocated without written approval.
- 3.11.5 The location of protective fencing will be confirmed once detailed plans are finalised.
- 3.11.6 At the end of the project the fence will be removed only after approval .
- 3.11.7 To guarantee the protection that the CEZ provides to retained trees and soils, contractors will be required to adhere to the following :
 - The protective tree fencing shall be maintained throughout the development phase.
 - No materials, machinery, temporary structures, chemicals or fuel shall be stored within the CEZ.
 - No excavations or increases in soil level within the CEZ should be permitted without prior written approval.
 - Care should be taken to ensure that wide or tall loads or plant with booms, jibs and counterweights come into contact with retained trees. Any transit or traverse of plant in close proximity to trees should be conducted under the supervision of a banks person to ensure that adequate clearance from trees is maintained at all times.
 - Material which will contaminate the soil such as concrete mixing, diesel oil and vehicle washing must not be discharged within 10m of the tree stems.
 - Fires must not be lit in a position where their flames can extend to within 5m of foliage, branches or trunk. This will depend on the size of the fire and the wind direction.
 - Any landscaping within the CEZ must avoid soil disturbance. Therefore re-grading and rotavators are not permitted. Any agreed soil re-profiling to facilitate final agreed levels must be carried out by hand with topsoil.

3.12 Construction traffic routeing

Objective

- 3.12.1 The objective is to avoid reduce and manage transport effects of construction traffic servicing the Site, and the movements associated with construction waste. It will apply to all the individual construction sites within the Development. The strategy includes the following main elements:
 - a) design:
 - minimising the requirement for material to be imported or exported. For example, the movement of earthworks material off-site will be reduced to a minimum by maximising the use of raised material into the landscaping;
 - specifying materials and construction techniques that are resource-friendly.
 - b) using locally sourced materials where possible, to reducing haulage lengths;
 - c) managing effectively the supply of goods to construction sites - this can significantly reduce both road vehicle mileage and construction costs and wastage;
 - d) encouraging the development of sustainable supply chains for construction materials;

- e) managing the movement of workers into the development - via a Construction Travel Plan for the Proposed Development addressing the main means by which the workforce will travel to the Site.
- 3.12.2 Phase-specific Construction Environmental Management Plans will provide further information on Construction traffic movements over the duration of that phase. The phase-specific plans will consider the following elements:
- a) Design;
 - b) On-site logistics;
 - c) Access Strategy;
 - d) Procurement strategy;
 - e) Operational Efficiency;
 - f) Delivery Practice;
 - g) Demand Smoothing;
 - h) Managing Construction Traffic;
 - i) Targets and Monitoring;
 - j) Waste Management
- 3.12.3 Phase-specific CEMPs will also identify approaches designed to achieve efficient logistics management. This might involve links with and/or exploit construction activity and practices taking place on various parts of the Application Site at any given time and perhaps even within other parts of Cambridge. These measures would be designed to reduce site traffic, and the number of movements involving removal of construction-generated waste.

Practicality of construction traffic movements

- 3.12.4 In practice, regardless of any super-imposed controls, only a very limited number of car and HGV construction movements typically occur during the peak hours. The working hours of most operatives would not coincide with the network peak, construction processes would be programmed to avoid reliance on deliveries of concrete and bituminous materials during the more congested periods and delivery drivers would wish to avoid being on the network at congested times of the day when drivable hours used are disproportionate to the quantities of goods deliverable.. This could be reinforced by the Development Construction Environmental Management Plan controlling construction movements during the peak hours

2014 Pre Opening.

- 3.12.5 During this period, trips would be assigned to the Maddingley Road Site Access to and from the M11, and would be prohibited from passing through Cambridge.

2014 Post Opening

- 3.12.6 During this period trips would continue to be prohibited from passing through Cambridge, and hence would mainly be concentrated on the link between the Maddingley Road Site Access and the M11.

Construction traffic coordinator

- 3.12.7 A construction transport coordinator will be employed during the construction period to monitor heavy goods vehicle deliveries and collections of construction materials to and from the Application Site ensure compliance so far as practicable by contractors with the above requirements.

3.13 Emergency Plan

General Arrangements

- 3.13.1 A set of standardised emergency response procedures will govern the management of environmental incidents¹. Construction contractors will be required to adhere to and implement these procedures and ensure that site operatives are familiar with the emergency arrangements.
- 3.13.2 The emergency procedure will contain emergency phone numbers and the method of notifying local authorities and statutory authorities. Contact numbers for key personnel will also be included.

Dealing with Spills

- 3.13.3 A site drainage plan will be kept on each of the worksites showing the water interests in the vicinity of the Application Site. This plan will include the location of both foul water drains and surface water drains. Spill kits will be kept on each of the worksites. The precise contents and capacity of the spill kits will depend on the detailed inventory of products that will be stored and handled on the Application Site, however they are likely to contain:
- Oil-absorbent granules;
 - String;
 - Floating “booms” or “sausages”;
 - Gloves;
 - Absorbent mats;
 - Knives;
 - Drain covers;
 - Shovels;
 - Polythene sheeting and bags
- 3.13.4 The spill kits will be clearly marked, sign-posted and held close to the area where materials are stored and handled.
- 3.13.5 A number of specialist spill contractors will be identified that can be called upon should this be required to manage a major spill.
- 3.13.6 In the event a spill occurs the following actions will be taken:

¹ An environmental incident is defined as “Any occurrence, including near-miss situations, which has the potential to cause or results in environmental damage”

- When a spill occurs the site manager will be informed immediately.
 - In dealing with the spillage the personal safety of the site-workers and the general public will not be compromised.
 - Where required to stop or contain the spillage work will be halted.
 - The cause of the spillage will be stopped.
 - The spill will be contained. Particularly pathways to any drains and water courses will be blocked as soon as possible.
 - The spilled materials will be removed and disposed of in accordance with the waste regulations.
- 3.13.7 In the event of major or complicated spills, the following additional actions will be taken:
- The site manager will assess the incident and if appropriate request a specialist spill contractor to attend the site.

4 BREEAM and the Code for Sustainable Homes

4.1 Introduction

4.1.1 A number of BREEAM and Code credits are for sustainable construction practices. Contractors will be required to target the following credits:

4.1.2 Considerate Constructors

Contractors will be required to manage construction areas in an environmentally and socially considerate, responsible and accountable manner. This means that they will be required to sign up to a good site practice scheme such as Considerate Constructors.

4.1.3 Construction site impacts

Contractors will be required to manage construction areas in an environmentally sound manner in terms of resource use, energy consumption and pollution. This means assigning responsibility to an individual(s) for monitoring, recording and reporting energy, water and transport consumption data resulting from all construction processes.

4.1.4 Responsible sourcing of materials

Contractors will be required to specify responsibly sourced materials for key building elements. See further text on waste practices below.

4.1.5 Construction waste management

Contractors will be required to promote resource efficiency via the effective management and reduction of construction waste. See further text on waste practices below.

4.1.6 Recycled aggregates

Contractors will be required where practicable and specification compliant to use recycled and secondary aggregates, thereby reducing the demand for virgin material and optimising material efficiency in construction. See further text on waste practices below.

4.1.7 Ecological value of site and protection of ecological features

Contractors will be required to protect existing ecological features from substantial damage during site preparation and completion of construction works.

4.1.8 Long term impact on biodiversity

In order to manage the long term impact of the Proposed Development on the Application Site and the surrounding area's biodiversity the principal contractor will be required to nominate a 'Biodiversity Champion' with the authority to influence site activities and ensure that detrimental impacts on site biodiversity are minimised in line with the recommendations of a suitably qualified ecologist.

The principal contractor will also be required to train the site workforce on how to protect site ecology during the project. Specific training will be carried out for the entire site workforce to ensure they are aware of how to avoid damaging site ecology during operations on site. Training will be based on the findings and recommendations for protection of ecological features highlighted within a report prepared by a suitably qualified ecologist.

The principal contractor will record actions taken to protect biodiversity and monitor their effectiveness throughout key stages of the construction process.

5 Conclusion

- 5.1.1 The overall objective of this Construction Environmental Management Plan is to ensure that throughout the construction period, the following fundamental goals are all met so far as practicable: exemplary environmental practice; protection of the interests of local residents, amenity, and environmental receptors; and efficient, economic and timely construction practices.
- 5.1.2 This document will remain live so that as more information and detail becomes available it can be incorporated.

Appendix 1: Legislation, codes of practice and guidance relevant to the CEMP

Other Documentation

- BS EN ISO14001: 2004 Environmental Management Systems
- BS 5837: 2005 Guide for Trees in Relation to Construction
- BS 5228: Noise control on construction and open sites:
 - Part 1 (1997) Code of Practice for basic information and procedures for noise control
 - Part 2 (1997) Guide to legislation for noise control applicable to construction and demolition, including road construction and maintenance
 - Part 4 (1992) Code of Practice for noise and vibration control applicable to piling operations
- BS 6031: Code of Practice for Earthworks
- BS 6472: 1992 Evaluation of human exposure of vibration in buildings (1Hz to 80 Hz)
- BS 7385 Evaluation and measurement for vibration in buildings:
 - Part 1: 1990 Guide for measurements of vibrations and evaluation of their effects on buildings
 - Part 2: 1993 Guide to damage levels from groundborne vibration
- BSI (2001) Investigation of Potentially Contaminated Sites. Code of Practice. 10175
- CIRIA, Control of water pollution from construction sites: Guidance for consultants and contractors (C532)
- CIRIA/Environment Agency Joint Guidelines: Concrete Bunds for Oil Storage Tanks
- CIRIA/Environment Agency Joint Guidelines: Masonry Bunds for Oil Storage Tanks
- CIRIA (1996) A guide to safe working on Contaminated Sites Report 132
- Guidance Notes for the reduction of obtrusive lighting, 2005 The Institute of Lighting Engineers
- Lighting in the Countryside: Towards Good Practice (1997) HMSO
- Bats and Lighting in the UK. Bats and the Built Environment Series Bat Conservation Trust
- DEFRA (2008) Non-Statutory Guidance for Site Waste Management Plans
- Environment Agency Pollution Prevention Guidance PPG01 General guide to the prevention of water pollution
- Environment Agency Pollution Prevention Guidance PPG02 Above ground oil storage tanks
- Environment Agency Pollution Prevention Guidance PPG05 Works near or liable to affect watercourses
- Environment Agency Pollution Prevention Guidance PPG06 Working at construction or demolition sites

- Environment Agency Pollution Prevention Guidance PPG21 Pollution incident response planning
- Environment Agency Pollution Prevention Guidance PPG23 Maintenance of structures over water
- Environment Agency Guidance Note: Piling into Contaminated Sites
- Environment Agency Technical Guidance WM2 Interpretation and Classification of Hazardous Waste provides assistance in classifying wastes.
- Waste Management - The Duty of Care, code of Practice (HMSO 1996).
- Buildings Research Establishment. Controlling particles, vapour and noise pollution from construction sites, Parts 1 to 5, 2003.
- Department for the Environment Food and Rural Affairs: Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2000.
- Control of Pollution Act 1974
- Salmon and Freshwater Fisheries Act 1975
- Wildlife and Countryside Act 1981, as amended
- Environmental Protection Act 1990
- Water Resources Act 1991
- Protection of Badgers Act 1992
- Land Drainage Act 1991
- Clean Air Act 1993
- Conservation (Natural Habitats &c) Regulations 1994, as amended
- Wild Mammals (Protection) Act 1996
- Pollution, Prevention and Control Act 1999
- Pollution Prevention and Control (England and Wales) Regulations 2000
- Countryside and Rights of Way (CROW) Act 2000
- Water Act 2003
- SI 1985/1968: The Construction Plant and Equipment (Harmonisation of Noise Emission Standards) Regulations 1985
- SI 1991/2839: Environmental Protection (Duty of Care) Regulations 1991
- SI 1998/2746: The Groundwater Regulations (EC Groundwater Directive: 80/68/EEC) 1998
- SI 2000/227: Contaminated Land (England) Regulations 2000
- SI 2001/1701: The Noise Emission in the Environment by Equipment for use Outdoors Regulations 2001 (EC Directive 2000/14/EC)
- SI 2001/2954: Control of Pollution (Oil Storage) Regulations 2001
- SI 2002/1559 Landfill (England and Wales) Regulations 2002
- SI 2002/2677: Control of Substances Hazardous to Health Regulations 2000

- SI 2005/894: Hazardous Waste (England and Wales) Regulations 2005
- SI 2008/314: Site Waste Management Plans Regulations 2008
- Planning Policy Statement 23: Planning and Pollution Control
- Defra/Environment Agency's Model Procedures for the Management of Contamination (CLR11)
- Contractors and Clients -Voluntary Code of Practice (Department of Trade & Industry - July 2004)
- Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009)
- Site handbook for the construction of SUDS (C698)

A stylized map of North West Cambridge is shown in the bottom left corner. It is a light brown color and depicts the irregular coastline of the area, including the River Cam and the surrounding land. The map is set against a light blue background that represents the water.

NORTH WEST cambridge

Environmental Statement: Ecology - Appendices 7.2, 7.4 and 7.5
Detailed Assessment Tables, Biodiversity Strategy and Bat Survey
March 2012

Appendix 7.2

Detailed Assessment Tables

The summaries of the detailed assessments of the potential effects on the ecological receptors of 'key' nature conservation importance are provided in the following tables.

Table 1: Key to Characterisation of Effect

Code	Descriptor	Sub-codes	Definitions
SI	Sign	Positive (beneficial (+ve)) or Negative (adverse (-ve))	This characteristic simply describes whether the Proposed Scheme would have a beneficial effect of the upon the receptor in terms of the policy objectives defined for it at the appropriate geographic level (positive), or would be harmful to the receptor, contrary to its policy objectives (negative).
PO	Probability of occurring	Certain, Probable, Unlikely	
CO	Complexity	Direct, Indirect, Cumulative	
EC	Extent and context	Area measures and percentage of total	Extent refers to the area over which the effect occurs, for example: the size in square metres of the area of species-rich grassland which would be lost as a result of the Proposed Scheme.
MA	Magnitude	In words, describe level of severity of influence (e.g. complete loss)	Magnitude refers to the size or amount of the effect. This has been quantified wherever possible, for example: the number of bat roosts lost as a result of the Proposed Scheme.
RE	Reversibility	Reversible or Not Reversible (can the effect be reverse, whether or not this is planned)	Reversibility addresses the permanence of the effects of the Proposed Scheme upon each Key Ecological Receptor. A reversible (or temporary) effect is one which can be undone either spontaneously through natural processes or through guaranteed mitigation. An irreversible (or permanent) effect is one for which natural recovery would not be possible within a reasonable timescale, or for which there is no reasonable chance of successful mitigation action being undertaken to reverse it. The

			reversibility of each effect has been stated.
DU	Duration	The duration of the effect, whether Short Term (ST), Medium Term (MT), Long Term (LT) or Permanent (P) in ecological terms	Duration refers to the time over which the effect is expected to last, until recovery or reinstatement (which may be longer than the effect causing activity). This has been quantified, wherever possible, and interpreted in relation to the ecological processes involved.
TF	Timing and frequency	In words, describe whether the timing or the frequency of the effect may influence its significance	The timing of the activities may have a role in determining the significance of the effects they have on the Key Ecological Receptors, and therefore this has been considered in relation to each effect. Many ecological receptors have important seasons and/or periods of their life cycle during which the effects of a particular activity may be particularly significant. Similarly, the frequency with which the activities would take place can be an important determinant of the effect on receptors, and has therefore also been assessed and described.

Confidence in Predictions

For each effect, the likelihood that it will occur has been described on a four-point scale, as set out within the IEEM Guidelines:

- Certain/near-certain: probability estimated at 95% chance or higher
- Probably: probability estimated above 50%, but below 95%;
- Unlikely: probability estimated above 5%, but below 50%;
- Extremely unlikely: probability estimated at less than 5%.

Significance

The levels of significance are derived from the IEEM guidelines with the equivalent scale of significance using the seven-point scale shown in bold.

A. Washpit Brook

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The value of the Washpit Brook has been assessed as 'District/Borough' value.</p> <p>The Washpit Brook flows adjacent to the M11 on the western boundary of the Application Site and through the centre of the north-western corner. A small number of common wetland plants are present within the Brook including Fool's Water-cress, Water-cress, a water-starwort species, and Common Duckweed. Water quality within the Washpit Brook is variable and this feature supports an aquatic invertebrate fauna of low nature conservation value.</p> <p>A small population of water voles is present on the Washpit Brook, in the channel directly adjacent to the M11. This section of the brook has a good bankside structure and plenty of in-channel vegetation, making it particularly suitable for water voles, although it is prone to dry out over significant lengths. In 2005, evidence of the presence of water voles was also recorded further north on the Washpit Brook within a section which also comprised habitat suitable for this species, although water voles were absent from this part of the Brook in 2009 and no evidence of water voles was found on any section in 2011. The remainder of the brook and associated ditch system within the survey area is considered to be less suitable for water voles, with hedges and tall bankside trees shading and suppressing in-stream vegetation that generally provides more valuable habitat for water voles. The watercourse is relatively shallow and prone to dry out in places, as well as being poached by grazing animals, despite the presence of stock-proof</p>	Construction Effects				
	<p><i>Pollution during construction</i></p> <p>Run-off from infrastructure roads and hard surfaces during construction has the potential to increase pollution and turbidity within the Washpit Brook and ditches within the site.</p> <p>Measures will be implemented to avoid pollution or increased turbidity in the ditches and the Washpit Brook during construction operations, to protect adjacent and downstream habitats, as part of the CEMP. Construction site drainage will be designed to include treatment and attenuation of run-off from infrastructure roads and hard surfaces through the use of balancing and pollution control mechanisms.</p>	SI: -ve	Not significant / Negligible (95% certain)	Not Applicable	Not significant / Negligible (95% certain)
		PO: Unlikely			
		CO: Direct			
		EC: Length of Brook within the site and immediately downstream			
		MA: Not applicable			
		RE: Reversible			
		DU: Temporary			
		TF: Effect likely to be more significant in periods of heavy rainfall. Effect likely to be more significant if pollution events happen regularly, rather than a one-off event. The more frequent the pollution events, the greater the effect.			
	<i>Increase in wetland habitat</i>	SI: +ve	Significant beneficial at the District/Borough	Not Applicable	Significant beneficial at the

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>fencing. It is therefore of relatively low value for water voles overall, and likely to support only a small population (if any).</p> <p>Although otters may use the Washpit Brook occasionally, to commute between larger watercourses, no signs of otter activity have been recorded during any of the survey visits. The Washpit Brook is considered likely to be of negligible importance to the local otter population. No potentially suitable resting sites were identified during the surveys.</p> <p>Maintaining and improving riverine habitats is listed as a target on both the UKBAP and LBAP. In addition, water voles are a priority species on the UKBAP and the LBAP. Although the Washpit Brook does not support a particularly diverse or valuable flora it is a priority habitat type and supports a priority species; it is also likely to function as a valuable corridor for wildlife.</p>	<p>The Washpit Brook will be retained, with some modifications to bank profile to allow a second stage channel to be provided for floodwater storage. An additional 'low flow channel' will be provided, resulting in an overall increase in the length of watercourse within the Application Site from 1km to more than 1.5km (an approximate increase of more than 50%). The new 'low flow channel' will be created with a meandering course to act as backwaters and linear ponds. The sections of the watercourse which support wetland plants will be retained intact; their banks will be largely unaffected by the modifications. The most valuable habitat for water voles will be retained unaffected (over a length of between 250 and 300m). This length of channel would be sufficient to support a population of the size likely to be present (even assuming a worst-case scenario) and is the location where water voles are likely to be present at the time of the works; it is considered likely that water voles will be absent from the affected sections. If works need to take place in an area occupied by water voles, the animals will be relocated in advance in accordance with current best practice guidance.</p> <p>The new low flow channel and linear ponds will be designed to provide valuable habitat for water voles as well as other wetland species associated with the brook, and will be managed in the</p>	PO: Certain	<p>level by 2026 / Minor beneficial by 2026</p> <p>(95% certain)</p>		<p>District/Borough level by 2026 / Minor beneficial by 2026</p> <p>(95% certain)</p>
		CO: Direct			
		EC: Not applicable			
		MA: There will be an overall increase in the amount of wetland habitat by more than 50%			
		RE: Reversible			
		DU: Permanent			
		TF: Timing is unlikely to be a factor which could give rise to a significant effect			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	long-term to maximise their suitability for these species.				
	Operational effects				
	<i>Improvement in water quality</i> Drainage for the Proposed Development has been designed to ensure that run-off from the development site will be attenuated and treated prior to discharge to the Washpit Brook. It is likely that water quality within the brook would improve in the long-term as a result of the pollution control measures included as part of the scheme design.	SI: +ve	Significant beneficial at the District/Borough level by 2026 / Minor beneficial by 2026 (95% certain)	Not Applicable	Significant beneficial at the District/Borough level by 2026 / Minor beneficial by 2026 (95% certain)
		PO: Likely			
		CO: Direct			
		EC: Watercourse within site and downstream			
		MA: Not applicable			
		RE: Reversible			
		DU: Permanent			
		TF: Timing is unlikely to be a factor which could give rise to a significant effect			

B. Mature, veteran and specimen trees

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The value of the ‘veteran’ or ‘near veteran’ oak tree within the site and the possible veteran oak trees on Huntingdon Road have been assessed as ‘County’ or possibly ‘Regional’ value. The remaining mature trees on site are of lower nature conservation value.</p> <p>A number of mature trees are present, the majority of which are located within hedgerows in the southern and western parts of the site. An avenue of mature horse-chestnut trees is present in the eastern part of the Application Site, and a number of mature oak trees are present on the Application Site’s southern boundary (adjacent to Madingley Road and the Park and Ride site). Only one tree within the site boundaries has been confirmed to be ‘veteran’ (or ‘near veteran’), an oak tree identified as T196 in Lockhart Garrat’s Tree Survey (Lockhart Garratt, 2011). Two mature oak trees on Huntingdon Road are also of particular ecological value (T229 and T230).</p> <p>Veteran trees are listed on the Local BAP and support a valuable invertebrate assemblage.</p> <p>The remaining mature trees on site, whilst of lower nature conservation value, also support rare and/or valuable invertebrate species/assemblages.</p>	Construction Effects				
	<i>Habitat loss during site clearance works.</i> The veteran (or near veteran) oak tree (T196 in the Tree Survey (Lockhart Garratt, 2010)) and the possible veteran trees on Huntingdon Road will be retained within the Proposed Development. No significant adverse effects on veteran trees are predicted. A small number of mature trees of local nature conservation value will be lost as a result of the proposals. Planting of replacement standard trees will be incorporated into the Proposed Development to off-set the loss of mature standard trees. The likely effects, in terms of tree health, of development close to this tree and other mature trees will be reviewed, with measures implemented to avoid possible effects arising from physical damage (accidental or through excavation in close proximity to the roots), soil compaction, pollution and airborne dust. Remedial tree surgery will be undertaken as necessary to promote the long-term survival of retained mature trees close to the footprint of the development.	SI: -ve	Not significant / Negligible (100% certain) The trees which would be lost are only considered to be of local conservation importance. The most ecologically valuable ‘near veteran’ tree will be retained.	Not Applicable	Not significant / Negligible (100% certain)
		PO: Certain			
		CO: Direct			
		EC: Not applicable			
		MA: Loss of a small number of mature standard trees			
		RE: Reversible			
		DU: Temporary until new planting matures (in the region of 30-50 years)			
	Operational effects				

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	<i>No adverse operational phase effects are expected.</i>	Not Applicable	Not significant / Negligible (100% certain)	Not Applicable	Not significant / Negligible (100% certain)

C. Hedgerows

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The value of the hedgerows within the site has been assessed as 'District/Borough' value.</p> <p>The majority of the hedgerows on site are species-poor, both in terms of the woody species present and their ground flora. However, seven hedgerows are species-rich (comprising five or more woody species) and two of these would be classified as 'important' under the Hedgerows Regulations (1997), using the Wildlife and Landscape criteria. The shrub species most commonly recorded in the hedgerows include Hawthorn, Blackthorn, Elder, Field-rose and Dog-rose. A number of the hedgerows also support English Elm trees, a large number of which are dead.</p> <p>Hedgerows have been identified as a priority habitat within the UKBAP and are listed in the LBAP.</p>	Construction Effects				
	<p><i>Habitat loss during site clearance works.</i></p> <p>During site clearance works, approximately 700m of species-poor hedgerows will be removed. None of the species-rich hedgerows, of greatest nature conservation importance, would be lost, although the species-rich hedgerow adjacent to the Washpit Brook will suffer the loss of two short sections (c.50m each) to allow the re-alignment of the watercourse. The majority of this hedgerow will be retained intact on its current alignment, and the short sections lost will be replanted. Appropriate buffer zones (approximately 5m wide) will be maintained alongside the retained hedgerows to ensure their protection in the long-term. Protective fencing will be installed during construction, where necessary, to safeguard retained vegetation from accidental damage.</p> <p>The loss of 700m of species-poor hedgerow will be more than off-set by the planting of at least 700m of new species-rich hedgerow within the areas of Open Land.</p>	SI: -ve	<p>Significant adverse at the local level at 2014 and 2026 / Minor adverse at 2014 and 2026</p> <p>(100% certain)</p> <p>Significant beneficial at the District/Borough level in the long-term (by 2056) / Minor beneficial by 2056</p> <p>(95% certain)</p>	<p>Not Applicable</p>	<p>Significant adverse at the local level at 2014 and 2026 / Minor adverse at 2014 and 2026</p> <p>(100% certain)</p> <p>Significant beneficial at the District/Borough level in the long-term (by 2056) / Minor beneficial by 2056</p> <p>(95% certain)</p>
		PO: Certain			
		CO: Direct			
		EC: Not applicable			
		MA: 700m of species-poor hedgerow			
		RE: Reversible			
		DU: Temporary until new planting matures (15-20 years)			
		TF: not applicable			
	Operational effects				

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	No operational phase effects are expected. Hedgerows will be managed to maximise their nature conservation value.	Not applicable	Not significant / Negligible (100% certain)	Not applicable	Not significant / Negligible (100% certain)

D. Coton Countryside Reserve

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>Area of farmland located 1km to the south-west of the Application Site, which is managed by Cambridge Past, Present and Future to enhance the landscape, benefit wildlife and provide quiet recreational opportunities for local people. The value of the reserve has been assessed as 'District / Borough' value, although it could increase to 'County' value in the future (it has been assessed, on a precautionary basis, as 'County' value by 2026).</p>	Construction Effects				
	No construction phase effects are expected.	Not applicable	Not significant / Negligible (100% certain)	Not applicable	Not significant / Negligible (100% certain)
	Operational Effects				
	<p><i>Habitat degradation due to increased visitor pressure</i></p> <p>Visitor numbers to the reserve may increase by up to 5% as a result of the Proposed Development</p>	SI: -ve	<p>Not significant / Negligible (95% certain)</p> <p>Due to the provision of Open Land within the Application Site the visitor numbers to the reserve are considered unlikely to increase significantly</p>	Not applicable	<p>Not significant / Negligible (95% certain)</p>
		PO: Unlikely			
		CO: Indirect			
		EC: could occur over the entire reserve			
		MA : not applicable			
		RE: Reversible			
		DU: Permanent			
		TF: not applicable			

E. Great Crested Newts

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The value of the great crested newt population within the site has been assessed as 'District/Borough' value.</p> <p>Great crested newts are protected under UK and European legislation and are a priority species for conservation in the UKBAP and LBAP.</p> <p>A population of great crested newts is present within ponds adjacent to the site boundaries, at the Park and Ride site and the Bird Sanctuary at Conduit Head Road CiWS. None of the ponds and ditches within the site boundaries were found to support breeding great crested newts, although other species of amphibians were recorded, including common frog, common toad and smooth newt. The Park and Ride pond and the Bird Sanctuary ponds are located approximately 250m apart, with few barriers to dispersal between them, and newts associated with them are therefore considered likely to form part of a single meta-population. Given the maximum counts of great crested newts recorded during the targeted surveys, the meta-population associated with the two ponds would be classed as 'medium' following Natural England's guidelines (English Nature, 2001).</p> <p>In addition, it is likely that great crested newts associated with these off-site ponds utilise habitats and features within the southern part of the site for foraging; the site may also provide refuges and hibernation sites. The areas of grassland, hedgerows, ditches and small woodlands within up</p>	Construction Effects				
	<p><i>Loss of terrestrial habitat</i></p> <p>The Proposed Development will result in the loss of approximately 11ha of arable land, of relatively low value for foraging newts, and a section of species-poor hedgerow within 250m of the ponds (the intermediate terrestrial habitat). An additional 19ha of arable land and 2ha of improved grassland will be lost at a distance of 250-500m from the ponds (the distant terrestrial habitat). These areas of terrestrial habitat are unlikely to be used by foraging newts, given their distance from the breeding ponds and the small size of the population they support.</p> <p>The areas of improved grassland and plantation woodland within 250m of the ponds (a total area of 9ha) will be enhanced for foraging newts, through the creation of new wetland features to the west of the Park and Ride pond, and implementation of appropriate management. Similarly, new wetland features and grassland, suitable for use by foraging newts, will be created within the extensive area of Open Land along the western edge of the site, as part of</p>	SI: -ve	<p>Significant adverse at the District / Borough level at 2014 and 2026 / Minor adverse at 2014 and 2026</p> <p>Significant beneficial at the District/Borough level in the longer-term (post-2036) / Minor beneficial post-2036 (95% certain)</p> <p>The most valuable terrestrial habitat for the newt population (the 'immediate' terrestrial habitat, i.e. that located within 50m of the ponds) will be retained unaffected. In the case of the Park and Ride pond the immediate terrestrial habitat within the site boundaries comprises a hedgerow, a dry ditch and part of an arable field. This area will form part of the Open Land provision for</p>	Not Applicable	<p>Significant adverse at the District / Borough level at 2014 and 2026 / Minor adverse at 2014 and 2026</p> <p>Significant beneficial at the District/Borough level in the longer-term (post-2036) / Minor beneficial post-2036 (95% certain)</p>
		PO: Likely (the loss of habitat is certain, but its value to great crested newts is based on probability)			
		CO: Direct			
		EC: 11ha of intermediate terrestrial habitat and 21 ha of 'distant' terrestrial habitat lost, but off-set through enhancement measures.			
		MA: As above			
		RE: Reversible			
		DU: Permanent			
		TF: Timing of works unlikely to affect significance of effects. Frequency is not applicable, since habitat removal would be a one-off event.			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>to 500m of the ponds may be of particular value to the great crested newt population. The arable fields also provide suitable habitat for foraging and hibernating great crested newts, but are likely to be of less importance to the population than the other habitats and features, given their intensive management and low species diversity.</p> <p>The most valuable terrestrial habitat for great crested newts is generally considered to be that within 50m of a breeding pond (the 'immediate' terrestrial habitat). The habitat located 50-250m from a breeding pond is of lower value (the 'intermediate' terrestrial habitat), and the habitat located more than 250m from the pond of lower value still (the 'distant' terrestrial habitat). None of the 'immediate' terrestrial habitat associated with the Bird Sanctuary ponds is located within the site boundaries, although a small proportion of the Park and Ride pond's 'immediate' terrestrial habitat is located within the site. Approximately 20ha of the population's 'intermediate' terrestrial habitat and 36ha of its 'distant' terrestrial habitat are located within the site.</p>	<p>the drainage and attenuation scheme, and associated landscaping, associated with the Washpit Brook.</p> <p>Overall, the proposals will result in short-term losses of foraging habitat of relatively low value to the great crested newt population. In the long-term, the provision of new ponds within Open Land along the western edge of the site will increase the availability of breeding sites (which is likely to be a limiting factor in terms of the current status of the local great crested newt population). This will encourage great crested newts to utilise the areas of Open Land along the western edge of the site which are currently located more than 250m from the Park and Ride pond, and are therefore likely to be infrequently used. This would be expected to deliver a beneficial effect on the local great crested newt population in the long-term (20-30 years).</p>		<p>the site and the arable field will be replaced with grassland, which will be managed to be of particular value for foraging newts; the ditch and hedgerow will be retained.</p> <p>There will be an overall loss of foraging habitat, which might be used by great crested newts at distance from the ponds of greater than 50m. However, given the status of the population associated with the ponds it is considered unlikely that the population is reliant on these habitats. It is more likely that the low value of the breeding habitat is a limiting factor to the population than the availability of foraging habitat.</p>		
	<i>Fragmentation of the meta-population</i>	SI: -ve	Not significant /	Not Applicable	Not significant /

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	The construction of an access route to link the site with Madingley Road will bisect the two off-site ponds which support the breeding population of great crested newts, and could therefore fragment the population. An amphibian tunnel will be provided under the access road in an appropriate location to link these two features. Amphibian-proof fencing will be provided to guide the animals into the tunnels and reduce the likelihood that they will be at risk of mortality on the new road (either due to traffic-related mortality, or mortality in drainage structures, such as gully pots).	<div>PO: Likely</div> <div>CO: Direct</div> <div>EC: Will affect the local population</div> <div>MA : Not applicable</div> <div>RE: Irreversible</div> <div>DU: Permanent</div> <div>TF: Not likely to have an effect.</div>	Negligible (95% certain) Assuming that the newts utilise the tunnel.		Negligible (95% certain)

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	<p><i>Incidental mortality during site clearance</i></p> <p>The potential exists for the incidental mortality of great crested newts during the construction phase. Site clearance operations within 500m of the Park and Ride and Bird Sanctuary ponds will take place under licence to Natural England. Temporary one-way amphibian-proof fencing will be installed around the site in this location, and newts captured from affected areas and relocated into off-site ponds. Ideally, works during the period when newts are hibernating would be avoided.</p>	<p>SI: -ve</p> <p>PO: Likely</p> <p>CO: Direct</p> <p>EC: could occur within 500m of the 2 off-site ponds</p> <p>MA : Only likely to affect small numbers of newts</p> <p>RE: Irreversible</p> <p>DU: Permanent</p> <p>TF: Works during April/May would reduce the likely significance of the effect.</p>	<p>Not significant / Negligible</p> <p>(95% certain)</p>	Not Applicable	<p>Not significant / Negligible</p> <p>(95% certain)</p>
	Operational Effects				
	<p><i>No adverse operational phase effects on great crested newts are predicted (assuming that the newt tunnel described above is utilised by newts, and animals are therefore not at risk of road-related mortality)</i></p>	Not applicable	<p>Not significant / Negligible</p> <p>(95% certain)</p>	Not Applicable	<p>Not significant / Negligible</p> <p>(95% certain)</p>

F. Terrestrial invertebrates

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The value of the terrestrial invertebrate assemblage within the site has been assessed as at least 'County' and possibly 'Regional' value.</p> <p>A number of scarce / declining species of wood-decay beetles, a nationally scarce species of tree-ant, and a nationally scarce lace hopper bug are present.</p> <p>Uncommon white-letter hairstreak and purple hairstreak butterflies are also present.</p> <p>A small number of other uncommon species have also been recorded.</p>	Construction Effects				
	<p><i>Loss of terrestrial habitat</i></p> <p>The most valuable habitat features will be retained, including the veteran and mature trees of particular value for wood-decay beetles and tree-ants. The Proposed Development will result in the loss of a small area of elm scrub and a small number of mature oak trees, of potential value for white-letter hairstreak and purple hairstreak butterflies, although this will be replaced within the Open Land along the western edge.</p> <p>The loss of arable farmland may result in some species being lost from the site, although these species are likely to be present in the wider area. The ecology of the nationally scarce species of lace hopper bug is poorly known, although it is thought to require soil cracking caused by summer droughts on land prone to winter flooding. These conditions will be created within the open land along the Application Site's western edge by virtue of the flood storage being provided along the Washpit Brook, and it is therefore considered likely that this species will be retained on site.</p>	SI: -ve	<p>Significant adverse at the Local level / Minor adverse at 2014</p> <p>Offset by beneficial 'operational' effects by 2026 to Not significant / Negligible (95% certain)</p>	Not Applicable	<p>Significant adverse at the Local level / Minor adverse at 2014</p> <p>Offset by beneficial 'operational' effects by 2026 to Not significant / Negligible (95% certain)</p>
		PO: Certain			
		CO: Direct			
		EC: Largely confined to a small area within the footprint of the High Cross junction			
		MA: relatively minor, given the provision of new habitat within OL			
		RE: Reversible			
		DU: Permanent			
		TF: Not applicable			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	Operational Effects				
	<i>Provision of new habitat managed to maximise its nature conservation value</i> OL within the western edge will be designed and managed to maximise its value to terrestrial invertebrates, including white-letter hairstreak and purple hairstreak butterflies	SI: +ve	Not applicable	Not applicable	Not significant / Negligible at 2014 Significant beneficial at the Local level at 2026 / Minor beneficial at 2026 (95% certain)
		PO: Likely			
		CO: Direct			
		EC: the OL within the western edge			
		MA : not applicable			
		RE: not applicable			
		DU: Permanent			
		TF: not applicable			

G. Common Toads

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The value of the common toad population within the site has been assessed as 'Local' value.</p> <p>Common toads are a priority species for conservation in the UKBAP and LBAP.</p> <p>A large population of common toads is present within Pond 4 (at the World Conservation Monitoring Centre) and the Park and Ride pond.</p> <p>In addition, it is likely that toads associated with these ponds utilise habitats and features within the site for foraging; the site may also provide refuges and hibernation sites.</p>	Construction Effects				
	<p><i>Loss of terrestrial habitat</i></p> <p>The Proposed Development will result in the loss of arable land, of relatively low value for foraging toads, although this will be replaced, to some extent, with gardens which toads will forage within. The most immediate terrestrial habitat around the pond will be retained.</p> <p>New habitat will be created within Open Land delivering a long-term enhancement for this species.</p>	SI: -ve	<p>Not significant / Negligible in the short-term</p> <p>Significant beneficial in the long-term (post-2026) / Minor beneficial post-2026 (50% certain)</p>	Not applicable	<p>Not significant / Negligible in the short-term</p> <p>Significant beneficial in the long-term (post-2026) / Minor beneficial post-2026 (50% certain)</p>
		PO: Likely (the loss of habitat is certain, but its value to toads is based on probability)			
		CO: Direct			
		EC: Unknown			
		MA: relatively minor, given the conversion of farmland to gardens			
		RE: Reversible			
		DU: Permanent			
		TF: Timing of works unlikely to affect significance of effects. Frequency is not applicable, since habitat removal would be a one-off event.			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	<i>Incidental mortality during site clearance</i> The potential exists for the incidental mortality of toads during the construction phase. Site clearance close to the ponds will take place under the supervision of a suitably experienced ecologist	SI: -ve	Not significant / Negligible (95% certain)	Not applicable	Not significant / Negligible (95% certain)
		PO: Unlikely			
		CO: Direct			
		EC: could occur within area surrounding Pond 4			
		MA : Only likely to affect small numbers of toads			
		RE: Irreversible			
		DU: Permanent			
		TF: Not applicable			
	Operational Effects				
	<i>Road-related mortality of toads crossing site access roads</i> Three amphibian tunnels and	SI: -ve	Not significant / Negligible	Not applicable	Not significant / Negligible
		PO: Unlikely			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	associated fencing will be provided to reduce the likelihood of this effect	CO: Direct	(50% certain)		(50% certain)
		EC: could occur within area surrounding ponds	Monitoring will be required to confirm that the provision of tunnels is effective in avoiding this effect		
		MA : Could affect large numbers of toads if tunnels not located effectively			
		RE: Irreversible			
		DU: Permanent			
		TF: Could occur annually			

H. Badgers

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The badger population with the site has been assessed as 'Local' value.</p> <p>One 'main sett complex' (which comprises two setts which appear to function together as a main sett), three 'subsidiary setts' and two 'outlying setts' are present within the site boundary. The bait-marking study confirmed the status of the setts, and showed that the site appears to be used by one social group of badgers. The territory boundaries of the resident social group of badgers appear to extend beyond the site boundaries, to the west and north-west, although clearly defined boundaries are not present, probably due to the lack of adjacent social groups of badgers. In this part of the UK badger social groups are often fragmented, with suitable sett locations being the limiting factor as to the area occupied by badgers. Badger social group territory sizes in this habitat are likely to be in the region of 50-60ha, but can extend up to 100ha, depending on the proportion of less productive arable habitat.</p>	Construction Effects				
	<p><i>Loss of an inactive part of the main sett complex and a small number of outlying setts.</i></p> <p>Based on the current status of the Proposed Development, site clearance works would lead to the loss of a small number of entrances at the northern end of the main sett complex, which would not be expected to affect use of the remainder of the sett(s) by badgers. An active outlying sett and a number of small outlying setts that are currently disused will also need to be closed, although this would not have a significant effect on the resident social group.</p> <p>Badgers will be excluded from affected setts (or parts of setts) under licence to Natural England.</p>	SI: -ve	<p>Not significant / Negligible (95% certain)</p>	<p>Not Applicable</p>	<p>Not significant / Negligible (95% certain)</p>
		PO: Certain			
		CO: Direct			
		EC: Not applicable			
		MA: Loss of an inactive part of the main sett complex and a small number of outlying setts.			
		RE: Irreversible			
		DU: Permanent			
		TF: Setts must be excluded between July and November (inclusive). No exclusion works are permitted between December to June (inclusive). Frequency is not applicable, since loss of the setts would be a one-off event.			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	<p><i>Loss of foraging habitat</i></p> <p>The site clearance works would lead to the direct loss of approximately 90 Ha arable land that may be used by the resident badgers for foraging. This will be off-set through the provision of valuable foraging habitat for badgers within the areas of Open Land. Some areas of amenity grassland closest to the main sett complex and the new artificial sett (see below) will be kept mown short to create optimal foraging conditions for badgers, and a high proportion of fruit-bearing trees and shrubs will be incorporated in new landscape planting.</p>	<p>SI: -ve</p> <p>PO: Certain</p> <p>CO: Direct</p> <p>EC: Across the site</p> <p>MA : Loss of 50ha of arable land</p> <p>RE: Irreversible</p> <p>DU: Permanent</p> <p>TF: Not applicable</p>	<p>Not significant / Negligible</p> <p>(95% certain)</p> <p>The resident social group of badgers would still have a sufficient area of high quality foraging habitat available to them to sustain a social group, although the group is likely to decrease in size over time.</p>	Not Applicable	Not significant / Negligible
	Operational Effects				
	<p><i>Abandonment of main sett complex</i></p> <p>Given the increased level of public use of the area around the main sett complex, badgers may abandon this structure. An artificial sett will be provided within an undisturbed part of the Open Land on the western edge of the site as an alternative form of shelter.</p>	<p>SI: -ve</p> <p>PO: Unlikely</p> <p>CO: Indirect</p> <p>EC: Not applicable</p> <p>MA: Loss of a main sett</p> <p>RE: Irreversible</p> <p>DU: Permanent</p> <p>TF: Not applicable</p>	<p>Not significant / Negligible</p> <p>(95% certain)</p>	Not Applicable	Not significant / Negligible

I. Breeding Birds

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The breeding bird population within the site has been assessed as 'District/Borough' value.</p> <p>The site supports a farmland breeding bird assemblage, which includes a number of species of nature conservation concern. Skylark (up to 12 pairs in 2009, but 8 and 10 pairs in 2011 and 2005 respectively), yellow wagtail (up to two pairs in 2005, but fewer in other survey years), song thrush (up to four pairs in 2011), starling, house sparrow, linnet (up to five pairs in 2004, but fewer in other survey years), bullfinch, yellowhammer (at least one pair) and reed bunting (one pair) are all listed as priority species for conservation on the UKBAP or LBAP, and/or are listed on the RSPB's 'Red' list of bird species of conservation concern (RSPB, 2009). In addition, dunnoek, whitethroat and willow warbler are listed on the RSPB's 'Amber' list as species of conservation concern (RSPB, 2009) and have also been recorded breeding within the site.</p> <p>It is estimated that up to 12 pairs of skylark may breed within the arable fields, although the number of pairs of skylark present is likely to vary in relation to the crop rotation, as certain crop types are likely to support a greater density of skylarks. On average it is assumed that the site supports approximately 10 pairs of skylark each year. The site's network of hedgerows and small woodland areas, and farm buildings, are likely to support smaller numbers of the other species listed above, given the limited opportunities for nesting that they</p>	Construction Effects				
	<p><i>Loss of farmland habitat</i></p> <p>The proposals would result in the direct loss of an area of farmland of value to a range of species, including several which are considered to be of conservation concern, such as skylark, linnet and yellowhammer. The development is likely to result in a shift in the species dynamics from agricultural to garden species.</p> <p>Certain farmland bird species (particularly skylark, linnet and yellowhammer) are likely to be lost from the development site altogether.</p>	SI: -ve	<p>Significant adverse at the local level (for farmland species) at 2014 and 2026 / Minor adverse for farmland species at 2014 and 2026</p> <p>(100% certain)</p>	<p>Provision of enhanced habitat for farmland birds on arable farmland outwith the development site through, for example, the provision of skylark plots, scrub and hedgerow planting, areas of wild bird seed mix within field corners and in strips adjacent to ditches and areas of unharvested fertiliser-free headlands.</p>	<p>Not significant / Negligible</p> <p>(95% certain)</p>
		PO: Certain			
		CO: Direct			
		EC: 90 ha of habitat suitable for farmland birds			
		MA: Complete loss of farmland habitat.			
		RE: Irreversible			
		DU: Permanent			
		TF: The loss of farmland habitat is likely to be phased over a number of years; therefore effects will occur where birds continue to use the remaining area of farmland until the completion of site clearance or abandonment of the farm.			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
provide. However, the site may support reasonable numbers of foraging birds which nest in the adjacent residential areas (such as starling, house sparrow, dunnoek and blackbird). There is some evidence that the site may be used by foraging barn owls (small numbers of old pellets at Hales Farm), although there was no evidence of this species breeding on site in any of the suitable trees or buildings.	<p><i>Loss of hedgerows/trees/buildings</i></p> <p>During site clearance works, approximately 700m of species-poor hedgerows and a number of trees will be lost from the Application Site. The new gardens and scheme landscaping will provide suitable habitat for most species (other than farmland birds) and some species would be expected to increase in number in the medium- to long-term (15-30 years), as the new habitats mature.</p> <p>Works will be timed to avoid site clearance during the breeding season, or following a survey to confirm the absence of nesting birds. The site will be re-surveyed to confirm the continued absence of barn owls. New nest sites will be provided on a proportion of the new buildings, and kingfisher nest sites will be created on the Washpit Brook.</p>	SI: -ve	<p>Not significant / Negligible in the short-term (at 2026)</p> <p>Significant beneficial in the long-term (post-2026) at the District/Borough level / Minor beneficial post-2026 (95% certain)</p>	Not Applicable	<p>Not significant / Negligible in the short-term (at 2026)</p> <p>Significant beneficial in the long-term (post-2026) at the District/Borough level / Minor beneficial post-2026 (95% certain)</p>
		PO: Certain			
		CO: Direct			
		EC: Small amount of habitat within site.			
		MA : As above.			
		RE: Reversible			
		DU: Temporary until new planting matures (15-20 years)			
		TF: Clearance works should be undertaken outside the bird breeding season to avoid effects on nesting birds.			
	Operational Effects				
	<i>No additional operational phase effects on breeding birds are predicted</i>	Not applicable	Not significant / Negligible (100% certain)	Not Applicable	Not significant / Negligible (100% certain)

J. Bats

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The site's assemblage of bats has been assessed to be of 'District/Borough' value.</p> <p>A brown long-eared bat maternity roost has been identified within the loft space of the farm house associated with the Gravel Hill farm complex (see Figure 7.1). A pipistrelle bat roost (likely to be common pipistrelle) has been identified within the porch of the same building, which is considered likely to be used as a day roost by only a small number of bats. No other bat roosts were identified in any of the remaining buildings within the site boundaries, the majority of which are considered to be largely unsuitable for use by roosting bats. A small number of trees within the site boundaries provide suitable roost sites for bats, although no evidence of use by bats was recorded in any of these features.</p> <p>Up to five species of bats were recorded commuting and foraging across the site during the activity surveys, including noctule, common pipistrelle, soprano pipistrelle, Daubenton's bat and serotine. The greatest level of activity was recorded at the southern end of the site, in fields adjacent to houses and woodland. Noctule and pipistrelle bats were recorded foraging and commuting over open fields, but the majority of bats were recorded commuting along linear features, primarily hedgerows and woodland edges. In addition, common pipistrelle bats were observed commuting along the avenue of Horse Chestnut trees, although the surveys</p>	Construction Effects				
	<i>Loss of potential roost sites</i>	SI: -ve	Not significant / Negligible (95% certain)	Not Applicable	Not significant / Negligible (95% certain)
	<p>The site clearance works would lead to the demolition of a number of buildings and the loss of a number of mature trees which have the potential to provide roosting sites for bats, although only one building has been confirmed as a roost (for two species).</p> <p>A re-survey will be undertaken prior to site clearance to confirm the absence of roosting bats from suitable features. Works to the confirmed roost site may need to proceed under licence to Natural England and should avoid periods when bats are present. A proportion of the new 'communal' buildings on site will be designed to incorporate features suitable for use by roosting bats, by allowing bats access into roofspaces (such as through raised tiles or cavities at roof apexes, and provision of bat bricks). Dedicated bat lofts will be provided in at least two new buildings.</p> <p>Bat boxes will be provided on retained mature trees to further increase the</p>	PO: Certain			
		CO: Direct			
		EC: Not applicable			
		MA: One roost for small numbers of common species			
		RE: Reversible			
		DU: Temporary			
		TF: Timing of works unlikely to affect significance of effects. Frequency is not applicable, since loss of these features would be a one-off event.			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
confirmed the absence of roosts from these trees. Overall, the level of bat activity recorded during the transect surveys was relatively low, probably due to low insect biomass over the majority of the site. Noctule and soprano pipistrelle bats are listed as a priority species on the UKBAP.	availability of roost sites. <i>Loss of low value foraging habitat/commuting routes</i> The site clearance works would lead to the direct loss of approximately 700m of hedgerows which could be used by bats for commuting and/or foraging. The creation of wetlands and mosaics of grassland within the Open Land on the site's western edge will provide an additional foraging resource for bats. As set-out in the Design, Access and Landscape Statement for the Development, low-level directional street lighting will be used to minimise light spillage and any effects on wildlife, in particular commuting bats. The western edge of the Development will be largely unlit, to ensure that there are areas of relative darkness within the areas of more valuable foraging habitat for bats.	SI: -ve PO: Certain CO: Direct EC: 700m of foraging habitat. MA : Minor loss RE: Reversible DU: Temporary TF: Not applicable.	Not significant / Negligible (95% certain) Given the low level of bat activity recorded on site during the surveys, and the retention of the most valuable features (the Washpit Brook, species-rich hedgerows, and the avenue of Horse Chestnut trees), significant losses of foraging habitat and/or commuting routes are not predicted.	Not Applicable	Not significant / Negligible (95% certain)
	Operational Effects				

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	<p><i>No additional operational phase effects on bats are predicted</i></p> <p>The design of the Proposed Development would include an area of Open Land which would include newly planted species-rich hedgerows, wetlands and mosaics of grassland which will provide an additional foraging resource for bats.</p>	Not applicable	Not significant / Negligible (100% certain)	Not Applicable	Not significant / Negligible (100% certain)

K. Brown hare

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
<p>The brown hare population is considered to be of 'District/Borough' importance.</p> <p>The site supports a population of brown hares, with a peak count of 35 hares recorded during the surveys. This is indicative of the site supporting a population of hares at a high density comparable with other areas of farmland in this part of the UK. Brown hares are listed as a priority species on the UKBAP and LBAP.</p>	Construction Effects				
	<p><i>Loss of farmland habitat used by brown hares</i></p> <p>The proposals will result in the loss of 125ha of farmland habitat used by brown hares. It is likely that brown hares will be lost from the site altogether, as the areas of Open Land are unlikely to provide habitat of particular value for this</p>	SI: -ve	<p>Significant adverse at the District/Borough level at 2014 and 2026 / Minor adverse at 2014 and 2026</p> <p>(100% certain)</p>	<p>The off-site enhancement of farmland (as described in relation to breeding birds, above) will also deliver increased habitat for brown hare to mitigate/</p>	<p>Not significant / Negligible</p> <p>(95% certain)</p>
		PO: Certain			
		CO: Direct			
		EC: Loss of 125 ha of habitat used by brown hares			

Ecological feature, value, policy and legal framework and factors on which its integrity or conservation status depends	Proposed activity, biophysical change and relevance to receptor in terms of ecosystem structure and function	Characterisation of Effect	Ecologically significant if unmitigated? (Effect on integrity or conservation status, confidence in this, and rationale)	Mitigation proposals	Residual effect and ecological significance
	species.	MA: Complete loss of brown hare population from the site.		compensate the losses associated with the Proposed Development.	
		RE: Irreversible			
		DU: Permanent			
		TF: Not applicable			
	Operational Effects				
	No adverse operational phase effects on brown hares are predicted	Not applicable	Not significant / Negligible (100% certain)	Not applicable	Not significant / Negligible (100% certain)

Appendix 7.4

Biodiversity Strategy

1. Introduction

- 1.0.1 This report provides a strategy for the protection and enhancement of biodiversity resources at the Proposed Development. It should be read in conjunction with the Environmental Statement for the Proposed Development and the Construction Environmental Management Plan (CEMP), which have both been submitted as part of the outline planning application (Appendix 2.1 of the Environmental Statement).
- 1.0.2 Detailed ecological surveys have been undertaken during the period 2004-2011 to inform the assessment of ecological effects set out in the Environmental Statement. The results of these surveys, along with consultation with the local planning authorities and other relevant consultees, have been used to guide the preparation of this Biodiversity Strategy.
- 1.0.3 The Development parameters relevant to this document are set out in the Description of Development and the Environmental Statement.
- 1.0.4 The purpose of this document is to set-out the implementation framework for ecological mitigation and biodiversity enhancement, including design and management objectives, as well as providing a strategy for monitoring.
- 1.0.5 This Biodiversity Strategy includes the following elements:
- A description of the current biodiversity resource, as set out in the Environmental Statement.
 - A description of the measures incorporated into scheme design and the CEMP to protect biodiversity resources.
 - Biodiversity objectives for the design of areas of Open Land and their management.
 - A description of enhancement measures to be delivered as part of the Proposed Development.
 - A description of suggested off-site mitigation measures to be funded.
 - A strategy for monitoring the Application Site's biodiversity resource and the success of mitigation and enhancement measures.
- 1.0.6 The strategy takes account of the proposed phasing of the Proposed Development and describes how measures will be delivered in relation to this.

2. Overall biodiversity objectives**2.1 UK and local Biodiversity Action Plans**

2.1.1 The UK Biodiversity Action Plan (BAP) provides a national strategy to conserve our threatened native species and habitats. A total of 1150 species and 65 habitats have been identified as priorities for conservation. The priority habitats and species, listed within the UK Biodiversity Action Plan, which are of particular relevance to the site are:

- Hedgerows
- Ponds
- Traditional orchards
- Lowland mixed deciduous woodland
- White-letter hairstreak butterfly
- Great crested newt
- Common toad
- Skylark
- Linnet
- Yellowhammer
- Yellow wagtail
- House sparrow
- Dunnock
- Starling
- Bullfinch
- Song thrush
- Water vole
- Brown hare
- Noctule
- Soprano pipistrelle bat
- Brown long-eared bat

2.1.2 The local BAP, produced by the Cambridgeshire and Peterborough Biodiversity Partnership, includes the following habitats and species of relevance:

- Hedgerows
- Managed greenspaces
- Ponds, lakes and standing water
- Neutral grassland
- Rivers and streams
- Traditional orchards
- Veteran trees and parkland
- Woodland
- Brown hare
- Great crested newt
- Pipistrelle bat

- Skylark
- Song thrush
- Water vole

2.2 Existing resources

2.2.1 The Application Site currently comprises intensively managed farmland, of which approximately 90ha is in arable production and approximately 35ha comprises grazing pasture, the remainder is occupied by University buildings or existing road infrastructure.

2.2.2 A number of small woodlands are present as well as two small former orchards. The fields in the western part of the Application Site are divided by hedgerows, some of which are species-rich. The majority of the field boundaries in the remainder of the Application Site comprise fences, or no longer exist. Mature trees are associated with some of the field boundaries and a proportion of the trees on the Application Site have been shown to support a valuable terrestrial invertebrate assemblage. A pit in the central part of the Application Site is not farmed, and is designated as a geological SSSI. A number of farm buildings are also present.

2.2.3 The Washpit Brook flows through the western part of the Application Site. Surveys in 2004 and 2009 confirmed that the Washpit Brook supports a small population of water voles (*Arvicola amphibius*) although no evidence of water voles was recorded in 2011. Occasional ponds are present which support breeding amphibians. Important populations of great crested newts (*Triturus cristatus*) are present associated with off-site ponds (and the Bird Sanctuary ponds and potentially the Park and Ride pond¹ to the south of the Application Site). Common toads (*Bufo bufo*) occur in the pond at the World Conservation Monitoring Centre immediately outside of the Application Site (but located close to its centre), and the Park and Ride pond (off-site).

2.2.4 The farmland supports breeding birds, a population of brown hares (*Lepus europaeus*), and is used by foraging bats and badgers (*Meles meles*). A brown long-eared bat (*Plecotus auritus*) roost and small pipistrelle (*Pipistrellus* sp.) bat roost is present in one of the farm buildings and numerous badger setts have been recorded across the Application Site.

2.3 Proposed resources – a vision for biodiversity at North West Cambridge

2.3.1 The Proposed Development has been designed to retain and protect the most valuable ecological features, by incorporating them into the indicative layout and parameter plans. The 'Western Edge' of the site, which includes the Washpit Brook, areas of woodland and the more valuable hedgerows, will provide an area of Open Land, for informal recreation. It will be managed to deliver a range of 'ecosystem services', including ecological, landscape and drainage functions, as well as providing a recreational resource which will be valued highly by future residents and visitors. In combination with the creation of other areas of Open Land this will provide green infrastructure, linking areas of farmland to the north and west of the Application Site allowing the creation of an ecological network on the north-western edge of Cambridge. The Proposed Development will therefore help to deliver some of the

¹ The 2009 surveys confirmed the presence great crested newts within the Park and Ride Pond but no adult great crested newts were identified during the 2011 surveys

beneficial effects described in the UK Government's white paper '*The Natural Choice: securing the value of nature*'. The areas of Open Land will also provide an ideal opportunity to re-connect people to nature, by providing and encouraging access to the countryside; this would be supported by delivering nature-related education and encouraging voluntary participation in nature conservation activities.

2.3.2 Ponds supporting great crested newts and large populations of common toads will be protected, as will the terrestrial habitat used by these species. Measures to improve the conservation status of the local great crested newt population are a feature of the design of the Western Edge. Badger setts have also been retained as part of the Proposed Development as far as possible.

2.3.3 Where the Proposed Development is likely to result in the loss of species, or assemblage of species, from the Application Site (as is the case for brown hares and farmland birds), off-site mitigation has been secured following the general approach of biodiversity offsetting, as recommended in the UK Government's white paper '*The Natural Choice: securing the value of nature*'.

2.4 Overall objectives

2.4.1 The overarching objectives for biodiversity at the Application Site are:

- To secure the long term nature conservation value of the Application Site;
- To maintain and, where possible, enhance the conservation status of those species which are national or local priorities for conservation, thereby delivering local Biodiversity Action Plan objectives;
- To promote habitat connectivity within the Application Site and with adjacent habitat;
- To provide a biodiversity resource which is valued and used by local residents; and
- To assist in the delivery of nature-related education and encourage the voluntary participation of the local community in conservation activities.

2.5 Achieving the objectives

2.5.1 Measures to protect habitats and species set-out in this document, the ES and the CEMP will be secured by way of planning conditions and/or the S106 agreement. Financial contribution to the delivery of off-site mitigation measures in relation to farmland birds and brown hares will be secured through the S106 agreement.

2.5.2 Detailed nature conservation management prescriptions will be produced, which will be implemented to deliver the biodiversity objectives set out in this document.

2.5.3 The delivery of enhancement measures and the monitoring strategy, as set out in this document, will be secured by way of planning conditions.

3. Design concept for the Western Edge**3.1 Design philosophy**

- 3.1.1 Ecological enhancement is a central theme in the design of Area 5 on parameter Plan 03 known as “the Western Edge” of the Application Site. The Western Edge will include the retained Washpit Brook and a number of retained hedgerows and mature trees. It will also deliver ecological enhancement as well as performing other environmental functions: recreation, landscape and noise buffer (from the M11) and drainage and attenuation of surface water.
- 3.1.2 The Western Edge will include an area of parkland habitat adjacent to the built edge of the Proposed Development and an area adjacent to the M11 designed to provide semi-natural habitat for wildlife.
- 3.1.3 The landscaping of the Western Edge will take place over three phases in parallel with the phases of the Proposed Development of the Application Site.

3.2 Watercourses and drainage features*Objectives*

- Protect the existing valuable wetland habitat and its associated species;
- Provide enhanced wetland habitat within the Washpit Brook;
- Provide valuable wetland habitat within new wetland features;
- Increase the availability of habitat and features for water vole, otter and kingfisher.

Habitat creation principles

- 3.2.1 The new drainage and attenuation features associated with the Washpit Brook will be designed to provide valuable habitat for water voles in particular. Linear habitat ponds will be created as part of new ‘low flow channels’, which will receive water from retention ponds and will be over-deepened to ensure that they hold water over as prolonged a period as possible. The new sections of channel and habitat ponds will have a steep (1:1 slope) earth bank on one side, sown with a wildflower grass mix, and with a planting ledge below water level. Where bank re-enforcement is required this will be achieved through the use of coir fibre matting. Wetland vegetation will be planted at, and immediately below, water level.
- 3.2.2 Areas of land adjacent to the Washpit Brook will be lowered to provide flood storage. These areas will flood regularly, but can be expected to dry out in summer, and will be seeded and managed as floodplain grassland; this habitat is expected to provide suitable habitat for the nationally scarce species of lace hopper bug (*Reptalus panzeri*).

3.3 Species-rich hay meadows*Objectives*

- Provide a floristically diverse habitat;
- Provide a valuable habitat for terrestrial invertebrates;
- Provide valuable foraging habitat for amphibians, particularly great crested newts;
- Provide suitable habitat for reptiles;

- Provide suitable foraging habitat for badgers.

Habitat creation principles

- 3.3.1 Remodelling of the landform within the Western Edge will allow the creation of dry grassland habitat in areas outside of the floodplain. Species-rich meadows will be sown in these areas, with an appropriate mix of native grasses and wildflowers, ideally of local provenance. Particular attention will need to be given to the subsoil and topsoil type, pH and depth to maximise the likelihood that the target grassland community develops.

3.4 Scrub, woodland and orchard*Objectives*

- Protect and enhance the existing woodland resource;
- Provide valuable habitat for invertebrates, particularly white-letter hairstreak and purple hairstreak;
- Provide valuable terrestrial habitat for amphibians, particularly great crested newts;
- Provide suitable habitat for reptiles;
- Provide valuable habitat for nesting and foraging birds;
- Provide valuable foraging and roosting habitat for bats;
- Provide suitable foraging habitat for badgers.

Habitat creation principles

- 3.4.1 Patches of scrub habitat will be planted throughout the Western Edge, and will comprise a mix of native species, including Pedunculate Oak (*Quercus robur*), Ash (*Fraxinus excelsior*), Hornbeam (*Carpinus betulus*), Field Maple (*Acer campestre*), English Elm (*Ulmus procera*), Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*). Where appropriate, a variety of different fruit trees will also be incorporated in the planting mixes (including Apple (*Malus domestica* agg.), Wild Pear (*Pyrus communis*), Wild Cherry (*Prunus avium*) and Wild Plum (*Prunus domestica*).

3.5 Parkland*Objectives*

- Provide a recreational resource for local residents;
- Provide foraging habitat for badgers;
- Provide (in the long-term) roosting and foraging habitat for bats;
- Provide (in the medium-term) nesting and foraging habitat for birds.

Habitat creation principles

- 3.5.1 Standard native trees, including Pedunculate Oak, will be planted to create a parkland-type landscape. A species-rich 'amenity' grassland mix will be sown, and managed as short grassland.

3.6 Ponds*Objectives*

- Provide new breeding habitat for amphibians within the Western Edge, particularly great crested newts.

Habitat creation principles

3.6.1 In addition to the linear habitat ponds described in 3.2 (above), a series of small ponds will be created, scattered throughout the Western Edge. Each pond will be located within 200m of another pond or wetland feature, and clusters of ponds will be created in some locations. Ponds will be designed to maximise their value for breeding great crested newts, and will therefore have the following characteristics:

- Surface area between 100m² and 300m²;
- Depth of at least 1m and ideally deeper in some areas to ensure open water maintained;
- Substantial cover of native submerged and marginal vegetation (but avoiding plant species like *Typha* that will dominate at the expense of other species);
- Absence of shading on south side of the pond.

4. Specific measures to protect and enhance biodiversity**4.1 Washpit Brook***Current status*

- 4.1.1 The Washpit Brook flows adjacent to the M11 on the western boundary of the Application Site and through the centre of the north-western corner. A small number of common wetland plants are present within the Brook including Fool's Water-cress (*Apium nodiflorum*), Water-cress (*Rorippa nasturtium-aquaticum*), a water-starwort species (*Callitriche* sp.), and Common Duckweed (*Lemna minor*). Although water quality within the Washpit Brook is variable, this feature may also support an aquatic invertebrate fauna of some local conservation value.
- 4.1.2 A small population of water voles has been observed on the Washpit Brook, in the channel directly adjacent to the M11. Further details are provided in Section 4.12, below.
- 4.1.3 No evidence of otters (*Lutra lutra*) has been recorded on this section of the Washpit Brook, although they may use it occasionally to commute between larger watercourses. No potentially suitable resting sites have been identified.

Objectives

- 4.1.4 Maintaining and improving riverine habitats is listed as a target on both the UKBAP and LBAP. In addition, water voles and otters are priority species on the UKBAP and the LBAP.
- 4.1.5 The key objectives for the Washpit Brook are as follows:
- Protect water quality, flow rates and bank structure during construction and operational phases of the Proposed Development;
 - Enhance water quality and flow rates where possible, through careful design of scheme drainage;
 - Increase the amount of wetland habitat present;
 - Protect any water vole population during construction and in the long-term;
 - Enhance the conservation status of any water vole population by managing the watercourse appropriately, and by providing new habitat of value for this species;
 - Encourage use of the Washpit Brook by otters by providing new habitat features of value for this species.

Protection measures

- 4.1.6 The Washpit Brook will be protected within a buffer zone throughout the construction and operational phases of the development. The buffer zone will be fenced off using netlon-type fencing to prevent accidental damage, and to restrict access during the works. Appropriate pollution control measures will be implemented to avoid pollution or increased turbidity in the Washpit Brook during construction operations, to protect adjacent and downstream habitats. This will be of particular importance during any modifications to bank profile and the re-modelling works in this part of the Application Site. These measures are detailed in the CEMP. Site drainage has been designed to include treatment and attenuation of run-off from roads and hard surfaces through the use of balancing and pollution control mechanisms.
- 4.1.7 Protection measures for water voles are identified in Section 4.12 below.

Enhancement measures

- 4.1.8 Scheme drainage will be designed to ensure a minimum water level in the brook to minimise the likelihood of sections drying out, as currently occurs. The linear habitat ponds will have deepened sections and be fed by an overflow from adjacent retention ponds to maximise the likelihood of open water being retained throughout the year. The Washpit Brook will be further enhanced through the implementation of appropriate management (see 'Management principles', below). Enhancement measures relating to water voles and otters are detailed in Sections 4.12 and 4.15 below.

Management principles

- a) Maintain water flow within the Washpit Brook
- 4.1.9 It will be necessary to remove silt and dense in-channel vegetation at 5 to 10 year intervals. Silt and in-channel vegetation removal should be done on a rotational basis so that only 20% of the length of the brook is de-silted in any one year.
- b) Maintain water quality within the Washpit Brook
- 4.1.10 Any spillages, litter or other pollutants within, or in the vicinity of, the Washpit Brook will need to be removed as soon as possible to prevent long-term effects on water quality.
- 4.1.11 Educational material should be provided to local residents and other users of the Application Site to reduce the likelihood of such events occurring.
- c) Maintain bankside and in-channel vegetation
- 4.1.12 Bankside and in-channel vegetation should be cut every two years on a rotational basis, so that vegetation is retained intact on one bank of the brook. Vegetation cutting should take place in October to minimise the effect on water voles and avoid the nesting bird period.

4.2 Woodland and scrub*Current status*

4.2.1 There are four blocks of woodland within the Application Site, as shown on Figure 1:

W1 is a triangular block of woodland supporting mature multi-stemmed trees including Ash (*Fraxinus excelsior*), Hornbeam (*Carpinus betulus*), Field Maple (*Acer campestre*), English Elm (*Ulmus procera*) and Sycamore (*Acer pseudoplatanus*). The understorey comprises dense Elder (*Sambucus nigra*), Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*). The ground flora comprises plants associated with secondary woodland and scrub, including Hedge Garlic (*Alliaria petiolata*), Rough Chervil (*Chaerophyllum temulum*) and False Brome (*Brachypodium sylvaticum*), Lesser Celandine (*Ranunculus ficaria*) and Common Nettle (*Urtica dioica*). The presence of large tree stumps indicates that this woodland may be of some antiquity.

W2 is a small copse supporting several large mature Pedunculate Oak (*Quercus robur*) trees. The dense understorey comprises Hawthorn, Elder and English Elm. The ground flora is dominated by Ivy (*Hedera helix*).

W3 is a small block of woodland comprising mature Ash trees with a patchy understorey of Hawthorn and Elder. It also contains a small number of mature Pedunculate Oak trees. Part of this woodland has been replanted with Sweet Chestnut (*Castanea sativa*) trees. The ground flora largely comprises Cow Parsley (*Anthriscus sylvestris*), Ivy and Common Nettle.

W4 is a small woodland block, the western end of which comprises mature Hybrid Black-poplar (*Populus nigra x deltoides*), Pedunculate Oak, Hornbeam and Beech (*Fagus sylvatica*) trees with immature Holm Oak (*Quercus ilex*) trees and an understorey of Hazel (*Corylus avellana*), Blackthorn, Hawthorn, Spindle (*Euonymus europaeus*), Goat Willow (*Salix caprea*), Wild Cherry (*Prunus avium*), Elder and Bramble (*Rubus fruticosus* agg.). The groundflora is dominated by Ivy and Common Nettle. The remainder of the woodland block appears to have been felled in recent years and comprises dense Bramble with scattered understorey shrubs. A row of mature trees and shrubs is present on the edge of the woodland largely comprising Sycamore, Hornbeam, Pedunculate Oak, Hawthorn, Hazel, Elder, Spindle and Bramble.

4.2.2 In addition, patches of scrub will be planted through the Western Edge, comprising a mixture of Hawthorn, Blackthorn, English Elm, Hazel and Pedunculate Oak trees.

Objectives

4.2.3 Maintaining woodland habitat and achieving appropriate management of woodland are local BAP targets. The key objectives for woodland and scrub on the Application Site are as follows:

- Protect areas of woodland from damage during construction;
- Protect areas of woodland and scrub from damage during the operational phase;
- Implement appropriate nature conservation management, through thinning (particularly removal of Sycamore trees);

- Control Bramble as necessary to promote ground flora species.

Protection measures

- 4.2.4 All areas of woodland within 10m of construction works will be fenced off using netlon-type fencing to protect them from being accidentally damage, or accessed during the works.

Enhancement measures

- 4.2.5 New areas of scrub will be planted as part of the landscape design for the Western Edge. The woodlands will be further enhanced through the implementation of appropriate management (see 'Management principles', below).

Management principles

a) Undertake thinning

- 4.2.6 Selectively fell over-mature trees within the woodlands to reduce shading of ground flora. Prioritise the removal of non-native tree species, such as Sycamore. Tree felling should take place once every 10 years. No more than 5% of tree canopy should be removed.

- 4.2.7 All felling work should take place outside the nesting bird period. Felled material will be used to create log piles and brash piles within the woodland in locations that do not destroy valuable ground flora. Larger pieces of felled material will be partially-buried to provide a permanent habitat feature for invertebrates and a hibernation site for amphibians and reptiles.

b) Control Bramble

- 4.2.8 Areas of dense Bramble scrub should be removed through mechanical cutting. Bramble removal should take place once every 5 years, with at least 50% of dense Bramble removed. Bramble removal should take place outside the nesting bird period.

c) Control public access

- 4.2.9 All of the woodland areas are too small to be able to accommodate public access with the exception of W4. An appropriate path should be constructed through the parts of W4 where limited vegetation clearance will be required. This will formalise woodland access. Woodlands W1, W2 and W3 should be fenced off to prevent public access.

d) Removal of litter

- 4.2.10 Litter removal should take place regularly. The appropriate frequency of litter removal will need to be determined during the operational phase, but is likely to be annually in some cases.

e) Scrub control

- 4.2.11 The areas of newly planted scrub should be reviewed on a 10 year basis to determine whether control measures are required (see Section 4.6, below).

4.3 Hedgerows*Current status*

- 4.3.1 The majority of the hedgerows on the Application Site are species-poor, both in terms of the woody species present and their ground flora. However, seven hedgerows are species-rich (comprising five or more woody species), as shown on Figure 1; two of these would be classified as 'important' under the Hedgerows Regulations (1997), using the Wildlife and Landscape criteria. These hedgerows will be retained as part of the Proposed Development, although minor effects on one species-rich hedgerow will be required to allow the construction of the second stage channel for flood storage. There will be some loss of species-poor hedgerows (approximately 700m). New species-rich hedgerow will be planted to mitigate this loss. The shrub species most commonly recorded in the hedgerows include Hawthorn, Blackthorn, Elder, Field-rose and Dog-rose. A number of the hedgerows also support English Elm trees, a large number of which are dead and are of value for terrestrial invertebrates

Objectives

- 4.3.2 Hedgerows are a national and local priority for conservation, and maintenance and favourable management of the hedgerows is therefore a priority. The key objectives for hedgerows are therefore as follows:
- Protect retained hedgerows during construction;
 - Increase the site's hedgerow resource through appropriate planting; and
 - Implement appropriate nature conservation management.

Protection measures

- 4.3.3 All retained hedgerows within 10m of construction works will be fenced off using netlon-type fencing to protect them from being accidentally damage, or accessed during the works.

Enhancement measures

- 4.3.4 At least 700m of new species-rich hedgerow will be planted. The retained hedgerows will be further enhanced through the implementation of appropriate management (see 'Management principles', below).

Management principles

- a) Hedgerow trimming
- 4.3.5 Hedgerows will be trimmed annually in late-January or early-February each year.

4.4 Veteran and mature trees*Current status*

- 4.4.1 There is one veteran (or 'near veteran') Pedunculate Oak tree on site, which will be retained (Tree T196 in the Arboricultural Report, as shown on Figure 1), although a number of other mature trees are relatively old and contain dead wood, making them also of ecological value. Tree T196 is of considerable age, supports a valuable assemblage of terrestrial invertebrates and is located on the boundary between South Cambridgeshire District and the City of Cambridge; although assessed as being 'near veteran' in the Arboricultural Report it is considered to represent a 'veteran' tree for the purposes of the ecological assessment. A number of other mature and semi-mature trees are present, the majority of which are located within hedgerows in the southern and western parts of the Application Site and will be largely retained. An avenue of mature horse-chestnut trees is present in the eastern part of the Application Site, which will also be retained, and a number of mature oak trees are present on the Application Site's southern boundary (adjacent to Madingley Road and the Park and Ride site), several of which will be felled to allow construction of an access route to Madingley Road.

Objectives

- 4.4.2 Veteran trees are listed as a nature conservation priority in the local BAP. Mature Pedunculate Oak and English Elm trees provide valuable habitat for butterflies (see Section 4.7, below). The veteran and other mature trees within the Application Site also support an important assemblage of terrestrial invertebrates, including several species of wood-decay beetle and a nationally scarce species of tree ant. The key objectives for veteran and mature trees are as follows:
- Protect retained trees during construction;
 - Manage mature and veteran trees to prolong their life and promote heartwood decay in living trees (which is of particular importance for the valuable terrestrial invertebrate assemblage present) through crown reduction;
 - Increase the number of veteran trees in the long-term.

Protection measures

- 4.4.3 All retained mature trees will be fenced off using netlon-type fencing to protect them from being accidentally damaged, or accessed during the works following appropriate British Standards for tree protection. Standing dead wood should be retained wherever possible.
- 4.4.4 All felling work / tree surgery should take place outside the nesting bird period. Felled material from the oak and elm trees removed to allow construction of the access to Madingley Road will be used to create log piles and brash piles. Larger pieces of felled material will be partially-buried to provide a permanent habitat feature for invertebrates (potentially including stag beetles, *Lucanus cervus*) and a hibernation site for amphibians and reptiles.

Enhancement measures

- 4.4.5 Standard trees will be planted as part of the landscaping proposals for the Application Site, including the Western Edge and within the built area.

Management principles

- 4.4.6 Tree surgery, through crown reduction, should be undertaken as required to ensure long-term health and survival of veteran and mature trees, promoting heartwood decay wherever possible, to increase the numbers of veteran trees present in the long-term..

4.5 Orchards*Current status*

- 4.5.1 There are two orchards present within the Application Site, as shown on Figure 1:

O1 is an abandoned orchard with scattered mature fruit trees and Hawthorn bushes. Dense Bramble covers the majority of the area with small patches of species-poor rabbit-grazed semi-improved neutral grassland dominated by mosses and grasses.

O2 is a small 'orchard' comprising four semi-mature Apple trees and several dwarf trees within an area of species-poor semi-improved grassland. This area is mown and also supports Yarrow (*Achillea millefolium*), Field Bindweed (*Convolvulus arvensis*), Ground Ivy (*Glechoma hederacea*), Dandelion (*Taraxacum officinale* agg.), Upright Hedge-parsley, Ribwort Plantain (*Plantago lanceolata*) and Common Knapweed (*Centaurea nigra*).

- 4.5.2 Both O1 and O2 will be retained as part of the Proposed Development.

Objectives

- 4.5.3 Old orchards are a local conservation priority. The key objectives for orchards are as follows:
- Protect orchard O1 and O2 during construction;
 - Increase the number of fruit trees within the Application Site;
 - Implement appropriate nature conservation management.

Protection measures

- 4.5.4 Orchard O1 and O2 will be fenced off using netlon-type fencing to protect these areas from being accidentally damaged, or accessed during the construction works.

Enhancement measures

- 4.5.5 Fruit trees will be incorporated into the planting scheme. Orchard O1 will be enhanced through the control of encroaching Bramble scrub and planting of new fruit trees.

Management principles

- a) Bramble control
- 4.5.6 Areas of dense Bramble scrub should be removed through mechanical cutting. In year 1 100% of Bramble should be removed. Thereafter Bramble removal should take place once every 3 years, with 100% of encroaching Bramble removed. Bramble removal should take place outside the nesting bird period.
- b) Tree surgery

- 4.5.7 Tree surgery should be undertaken as required to ensure long-term health and survival of old fruit trees.

4.6 Grassland

Current status

- 4.6.1 There is one small area of species-rich semi-improved neutral grassland adjacent to the Application Site, as shown on Figure 1. The grassland was seeded with a wildflower seed mix and a single specimen of Snakeshead Fritillary (*Fritillaria meleagris*) has been recorded (in 2004). This grassland is outside of the Application Site and associated with the World Conservation Monitoring Centre.
- 4.6.2 All other areas of grassland comprise agriculturally-improved grassland or amenity grassland. Some of these areas will be lost to the Proposed Development. The retained areas along the Western Edge will be enhanced as part of the landscape design.

Objectives

- 4.6.3 Species-rich meadow grassland is a local priority for nature conservation. The key objectives for grassland are as follows:
- Enhance the nature conservation value of retained grassland areas;
 - Increase the availability of dry species-rich grassland and wet grassland habitat through the creation of new areas within the Western Edge;
 - Create areas of bare ground that will provide suitable habitat for the nationally scarce lace hopper bug *Reptalus panzeri*.

Protection measures

- 4.6.4 None required.

Enhancement measures

- 4.6.5 New areas of dry species-rich meadow and wet grassland habitat will be created as part of the landscape design for the Western Edge through seeding with an appropriate mix of native species.

Management principles

a) Cutting

- 4.6.6 The majority of the dry species-rich grassland and wet grassland areas should be mown once annually in late-summer. Hay should be left on site to dry for 3-5 days before being removed, to encourage spread of seeds.
- 4.6.7 Species-rich grassland sown in new areas of 'parkland' (see Section 3.5) will be cut more frequently to maintain a short sward.

b) Grazing

- 4.6.8 The hay meadows will be lightly grazed over autumn and winter to maintain a short sward (3cm). This can also help to disturb the ground and encourage areas for the

establishment of new growth from seed. Stock should be removed by the end of February. Small patches of bare ground created during winter grazing should not be allowed to re-seed.

c) Fertiliser

- 4.6.9 Chemical fertilisers should not be used. A light application of manure can be introduced if needed.

4.7 Invertebrates

Current status

- 4.7.1 The Application Site is of importance for an assemblage of wood-decay (saproxylic) invertebrates associated with the mature and 'near veteran' trees present. These trees are concentrated in three areas: the main group of older hedgerows in the south-western part of the Application Site, with mainly mature pedunculate oaks; a line of mature willow trees along the Washpit Brook; and the avenue of horse-chestnut trees. The invertebrate fauna includes several scarce and/or declining species of wood-decay beetles and a nationally scarce species of tree-nesting ant.
- 4.7.2 In addition, the uncommon white-letter hairstreak butterfly (*Satyrus w-album*) is also present, which is associated with Elm trees. There are also desk study records of purple hairstreak (*Neozephyrus quercus*) butterflies in the area, from the Park and Ride site, which could also be present, associated with oak trees, although none were recorded during targeted surveys.
- 4.7.3 The majority of fields are ploughed to the field margins and farm tracks, reducing their likely value for invertebrates. However, a small number of other uncommon species of invertebrate have also been found along the hedgerows and in the fields, including one further nationally scarce species (a lace hopper bug, *Reptalus panzeri*) which was found to be widely present around the arable fields on clayey soils. The ecology of this species is poorly known, although it is thought to require soil cracking caused by summer droughts on land prone to winter flooding. These conditions will be created within the open land along the Application Site's western edge by virtue of the flood storage being provided along the Washpit Brook.
- 4.7.4 The aquatic macro-invertebrate communities at both locations sampled on the Washpit Brook in 2011 were found to comprise a low diversity of common species, representative of such small ditches, with intermittent flow. The sample site at the northern end of the Application Site was significantly more diverse than that within the section of the brook adjacent to the M11. However, its diversity was still low and the communities at both sites were assessed as being of 'low' conservation interest.

Objectives

- 4.7.5 White-letter hairstreak is a national priority species for conservation. The key objectives for invertebrates are as follows:
- Protect and improve water quality within the Washpit Brook;
 - Increase the diversity of wetland habitat available for invertebrates through enhancement of the Washpit Brook and provision of new wetland features;

- Increase the availability of valuable habitat for terrestrial invertebrates, particularly white-letter hairstreak, purple hairstreak and the lace hopper bug *Reptalus panzeri*;
- Protect and enhance the dead wood habitat available, by protecting veteran and mature trees (see Section 4.4 above) and creating piles of dead wood within retained woodlands (see Section 4.2 above).

Protection measures

- 4.7.6 The protection measures set out in relation to protection of habitat features (above) will serve to protect invertebrates. No additional protection measures are required.

Enhancement measures

- 4.7.7 The measures set out in Section 4.1 above, in relation to enhancement of the Washpit Brook, will deliver increased habitat diversity for aquatic invertebrates. The provision of new wetland features as part of the landscape design for the Western Edge will also provide increased habitat availability.
- 4.7.8 The creation of dry species-rich meadows and wet grassland with patches of scrub and areas of bare ground as part of the landscape design for the Western Edge will provide improved habitat diversity for terrestrial invertebrates. Oak and elm trees will be planted, as well as other species, to specifically favour white-letter hairstreak and purple hairstreak.
- 4.7.9 The creation of piles of dead wood from felled material in woodlands will increase the availability of habitat for dead-wood beetles.

Management principles

- 4.7.10 The management principles set out in relation to habitat features (above) will provide appropriate management in relation to invertebrates. No additional management principles are proposed.

4.8 Amphibians*Current status*

- 4.8.1 None of the ponds on the Application Site support breeding great crested newts (*Triturus cristatus*), although a medium sized population of this species does breed in ponds immediately to the south of the Application Site (at the Park and Ride and the Bird Sanctuary (Ponds 1 and 6 respectively)). Great crested newts are therefore likely to use parts of the Application Site during the terrestrial phase of their lifecycle.
- 4.8.2 Common toads (*Bufo bufo*) are present in large numbers in the pond at the World Conservation Monitoring Centre (Pond 4) and the off-site pond at the Park and Ride (Pond 1). Toads are likely to use the habitats present on site during the terrestrial phase of their lifecycle.
- 4.8.3 Smooth newts (*Lissotriton vulgaris*) and common frogs (*Rana temporaria*) also use these ponds as well as other ponds on the Application Site.

Objectives

4.8.4 Great crested newts are a national priority species for conservation and receive legal protection under the Conservation of Habitats and Species Regulations 2010 and the Wildlife and Countryside Act 1981 (as amended). Common toads are also a national priority for conservation. The key objectives for amphibians are as follows:

- Protect individual animals during site clearance and construction;
- Protect features used by breeding amphibians during construction;
- Ensure that any works undertaken are in accordance with current legislation and licensing procedures;
- Increase the availability of breeding habitat for amphibians by creating new features within the Western Edge;
- Provide enhanced foraging habitat for amphibians within the Western Edge;
- Promote safe movement of amphibians between retained and new habitat.

Protection measures

4.8.5 The pond at the World Conservation Monitoring Centre will be fenced off using netlon-type fencing to protect it from being accidentally damaged, or accessed during the works.

4.8.6 Site clearance operations within 500m of the Park and Ride and Bird Sanctuary ponds will take place under licence to Natural England in respect of great crested newts. Temporary one-way amphibian-proof fencing will be installed around the construction site in this location, and newts captured from the affected areas using a combination of methods (pitfall trapping, drift fencing, and artificial refuges). Animals captured during this process will be relocated into the off-site ponds. Works during the period when newts are hibernating (October/November to March) will be avoided as far as possible.

4.8.7 Site clearance operations affecting suitable refuge sites for toads (which includes scrubby vegetation, hedgerows and species-rich grassland) will be undertaken under the supervision of a suitably experienced ecologist. Any toads encountered will be moved to new refuge sites in retained areas around ponds 1 and 4.

4.8.8 All amphibians will be relocated from on-site ponds that will be lost as a result of the Proposed Development. These animals will be captured using appropriate methods and relocated into new or retained ponds within the Application Site. Where necessary, vegetation and invertebrates will be relocated with the amphibians to ensure that suitable habitat exists within the new and retained ponds.

4.8.9 At least three amphibian tunnels will be provided under site access roads in appropriate locations to link the populations:

- Under the Madingley Road link, between the Park and Ride pond and the Bird Sanctuary ponds;
- Under the site access road to the south of the World Conservation Monitoring Centre; and
- Under the site access road to the north of the World Conservation Monitoring Centre.

- 4.8.10 Amphibian-proof fencing will be provided to guide the animals into the tunnels and reduce the likelihood that they will be at risk of mortality on the new road (either due to traffic-related mortality, or mortality in drainage structures, such as gully pots). The tunnels and associated fencing will be designed as an integral part of the detailed design work for the relevant parts of the Proposed Development.

Enhancement measures

- 4.8.11 The landscape design for the Western Edge includes a mosaic of habitats of value for amphibians, including small ponds (to provide breeding habitat) and grassland/scrub to provide foraging habitat and hibernation sites. Artificial hibernation sites will also be constructed on the Western Edge and around the pond adjacent to the World Conservation Monitoring Centre.

Management principles

- 4.8.12 New ponds will be managed to maximise their value for breeding amphibians. Bankside vegetation will not be cut. Emergent vegetation will be removed by hand annually if necessary to retain at least 80% of each pond as open water. Scrub control measures will be implemented if required to prevent shading of the ponds.
- 4.8.13 The management of grassland, scrub and woodland will follow the principles set out in Sections 4.2 and 4.6 above.

4.9 Reptiles

Current status

- 4.9.1 The Application Site may support small numbers of common reptile species, although none have been recorded and the habitat currently present is sub-optimal. The landscaping for the Western Edge would be expected to enhance the value of this part of the Application Site for reptiles.

Objectives

- 4.9.2 Common species of reptiles are protected under the Wildlife and Countryside Act 1981 (as amended) against killing or injury. The key objectives for reptiles are as follows:
- Protect individual animals during site clearance and construction;
 - Provide enhanced habitat for reptiles within the Western Edge;

Protection measures

- 4.9.3 The supervision of site clearance operations by an ecologist identified as a protection measure in relation to amphibians will also serve to protect reptiles.

Enhancement measures

- 4.9.4 The landscape design for the Western Edge includes a mosaic of habitats of value for reptiles, including small ponds (to provide foraging sites for grass snakes) and grassland/scrub (to provide foraging habitat and hibernation sites for all species).

Management principles

- 4.9.5 The management of grassland, scrub and woodland will follow the principles set out in Sections 4.2 and 4.6 above.
- 4.9.6 Features of value for reptiles will be created as part of routine management activities: log piles and brash piles during woodland management, and piles of grass cuttings during mowing.
- 4.9.7 Mowing of meadow areas should be undertaken with an initial cut to a height of 150mm, followed by a second cut to complete the mowing. Ideally, mowing should only be undertaken in warm and sunny conditions when reptiles are more active, and able to move away from machinery.

4.10 Birds

Current status

- 4.10.1 The site currently supports a farmland breeding bird assemblage, which includes a number of species of nature conservation concern. Skylark (*Alauda arvensis*), yellow wagtail (*Motacilla flava*), song thrush (*Turdus philomelos*), starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), linnet (*Carduelis cannabina*), dunnoek (*Prunella modularis*), bullfinch (*Pyrrhula pyrrhula*), yellowhammer (*Emberiza citrinella*) and reed bunting (*Emberiza schoeniclus*) are all listed as priority species for conservation on the UKBAP or LBAP, and/or are listed on the RSPB's 'Red' list of bird species of conservation concern (RSPB, 2009). In addition, whitethroat (*Sylvia communis*) and willow warbler (*Phylloscopus trochilus*) are listed on the RSPB's 'Amber' list as species of conservation concern (RSPB, 2009) and have also been recorded breeding within the site. The site also provides foraging habitat for birds breeding in the adjacent residential areas (such as starling, house sparrow, dunnoek and blackbird (*Turdus merula*)). The site may also be used by foraging barn owls (*Tyto alba*) although they have not been recorded breeding on site.
- 4.10.2 The development of the site is likely to change the species composition of the assemblage of breeding birds. Farmland specialist species, such as skylark, yellow wagtail and linnet, are likely to be lost as the development progresses. Other species are likely to increase in number, as the buildings and associated gardens, and landscaping along the Western Edge, provide increased nesting and foraging habitat.
- 4.10.3 The farmland is also used by wintering birds. The following species of particular conservation concern have been recorded using the Application Site during the winter months: herring gull (*Larus argentatus*); skylark; fieldfare (*Turdus pilaris*); song thrush; starling; linnet; yellowhammer; and golden plover (*Pluvialis apricaria*).

Objectives

- 4.10.4 A number of species of conservation concern are present on the site (see above). All nesting birds are protected under the Wildlife and Countryside Act 1981 (as amended). The key objectives for birds are as follows:
- Protect nesting birds during site clearance and construction;
 - Maximise the availability of nesting and foraging habitat;
 - Provide off-site mitigation measures to off-set the loss of habitat for farmland specialist species (as described in Section 6).

Protection measures

- 4.10.5 Each phase of vegetation clearance and topsoil stripping will be undertaken outside the bird breeding season (that is, not between end-February and mid-August) wherever possible.
- 4.10.6 Where works during the nesting period are unavoidable, the relevant area of the site will be cleared during the preceding winter if at all possible, or surveyed prior to works to confirm the absence of nesting birds. Similarly, surveys should be carried out to confirm the absence of nesting birds from any buildings which may be demolished during the bird breeding season. Should active bird nests be identified, a suitably adequate buffer zone would be put in place between any active nests and construction works in order to avoid disturbance to nesting birds until the chicks have fledged.
- 4.10.7 Netlon-type fencing will be used to denote retained features where nesting birds are present to avoid accidental damage.

Enhancement measures

- 4.10.8 The landscape design for the Western Edge includes a mosaic of habitats of value for breeding and foraging birds, including small ponds and grassland/scrub.
- 4.10.9 Artificial nest sites for a range of species will also be provided, following the guidelines set-out in the South Cambridgeshire Biodiversity Strategy:
- Four kingfisher (*Alcedo atthis*) nest sites will be constructed in the banks of the Washpit Brook. These will be located as two sets of two closely associated nest sites, within locally steepened sections of bank, ideally 1.5m above water level and 0.5m below top of bank.
 - Nest sites for swifts (*Apus apus*), starlings, house sparrows and blue tits (*Cyanistes caeruleus*)/great tits (*Parus major*) will be incorporated into the design of at least 1% of new buildings. These will include internal swift boxes in communal buildings, with calls played to help establish a new colony.

Management principles

- 4.10.10 The management of the Washpit Brook, grassland, scrub and woodland will follow the principles set out in Sections 4.1, 4.2 and 4.6 above.

4.11 Bats*Current status*

4.11.1 The Application Site currently supports a maternity roost of brown long-eared bats in the loft space of the farm house associated with the Gravel Hill Farm complex (see Figure 1). A further roost is present in the porch of the same building, which is considered likely to be used as a day roost by only a small number of common pipistrelle bats (*Pipistrellus pipistrellus*). These roosts will be lost as a result of the Proposed Development. No other bat roosts have been identified although a small number of mature trees provide suitable roost sites for bats and these will be retained.

4.11.2 Up to five species of bats have been recorded commuting and foraging across the site, including noctule (*Nyctalus noctula*), common pipistrelle, soprano pipistrelle (*Pipistrellus pygmaeus*), Daubenton's bat (*Myotis daubentonii*) and serotine (*Eptesicus serotinus*). The overall level of bat activity is low, probably due to low insect biomass associated with the farmland. The greatest level of bat activity is at the southern end of the Application Site, in fields adjacent to houses and woodland. Noctule and pipistrelle bats have been recorded foraging and commuting over open fields, but the majority of bats commute along linear features, primarily hedgerows and woodland edges. In addition, common pipistrelle bats have been observed commuting along the avenue of Horse Chestnut trees. The features of greatest value for bats will be retained as part of the Proposed Development.

Objectives

4.11.3 Noctule, brown long-eared and soprano pipistrelle bats are listed as priority species on the UKBAP. All bats are protected under the Conservation of Habitats and Species Regulations 2010 and the Wildlife and Countryside Act 1981 (as amended). The key objectives for bats are as follows:

- Provide new roost sites in communal buildings to replace the roost lost at Gravel Hill Farm;
- Protect individual bats during site clearance/demolition;
- Ensure that any works undertaken are in accordance with current legislation and licensing procedures;
- Provide enhanced foraging and roosting habitat for bats within the Western Edge.

Protection measures

4.11.4 Re-survey the roost sites prior to demolition. Works may need to proceed under licence to Natural England and should avoid periods when bats are present.

4.11.5 Create bat lofts within at least two of the new communal buildings in the area of the farm house (a roofspace containing suitable roosting features for bats and to which human access is restricted) to enable the roosts to continue to be present in this part of the Application Site. The creation of new roost sites for bats will follow the guidelines set-out in the South Cambridgeshire Biodiversity Strategy and Natural England's 'Bat Mitigation Guidelines' (Natural England, 2004).

4.11.6 Repeat the surveys of all suitable trees and buildings prior to each phase of site clearance to confirm the continued absence of roosting bats from these features. In

the unlikely event that bats are present, works may need to take place under licence to Natural England and may be seasonally constrained.

- 4.11.7 Lighting to be minimised within the Western Edge. No lighting to be provided within the new meadows and scrub areas to the west of the Washpit Brook. Lighting at the sports fields and to the east of the Washpit Brook to be designed to prevent light spillage onto the brook, woodlands, hedgerows and mature trees.

Enhancement measures

- 4.11.8 A proportion of the new buildings on site (at least 1%) will be designed to incorporate features suitable for use by roosting bats, by allowing bats access into roofspaces of communal buildings (such as through raised tiles or cavities at roof apexes, and provision of bat bricks).
- 4.11.9 A total of 50 bat boxes will be provided on retained mature trees to further increase the availability of roost sites. The 50 boxes are to include 3 Schwegler 1FW 'hibernation' boxes; the remainder to be a mix of Schwegler boxes (2F, 2F-DFP, 1FD and 2FN). The boxes are to be installed in the following locations (with approximate numbers and types indicated, although these can be varied slightly, dependent on availability):
- Woodland W1: 22 boxes, including 2 x 1FW, 8 x 2F, 6 x 2FN, 3 x 2F-DFP and 3 x 1FD
 - Woodlands W3 and W4: 16 boxes combined, including 1 x 1FW, 6 x 2F, 3 x 2FN, 3 x 2F-DFP and 3 x 1FD
 - Retained mature trees in hedgerows in the south-western part of the Application Site: 12 x 2F boxes

Management principles

- 4.11.10 The management of the Washpit Brook, grassland, scrub and woodland will follow the principles set out in Sections 4.1, 4.2 and 4.6 above.

4.12 Water voles

Current status

- 4.12.1 The section of the Washpit Brook adjacent to the M11 has a good bankside structure and plenty of in-channel vegetation, making it particularly suitable for water voles, although the southern end of this section is prone to dry out, making it less suitable for water voles. During a survey in 2011 no evidence of the presence of water voles on the Washpit Brook, within the Application Site, was recorded. The Application Site's water vole population has contracted in extent and size over the period during which surveys have been undertaken (2005-2011). The remainder of the brook and associated ditch system within the survey area is considered to be less suitable for water voles, with hedges and tall bankside trees shading and suppressing in-stream vegetation that generally provides more valuable habitat for water voles. In addition, the watercourse is relatively shallow and prone to dry out in places, as well as being poached by grazing animals, despite the presence of stock-proof fencing. The watercourse will be retained but modifications to bank profile will be required in places to allow the creation of a second stage channel to provide flood storage. The most valuable sections of the brook for water voles will be retained intact. Modifications to bank profile will ensure that the most valuable habitat for water voles is not flooded on

a frequent basis. There will be an overall increase in the availability of wetland habitat (by more than 50%) as new backwaters and linear ponds are created. The new sections of channel will have a steep bank (1:1) on one side and a planting shelf where marginal vegetation will become established.

Objectives

4.12.2 Water voles are a national and local priority for conservation. They are protected under the Wildlife and Countryside Act 1981 (as amended). Key objectives for water voles are as follows:

- Protect the water vole population during construction (if still present);
- Provide improved habitat for water voles within the Washpit Brook and any other new wetland features.

Protection measures

4.12.3 Prior to the brook modification works taking place the entire length of the channel will be re-surveyed for water voles. In the unlikely event that works need to take place in an area occupied by water voles, the animals will be relocated in advance of works commencing through 'displacement' by strimming the vegetation and undertaking a careful destructive search, in accordance with current best practice guidance (Strachan and Moorhouse, 2006; Natural England 2008). Water voles will be displaced into the retained sections which provide valuable habitat.

Enhancement measures

4.12.4 The Washpit Brook will be enhanced through the implementation of appropriate management (described in Section 4.1).

4.12.5 New wetland features will be provided within the Western Edge, including lengths of new channel, balancing and attenuation features and permanent ponds. These features will be designed to maximise their value for water voles, by creating steep banks (1:1 slopes), with marginal vegetation planted at the toe of the banks.

Management principles

4.12.6 The management of the Washpit Brook, and any other new wetland features will follow the principles set out in Sections 4.1 above.

4.13 Brown hares

4.13.1 The site currently supports a population of brown hares (*Lepus europaeus*), with a peak count of 35 hares recorded during surveys in 2011. The development will result in the loss of farmland habitat, and therefore the loss of brown hares from the site.

4.13.2 Brown hares are a national and local priority for conservation. The key objective for brown hares is as follows:

- Provide off-site mitigation measures to off-set the loss of habitat for farmland specialist species (as described in Section 6).

4.13.3 No specific protection, enhancement or management measures are required.

4.14 Badgers*Current status*

- 4.14.1 The Application Site supports a single social group of badgers. There are a number of setts present, the status of which vary slightly between years. During a survey in 2010 there was found to be one 'main sett complex' (which comprises two setts which appear to function together as a main sett), three 'subsidiary setts' and two 'outlying setts'. The main sett complex and subsidiary setts will be retained as part of the Proposed Development. Outlying setts may need to be closed.
- 4.14.2 An artificial sett will be provided as an alternative to the main sett complex. Although the main sett will be retained this part of the Application Site will be subject to disturbance as it will form part of a recreational area of Open Land.
- 4.14.3 The resident social group of badgers is likely to lose approximately 90ha of arable land, which is of low value as a foraging habitat. The areas of Open Land, including the Western Edge, will provide approximately 40ha of grassland habitat of high value for foraging badgers.

Objectives

- 4.14.4 Badgers are protected under the Protection of Badgers Act 1992. The key objectives for badgers are as follows:
- Protect badgers and their setts during site clearance and construction;
 - Ensure that any works undertaken are in accordance with current legislation and licensing procedures;
 - Maximise the value of areas of Open Land for foraging badgers;
 - Provide an alternative artificial sett for badgers in an undisturbed part of the site.

Protection measures

- 4.14.5 The northern end of the main sett complex may need to be closed, although the majority of the sett will be retained. Outlying setts may also need to be closed. Any sett closures will be carried out under licence to Natural England and following the methodology set-out in the confidential 'Badger Mitigation Strategy' (January 2011). Other operations involving heavy machinery within 30 metres of any retained setts may also need to proceed under licence to Natural England. A pre-construction badger survey will be undertaken immediately prior to each phase of site clearance to determine whether any new setts are present.
- 4.14.6 An artificial sett will be constructed in advance of Phase 1 of the Proposed Development. The location of the sett and further details in relation to its construction are provided in the confidential 'Badger Mitigation Strategy' (August 2011).

Enhancement measures

- 4.14.7 The grassland habitat within the various areas of Open Land will be managed to maximise their value for foraging badgers, by keeping areas of amenity grassland mown short. The planting of fruit trees as part of the landscape design for the areas of Open Land will also deliver benefits for foraging badgers.

Management principles

4.14.8 No specific management measures are required.

4.15 Otters*Current status*

4.15.1 Otters have not been recorded using the Washpit Brook. The brook provides habitat of limited value to otters, although they may commute along it.

Objectives

4.15.2 Otters are a priority for conservation in the national and local BAPs. The key objective for otters is as follows:

- Provide resting sites and enhanced habitat to encourage otters to use the Washpit Brook and other wetland features.

Protection measures

4.15.3 No specific protection measures are required.

Enhancement measures

4.15.4 The provision of new wetland habitat within the Western Edge will deliver habitat enhancement for otters. In addition, two artificial otter holts will be provided on the Washpit Brook.

Management principles

4.15.5 No specific management measures are required.

5. Education and community involvement

- 5.1.1 A strategy for monitoring the Application Site's biodiversity resource has been set-out in Section 7, below. This provides an opportunity to involve the local residents in conservation activities, educate local residents about biodiversity, and educate local residents about the work undertaken to mitigate the impacts of the Proposed Development. Local residents will therefore be encouraged to participate in monitoring wherever possible (this will not always be possible for health and safety reasons, or due to some monitoring surveys needing to be undertaken by a licensed ecologist). The results of the monitoring will be made available to the local residents.
- 5.1.2 Local community involvement in management activities will also be encouraged. This is likely to be particularly appropriate in relation to management activities for woodland and scrub, orchards, and amphibians. At least one 'work day' will be organised annually, where local residents will be encouraged to participate in management activities. The University of Cambridge will organise work days through an appropriate organisation, such as the local Wildlife Trust.
- 5.1.3 Other opportunities to use the Application Site's biodiversity resource for education will be sought, such as class field trips for the local school.

6. Off-site mitigation measures**6.1 Introduction**

- 6.1.1 As described in the ES, in order to mitigate the loss of habitat as a result of the proposals for certain farmland bird species and brown hares, appropriate levels of funding will be contributed to relevant biodiversity projects, to enhance areas of farmland for these species. Whilst this would represent a mitigation / compensation measure for these species, it would also be expected to deliver an enhancement for other species of farmland birds.
- 6.1.2 The precise mechanisms by which habitat enhancement will be delivered are yet to be determined. However, a number of suggested measures are described below.

6.2 Skylark plots

- 6.2.1 Skylark plots (areas of undrilled patches within wheat crops, approximately 4m x 4m) at a density of 2/ha have been shown to increase breeding success of skylarks by 49% (SAFFIE, 2007). Skylarks nest at a density of up to 0.4/ha in winter wheat (Eraud and Boutin, 2002) and therefore the provision of skylark plots within 50ha of arable farmland sown as winter wheat, or similar, would be expected to increase breeding success to a level which offsets the effects of loss of breeding habitat from within the Application Site.

6.3 Valuable habitat features for nesting linnets and yellowhammers

- 6.3.1 The planting of scrub and/or hedgerows would increase the availability of nesting habitat for linnets and yellowhammers. The planting of at least 200m of dense, species-rich hedgerow, would be expected to offset the loss of the limited nest sites for this species that will be lost as a result of the Proposed Development.

6.4 Valuable foraging habitat for skylarks, linnets and yellowhammers

- 6.4.1 Valuable foraging habitat could readily be created in field corners and in strips adjacent to ditches (straightening field edges where there are 'meanders' in a ditch), by managing field corners as grassy areas, creating uncropped cultivated areas, providing beetle banks, or sowing wild bird seed mix; approximately 2ha of habitat created in this way would offset loss of habitat from within the Application Site. This will also deliver enhanced habitat for brown hares.
- 6.4.2 The measures identified above should follow the methods set-out in Natural England's Entry Level Stewardship Handbook (EF8 – skylark plots; EF1 – management of field corners; EF2 – wild bird seed mixture; EF7 – beetle banks; and EF13 – uncropped, cultivated areas for ground-nesting birds on arable land) (Natural England, 2010). The combination of measures selected should include the provision of permanent habitat features, as well as temporary measures that will need to change location annually in response to crop rotation patterns.
- 6.4.3 The approach to mitigation in relation to farmland birds described above follows the general approach of biodiversity offsetting, as recommended in the UK Government's white paper '*The Natural Choice: securing the value of nature*'.

7. Monitoring strategy**7.1 General***Responsibility*

- 7.1.1 The University of Cambridge will commission ecologists to undertake the monitoring set out in this section. A proportion of the monitoring may be undertaken by local interest groups, although overall responsibility will be assigned to a consultant ecologist. Wherever possible, local residents will be encouraged to participate in undertaking monitoring surveys. Any monitoring surveys requiring protected species licences (bats, great crested newts) will need to be undertaken by a suitably licensed ecologist.

Dissemination of results

- 7.1.2 The results of all monitoring undertaken in any year will be provided in a written report on an annual basis. The report will be submitted to South Cambridgeshire District Council and Cambridge City Council. The report will be made available to local residents.

7.2 Washpit Brook*Monitoring methods*

- 7.2.1 Botanical surveys of the Washpit Brook will be undertaken to determine whether there has been an increase in species diversity.

Frequency, timing and duration of monitoring

- 7.2.2 The survey will be undertaken on a single visit in June/July every two years. Surveys will commence following the implementation of habitat enhancement measures and will continue for 15 years.

7.3 Woodland and scrub*Monitoring methods*

- 7.3.1 Botanical surveys of the woodland areas (W1, W2, W3 and W4) will be undertaken every three years to record ground flora species using the DAFOR scale. Woodland ground flora will be sampled using an appropriate number of quadrats. The survey will also identify non-native tree species and map areas of dense Bramble scrub to inform future management.

Frequency, timing and duration of monitoring

- 7.3.2 The survey will be undertaken on a single visit in April every three years. Surveys will commence 2 years after completion of the first phase of the development and will continue for 15 years.

7.4 Hedgerows

- 7.4.1 No hedgerow monitoring is proposed beyond any monitoring of new hedgerows to inform aftercare.

7.5 Veteran and mature trees*Monitoring methods*

- 7.5.1 All veteran and mature trees will be inspected to determine whether valuable features such as rot holes or torn limbs have developed, and retention of these features discussed with a tree surgeon, where required.

Frequency, timing and duration of monitoring

- 7.5.2 The survey will be undertaken on a single visit every five years during winter or early spring. Surveys will commence 2 years after completion of the first phase of the development and will continue for 15 years.

7.6 Grassland*Monitoring methods*

- 7.6.1 Botanical surveys of the grassland areas will be undertaken every two years to record species using the DAFOR scale. An appropriate number of quadrats will be sampled in each field.

Frequency, timing and duration of monitoring

- 7.6.2 The survey will be undertaken on a single visit in June every two years. Surveys will commence 2 years after the completion of the first phase of grassland enhancement /creation on the Western Edge and will continue for 15 years.

7.7 Invertebrates*Monitoring methods*

- 7.7.1 Aquatic invertebrate surveys of the Washpit Brook will be undertaken every two years following a standard kick-sampling methodology, with 'scores' given following the BMWP approach.

- 7.7.2 Terrestrial invertebrate surveys of the Western Edge will be undertaken every two years, and will include butterfly and dragonfly transects undertaken at an appropriate time of day, specifically targeting white-letter and purple hairstreak butterflies, and targeted searches for the lace hopper bug *Reptalus panzeri*. Surveys for wood-decay beetles and other species associated with veteran and mature trees will be undertaken every five years; this survey will focus on areas of suitable habitat within the Application Site.

Frequency, timing and duration of monitoring

- 7.7.3 Aquatic invertebrate surveys will be undertaken on a single visit in June every two years. Surveys will commence immediately following the start of construction and will continue for 15 years.

- 7.7.4 Butterfly and dragonfly transect surveys will be undertaken on three visits during June/July every two years, timed appropriately to coincide with optimal times for surveying for white-letter and purple hairstreak butterflies. Targeted surveys for the lace hopper bug *Reptalus panzer* will also be undertaken every two years. Surveys for wood-decay beetles and other species associated with veteran and mature trees will be undertaken on a single visit in June/July. Surveys will commence 2 years after the completion of the first phase of enhancement work on the Western Edge, and will continue for 15 years.

7.8 Amphibians

Monitoring methods

- 7.8.1 Torchlight surveys will be undertaken to assess the status of great crested newts and common toads on the site. This will include surveys at all new and retained ponds, as well as two off-site ponds (the Park and Ride pond (Pond 1) and the Bird Sanctuary ponds (Pond 6). Great crested newt surveys will need to be undertaken by a licensed ecologist.

Frequency, timing and duration of monitoring

- 7.8.2 Surveys will commence in the first spring following the start of construction and be undertaken annually for the first three years, and every three years thereafter until 15 years post-construction. The surveys will be undertaken over eight visits in each year of survey:
- Three visits in March, spread out at approximately weekly intervals to record the maximum count of toads. One of the visits should take place in late-March and be used to record great crested newts.
 - Three visits between mid-April and mid-May to record great crested newts within the Park and Ride pond and the Bird Sanctuary ponds (two visits during the same period for all other ponds).
 - Two visits between mid-May and mid-June to record adult great crested newts and any evidence of breeding within the Park and Ride pond and the Bird Sanctuary ponds (one visit during the same period for all other ponds).

7.9 Reptiles

- 7.9.1 Any reptiles identified during other monitoring visits will be recorded (species, life stage, sex and location). Targeted reptile surveys will not be undertaken.

7.10 Birds

Monitoring methods

- 7.10.1 Monitoring of artificial nest sites will be undertaken to determine level of use. This will be undertaken by a suitably experienced surveyor watching for evidence of breeding activity from a suitable distance to avoid disturbance of the birds. Any birds identified during other monitoring visits will be recorded (species, life stage, sex and location).
- 7.10.2 Monitoring of off-site mitigation will be undertaken in agreement with the relevant landowner(s). A suitably experienced ecologist will undertake a breeding bird transect survey, sampling the areas where habitat enhancement measures have

been implemented. Species present, approximate numbers and any evidence of breeding will be recorded.

Frequency and duration of monitoring

- 7.10.3 Monitoring of artificial nest sites will be undertaken on a single visit in May/June. Surveys will commence 2 years after the commencement of the development and will continue for 15 years or until success of the measures has been established.
- 7.10.4 Monitoring of off-site mitigation will be undertaken every two years on two visits (one in April/May and one in June/July). Surveys will commence 2 years after the implementation of the mitigation and will continue for 15 years. A baseline survey will be carried out in advance of the implementation of the mitigation to provide a suitable dataset for comparison.

7.11 Bats

Monitoring methods

- 7.11.1 The bat lofts will be surveyed annually during the summer months by an internal inspection, for evidence of use by bats for at least five years following their completion. Inspections of other artificial roost sites will be undertaken to determine level of use; this will comprise checks of bat boxes and / or 'emergence' surveys at dusk of other features. Internal inspections of bat lofts and bat box checks will need to be undertaken by a licensed ecologist.

Frequency and duration of monitoring

- 7.11.2 The bat loft inspections will be undertaken annually on a single visit in June/July for at least five years following completion of the lofts. Thereafter they will be surveyed every other year in parallel with other artificial roost sites (until success of the measures has been established).
- 7.11.3 The surveys of other artificial roost sites will be undertaken every two years on a single visit in June/July. Surveys will commence 2 years after the commencement of the development and will continue for 15 years (or until success of the measures has been established).

7.12 Water voles

Monitoring methods

- 7.12.1 Field sign surveys will be undertaken along the Washpit Brook and any other wetland features, to determine the extent and (relative) size of the water vole population. Survey methods will follow Strachan and Moorhouse (2006). Latrine counts will be used to determine relative population size.

Frequency and duration of monitoring

- 7.12.2 The survey will be undertaken every two years on a single visit in May/June. Surveys will commence 2 years after the commencement of the development and will continue for 15 years (or until the successful establishment of water voles on the brook has been confirmed).

7.13 Brown hares

- 7.13.1 Any brown hares recorded using the site or the area of off-site mitigation will be recorded during other surveys. Targeted surveys for brown hares are not proposed.

7.14 Badgers*Monitoring methods*

- 7.14.1 The status of the setts on site, including the artificial sett, will be re-assessed annually (see the confidential 'Badger Mitigation Strategy' (August 2011) for further details) .

Frequency and duration of monitoring

- 7.14.2 The survey will be undertaken annually on a single visit during March/April, commencing upon commencement of the development and continuing for 15 years.

7.15 Otters*Monitoring methods*

- 7.15.1 Monitoring of artificial holts will be undertaken to determine level of use. This will be undertaken by a suitably experienced surveyor searching for field signs of otters or other evidence of use. Internal inspections of the structures will not routinely be undertaken. If such a survey (using a fibrescope, for example) is considered necessary, this would need to be undertaken under licence to Natural England.

Frequency and duration of monitoring

- 7.15.2 The survey will be undertaken every two years on a single visit in May/June. Surveys will commence 2 years after the construction of the artificial holts and will continue for 15 years (or until successful occupation of the holts has been determined).

8. References

English Nature (2001). Great Crested Newt Mitigation Guidelines. Natural England, Peterborough.

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Natural England (2004). *Bat Mitigation Guidelines*. Natural England, Peterborough.

Natural England (2008). Water voles – the law in practice (NE86). Natural England, Peterborough.

Natural England (2010). *Entry Level Stewardship: Environmental Stewardship Handbook (Third Edition)*. Natural England, Peterborough.

Strachan, R. and Moorhouse, T. (2006). *Water Vole Conservation Handbook. Second Edition*. WildCRU, Oxford.

SAFFIE (2007). *Skylark plots: best practice guide*.



- Key
- Application Site Boundary

Species rich hedgerow

Species poor hedgerow

Defunct species poor hedgerow

Veteran tree

Woodland

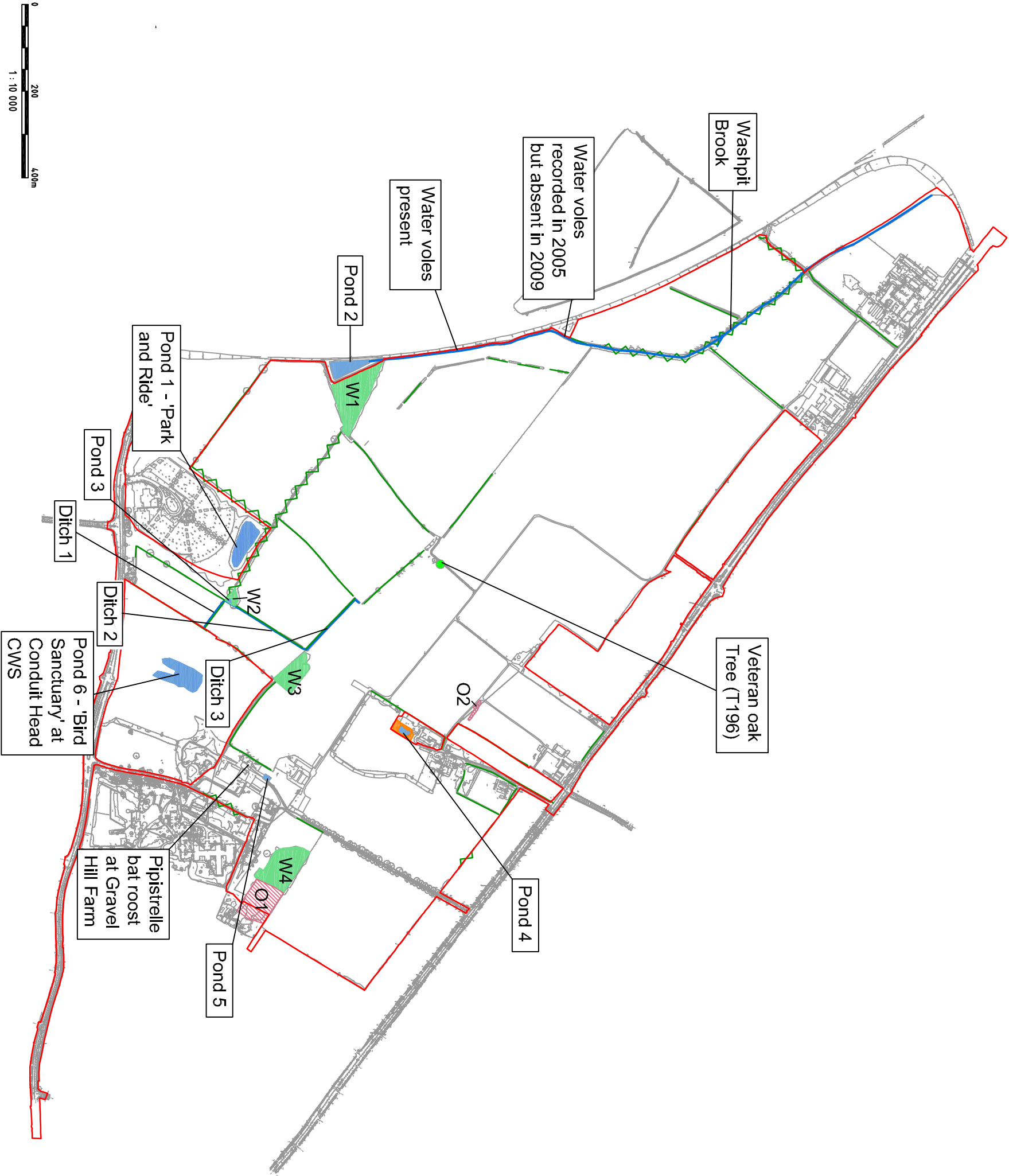
Orchard

Species-rich grassland

Pond supporting great crested newts

Pond not supporting great crested newts

Running water



02	REVISED SITE BOUNDARY	AUG 2011
01	FIRST ISSUE	JUN 2011
Issue	Description	Date


Client

Status
NOT TO BE USED FOR CONSTRUCTION

Scales	1:10000	Author J.JAMESON
Original Size	A3	Checker M.DEAN
Height	0.5	Approver M.DEAN
Grid	0.5	Copyright reserved

Project
NW CAMBRIDGE

Title
BIODIVERSITY STRATEGY
FIGURE 1



HYDER CONSULTING (UK) Limited
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Drawing No. 100 — Project No. UA001601 — Issue 02

Appendix 7.5

Bat Survey

AECOM

North West Cambridge Bat Survey of Trees on Madingley Road

February 2012

Report no: UA001601/C743/BSR/v2

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1 Introduction

This report sets out the methodologies and findings of a bat survey of trees which would be affected by the construction of a new access to the North West Cambridge site from Madingley Road (as shown on drawing D127313-700-104, URS Scott Wilson-). The survey was undertaken in January 2012 by Cresswell (formerly known as Cresswell Associates), the ecological division of Hyder Consulting, on behalf of AECOM.

The site is located on Madingley Road, to the west of Cambridge city centre, and comprises a belt of woodland between the Madingley Road Park and Ride car park and Madingley Road. The site was defined as the area within which a new access road is to be constructed from Madingley Road to the new development site; the boundary is indicated by the red line on Figure 1. The proposals comprise the clearance of an area of mature woodland and landscape planting to allow the construction of a single carriageway access road. Specifically, these proposals will involve the removal of several mature or semi-mature trees to the north of Madingley Road, and one semi-mature ash and a group of approximately ten small trees to the south.

2 Methodology

All trees within the area shown on Figure 1 were assessed in terms of their suitability for use by roosting bats. Potential roost sites (such as holes, cracks, cavities, thick-stemmed ivy, loose bark (Bat Conservation Trust, 2007)) were identified from the ground using binoculars. These features were then inspected using a video fibrescope and/or inspection mirror, and any roosting bats or evidence of use by roosting bats including bat droppings, staining or scratches were identified. Where such features were above ground level the inspections were undertaken from a ladder or by roped access. The survey was undertaken in January 2012 by an experienced surveyor holding a Natural England bat licence and NPTC Certification in tree climbing and aerial rescue.

3 Results and Assessment

Potentially suitable features were identified within a total of six trees, the locations of which are identified on Figure 1. All of these features were considered to have low suitability for use by bats and no evidence of use by bats was recorded. Only two of these trees are likely to need to be felled as a result of the proposed works (those indicated by Target Notes 1 and 2 on Figure 1). It was not possible to comprehensively confirm the absence of bats from the tree indicated by Target Note 3, although it has low suitability for bats and is unlikely to be affected by the construction of the proposed new access. Further details are provided in Appendix 1. None of the other trees within the area surveyed contained features suitable for use by roosting bats.

Although no evidence of use by bats was recorded, and all of the potentially suitable features identified were of low suitability, bats can use sub-optimal features on rare occasions. Therefore, in order to ensure compliance with the legislative protection afforded to bats, it would be appropriate for a pre-construction survey to be undertaken immediately prior to the felling of any of these trees to confirm the continued absence of bats.

4 References

Bat Conservation Trust (2007). *Bat Surveys – Good Practice Guidelines*. Bat Conservation Trust, London

Figure 1 - Site location and locations of trees



Appendix I: Potential bat roost tree-climbing survey results (see Figure 1)

Target Note (Figure 1)	Tree description	Survey results
1	Mature Oak tree (Tree tag number 4395) containing features potentially suitable for use by roosting bats. Narrow horizontal scar/split in primary limb at 10m height, on NE side of tree. This tree is within area of proposed site clearance.	No evidence of use by roosting bats was identified. Scar and split in limb does not form cavity suitable for use by roosting bats, as split immediately tapers down to nothing and does not form a cavity. A small amount of loose bark was identified on dead limbs within the crown, but this was unlikely to be suitable for use by roosting bats.
2	Mature Oak tree (Tree tag number 4396) containing features potentially suitable for use by roosting bats. Knothole on SE side of main trunk at 5m height. This tree is within area of proposed site clearance.	No evidence of use by roosting bats was identified. Knothole c. 40mm diameter extended into rounded blind ending cavity c. 80-100mm diameter. Cavity extended downwards only, and contained evidence of use by nesting or roosting birds. The cavity is relatively open to light and weather, and is unlikely to be used by roosting bats.
3	Standing dead oak tree, containing features potentially suitable for use by roosting bats. Tree has sections of loose bark forming potentially suitable cavities. This tree is unlikely to be affected by proposed site clearance.	It was not possible to climb this tree for health and safety reasons, and the tree was therefore inspected from the ground and a ladder. No evidence of roosting bats was identified within any of the areas inspected, although it was not possible to comprehensively rule it out. Likely to be of low potential only.
4	Semi-mature Ash tree, containing features potentially suitable for use by roosting bats. Large rot cavity in main trunk at 4m height and scar on primary limb at 6m, both features on north side of tree. This tree is unlikely to be affected by proposed site clearance.	No evidence of use by roosting bats was identified. Rot hole into main stem forms cavity c. 100mm diameter x 250mm deep. This cavity was very open and unlikely to be used by roosting bats; it appears to have been used by nesting or roosting birds. Scar on limb does not form any cavities, and is not suitable for use by roosting bats.
5	Semi-mature Ash tree, containing features potentially suitable for use by roosting bats. Small knot hole in end of branch at 2m height, and fold/scar on main stem at 3m height, both features on north side of tree. This tree is unlikely to be affected by proposed site clearance.	No evidence of use by roosting bats was identified. Small knothole c. 40mm diameter x 50mm deep is blind ending and unlikely to be suitable for use by roosting bats. Scar on main trunk does not form any cavities, and is not suitable for use by roosting bats.

Target Note (Figure 1)	Tree description	Survey results
6	Semi-mature Ash tree, containing features potentially suitable for use by roosting bats. Vertical scar/split in main stem at 4-5m height on north side of tree. This tree is unlikely to be affected by proposed site clearance.	Scar on trunk extends upwards into cavity 20-30mm diameter, extending 100mm up into stem. No evidence of use by roosting bats was identified; cavity appears to have been used by nesting or roosting birds.

Surveyor Experience

Tree climbing inspections were undertaken by two qualified tree climbers: Patrick James (survey leader) and Rob Masters, both of whom are experienced in undertaking inspections of trees for bats. Patrick has held a Natural England personal bat licence (current NE Bat Licence No. 20114760) for over five years, and holds equivalent Scottish Natural Heritage (SNH) and Countryside Council for Wales (CCW) personal bat licences for Scotland and Wales. Patrick is an experienced tree climber and holds NPTC Certification in Tree Climbing and Aerial Rescue. In the 14 years he has worked as a consultant ecologist, a high proportion of his work has been focused on bats and he has been the licensed ecologist or an accredited agent on many site-specific bat licences during this time. Patrick's involvement has included leading the initial surveys of trees, buildings and other structures (to confirm either the presence of roosting bats or the suitability of the structure for use by roosting bats) and the implementation of specific mitigation measures (such as directly overseeing the felling of trees containing confirmed or potential roosts, the demolition of buildings containing roosts, and the erection and monitoring of bat boxes and other artificial roost sites). These surveys and mitigation measures have been implemented on a range of development schemes including major road schemes, pipelines and housing developments. Rob is a Senior Ecologist with over 5 years experience in consultancy. His survey experience has included undertaking many bat surveys and inspections to inform ecological appraisals and is currently working towards obtaining a Natural England personal bat licence. Rob has held an NPTC Certification in Tree Climbing and Aerial Rescue since 2008 and has subsequently been involved with the assessment and inspection of potential bat roosts in trees on several major development projects including major road schemes, housing developments and pipelines.

A stylized map of North West Cambridge is shown in the bottom left corner. It is a light brown color and depicts the irregular coastline of the area, including the River Cam and the surrounding land. The map is set against a light blue background that represents the water.

NORTH WEST **cambridge**

Environmental Statement - Appendix 8.7
Geological Site Management Plan
March 2012

North West Cambridge

Geological Site Management Plan

ES Appendix 8.7

February 2012



Prepared for



**UNIVERSITY OF
CAMBRIDGE**

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1 Introduction

1.1 Preamble

- 1.1.1 The University of Cambridge proposes to develop an area of farmland to the north west of Cambridge (“the Site”). This land is currently part of the University Farm. The Development is known as North West Cambridge (“the Proposed Development”).
- 1.1.2 Within the Site a Site of Special Scientific Interest (SSSI) is present known as the Traveller’s Rest Pit SSSI. This has been designated a SSSI due to the national importance of geology it contains. The SSSI status conserves the geology for scientific research.
- 1.1.3 The Proposed Development is the subject of an environmental impact assessment and has been the subject of consultation with a wide range of stakeholders, including members of the public, local authorities affected by the scheme and a range of statutory and non-statutory consultees.
- 1.1.4 Measures to mitigate any adverse environmental effects have been developed through the consultation process with statutory bodies, such as Local Planning Authorities and Natural England.
- 1.1.5 Section 3.7.4 of the Environmental Statement recognises that the construction of the Development Proposals will be subject to a Construction Management Plan. An outline Construction Environmental Management Plan (CEMP) has been prepared and this will be developed further by the appointed contractor and submitted to, and approved by, the planning authority in advance of any construction activities commencing on or off-site. This will include detailed construction provisions, detailed environmental provisions and on-site rules.
- 1.1.6 The CEMP has been discussed with the local planning authorities and relevant consultees, including Natural England.
- 1.1.7 This Geological Site Management Plan (GSMP) will be incorporated into the CEMP to assist in ensuring that the Proposed Development does not have an adverse effect on the notified geological interest. Natural England has been consulted in the preparation of this document

1.2 Purpose and Content of the GSMP

- 1.2.1 This document sets out requirements and recommendations to ensure the geology currently conserved at the Traveller’s Rest Pit SSSI is not damaged during construction works or the operational phase of the Proposed Development. It places restrictions on development and explores options for making the Traveller’s Rest Pit SSSI accessible for public activities and research purposes. The GSMP also outlines the types of works involved in the Proposed Development on which Natural England should be consulted.
- 1.2.2 This document also summarises the ways in which the Proposed Development will deliver the mitigation and enhancement measures outlined in the Environmental Statement and how any issues that arise will be handled to ensure compliance with relevant legislation.

1.3 Legal and Policy Framework

Legislation

- 1.3.1 The Traveller's Rest Pit is designated as a SSSI as a result of its nationally important geology. The site was originally designated in 1959 under the National Park and Access to Countryside Act 1949. It was first notified in 1983 under Section 28A of the Wildlife and Countryside Act 1981. The 1983 notification was varied by Natural England in July 2010 under Section 28B of the Wildlife and Countryside Act 1981, as inserted by Schedule 9 to the Countryside and Rights of Way Act 2000 and amended by Section 56 of the Natural Environment and Rural Communities Act 2006.
- 1.3.2 The Traveller's Rest Pit SSSI notification contains a list of operations which cannot take place at the site without the consent of Natural England.

National Policy

- 1.3.3 The Government's position on the conservation and enhancement of geological sites is given in Planning Policy Statement 9 (PPS9) which outlines the Government's objectives in relation to national planning policies with regard to biodiversity and the conservation of geology. The Statement is taken into account by local planning authorities when preparing regional or local development plans. The main aim in relation to geology is to ensure the conservation and enhancement of geological diversity by making it an integral part of social, environmental and economic development.
- 1.3.4 The Traveller's Rest Pit SSSI has been selected by the Joint Nature Conservation Committee (JNCC) as a Geological Conservation Review Site (GCR no. 1315).
- 1.3.5 Guidance on the conservation of geologically important sites is given by Natural England in their publication 'Geological Conservation, a Guide to Good Practice'. This includes suggested methods for conserving and enhancing a range of geological sites and several case studies.

Local Policy

- 1.3.6 The Traveller's Rest Pit SSSI is mentioned in Cambridge City Council's Local Development Framework North West Cambridge Area Action Plan (2009) as requiring protection.

2 General Site Information

2.1 Site Description and Context

- 2.1.1 The Traveller's Rest Pit SSSI is located in the south eastern part of the Site centred around grid reference TL 429598, immediately south of the World Conservation Monitoring Centre. The location of the Traveller's Rest Pit SSSI is shown in Figure 2.1.
- 2.1.2 The Traveller's Rest Pit SSSI is on land owned by the University of Cambridge.
- 2.1.3 The Traveller's Rest Pit SSSI covers an area of disused gravel pit and an area of adjacent undisturbed ground to the southwest and west of the gravel pit.
- 2.1.4 Part of the Traveller's Rest Pit SSSI included in the 1983 notification was denotified in 2010 following surveys conducted by the University of Cambridge in 2008 which indicated that the geological units of interest had been removed from that part of the site during the original quarrying works (see the Supporting Information to the SSSI notification document by Natural England, 2010). The total area of the Traveller's Rest Pit SSSI is now 2.25 hectares.
- 2.1.5 As part of the renotification process, Natural England published the papers necessary to confirm the List of Operations requiring their consent. This GSMP is based on the Traveller's Rest Pit SSSI within the 2010 notified boundaries as indicated on Figure 2.1. The final notification is included in Annex A.
- 2.1.6 The larger part of the Traveller's Rest Pit SSSI is composed of a level grassed area surrounded on three sides, to the northwest, southwest and southeast, by steeply sloping degraded quarry faces. The steep slopes around the quarry edges are between 3.3 and 3.8m high and have gradients of between 1v:2h and 1v:3h. The ground surrounding the disused quarry is gently sloping to the northeast.
- 2.1.7 The base of the disused quarry has been laid to pasture and the higher ground around the quarry to arable use. The quarry slopes are generally overgrown with long grass, stinging nettles, shrubs and small trees. In places there is evidence of extensive animal burrowing within the slopes. To the southwest of the quarry a concrete single track road leading to University Farm runs parallel to the edge of the quarry.

2.2 Development Proposals

- 2.2.1 A summary of the main elements of the Development Proposals in the vicinity of the Traveller's Rest Pit SSSI is shown in Figure 2.2.
- 2.2.2 As shown in Figure 2.2, the entire area of the Traveller's Rest Pit SSSI and a 10m wide buffer zone around the boundary will be occupied by Primary Open Land. Additional land to the north, east and southwest will also be utilised as primary open land. The existing buildings at the World Conservation Monitoring Centre (outside of the application boundary) and Agronomy Centre will remain.
- 2.2.3 Dual purpose foot/cycle routes will run along edge of the buffer zone to the southwest and northwest of the Traveller's Rest Pit SSSI.
- 2.2.4 Zones containing residential properties will be located to the north and east of the area of open land, these lie over 60m from the Traveller's Rest Pit SSSI boundary.

-
- 2.2.5 An area designated for academic and research facilities will be located to the south. This zone will be no closer than 10m from the southern corner of the Traveller's Rest Pit SSSI. As far as possible, soft development such as open space/landscaping will be included within the Proposed Development, adjacent to the buffer zone.
- 2.2.6 A zone containing residential and complementary mixed use properties will be located to the southwest. This will be separated from the Traveller's Rest Pit SSSI by more than 30m of open green land.
- 2.2.7 A school will be located to the west and northwest. A triangular piece of open land will lie between the Traveller's Rest Pit SSSI buffer zone and the area containing the school buildings. Entrances/fencing to the school will be designed in a way which does not encourage access across the Traveller's Rest Pit SSSI
- 2.2.8 The Traveller's Rest Pit SSSI will be left as Primary Open Land. Some or all of the following changes to the Traveller's Rest Pit SSSI may be considered at the detailed planning stage in consultation and where required with the formal consent of Natural England:
- Creation of an unlit footpath across the Traveller's Rest Pit SSSI. Signs will be erected outside the Traveller's Rest Pit SSSI boundary to warn the general public that access is only suitable during daylight hours.
 - Creation of steps or a ramp for access down the steep disused quarry slopes in association with the footpath.
 - Planting of flowers and/or grasslands.
 - Installation of information points adjacent to the Traveller's Rest Pit SSSI.
- 2.2.9 The details of any of the above proposals would be discussed and agreed with local planning authorities and relevant consultees, including Natural England, at the detailed planning stage.
- 2.2.10 All the built development is indicated outside the 10m buffer zone around the Traveller's Rest Pit SSSI. Therefore likely effects on the Traveller's Rest Pit SSSI will not be directly related to the creation of buildings and roads. The main effect that the Proposed Development will have on the Traveller's Rest Pit SSSI will be related to the increase in the number of people likely to visit the Traveller's Rest Pit SSSI and improvements in the level of maintenance of the Traveller's Rest Pit SSSI.

3 Geology

3.1 Geology

- 3.1.1 The geological map (NERC, 1981) covering the Site, presented as Figure 3.1, indicates Recent and Pleistocene Age Head Gravel and Observatory Gravels overlying Cretaceous Age Gault Formation. The Head Gravel and Observatory Gravels are present as a north south aligned deposit within a larger area of Gault. The map describes the Head Gravel and Observatory Gravels as including ‘irregular patches of poorly sorted flint and chalk gravels at levels higher than the present river terrace system, and of uncertain origin’.
- 3.1.2 The majority of the Traveller’s Rest Pit SSSI located outside of the Traveller’s Rest Pit itself is underlain by the Observatory Gravels.
- 3.1.3 The Observatory Gravels were deposited within a channel structure which cuts into the Gault Formation that underlies the majority of the development site. The Gault is generally described on exploratory borehole logs as firm to very stiff clay.
- 3.1.4 The surveys by the University of Cambridge in 2008 indicate the presence of deeper superficial deposits between the Observatory Gravels and the Gault. These deposits are not present in all areas and geophysical survey sections suggest these materials are infilling channel features cut into the Gault Clay. These deposits generally consist of sand and gravel composed of flint and chalk with silt and clay present in the top metre of the deposit. It has been postulated that these deposits represent ‘tunnel valley’ sediments and are not part of the Observatory Gravels, – i.e. they were deposited from a subglacial river that carved a valley into the Gault Clay beneath the ice sheets that covered this part of the country, possibly during the Anglian glaciation (see Boreham, S. (2008) A Short Report on Ground Conditions at Traveller’s Rest Pit, Girton, Cambridgeshire).
- 3.1.5 The pit side slopes are currently 3.3 to 3.8m high which suggests, when compared with the 5 to 7m thickness of Observatory Gravels described by Marr (in Worssam and Taylor 1969), Boreham (2008c) and Green (2008) that about 2m of Observatory Gravel could underlie the base of the pit. In some areas this has been excavated and replaced by made ground. In other areas the borehole descriptions provided by Boreham (2008a) do not differentiate between the Observatory Gravel and the Tunnel-valley channel-fill.
- 3.1.6 Preliminary exploratory holes carried out for the Project indicate that the Observatory Gravels are absent, or thin, under some parts of the base of the pit where made ground is present.

3.2 Geological features

- 3.2.1 Observatory Gravels are present within the Traveller’s Rest Pit SSSI. These contain non-marine cold water mollusc fossils and ice wedge casts, both of which indicate deposition under cold climatic conditions. The gravels have also yielded fossil remains of large vertebrates (red deer and horse) and Palaeolithic worked flints.
- 3.2.2 The geological succession recorded in a 5.8m high face of the Traveller’s Rest Pit by Marr in 1920 is reported in Worssam and Taylor (1969) as the following (numbering as original):
- (iv) upper evenly bedded gravels

-
- (iii) brown sandy loam with scattered flint pebbles and some seams of gravel
 - (ii) unevenly bedded gravels
 - (i) lower evenly bedded sands and gravels
- 3.2.3 These deposits consist mainly of subangular flints and contain ‘an unusual number of large boulders up to 300mm in diameter’ (Worssam and Taylor, 1969). The boulders are composed of rocks derived from Glacial Till in the area including red chalk, a type similar to the Corallian Beds of Yorkshire.
- 3.2.4 Frost cracks were recorded in the unevenly bedded gravels and cryoturbation in the brown sandy loam.
- 3.2.5 Stone age (Chellean, Acheulian, Early Levalloisian and Clactonian type) implements were found in layer (ii) and (i).
- 3.2.6 Worssam and Taylor, 1969 record that further excavations revealed that in places the ‘unevenly bedded gravels’ consisted of evenly bedded layers of gravel, sand and fine loam. Within these loam seams molluscs indicating cold conditions were recorded.
- 3.2.7 Fossil remains of red deer, rhinoceros and horse have also been recorded at this site (Boreham, 2002).
- 3.2.8 The Traveller’s Rest Pit SSSI notification states that the reason for preservation of this site is that it contains a ‘unique exposure in fossiliferous cold stage gravels, sands and silts of a high-level terrace (Observatory Gravels).’ The 2010 notification assigns the deposits to the Anglian Stage of the Pleistocene Period.
- 3.2.9 These deposits have been viewed in the past, as either stream/river deposits or glacial outwash deposits. Boreham (2002) suggested that the Observatory Gravels represent deposition in a braided stream which, at some point in its history, became exposed to cold conditions during which cryoturbation and ice wedge formation took place. Further braid plain deposition covered up these structures.

4 Site Evaluation

4.1 Site Condition and Use

General

- 4.1.1 The following is a general description of the condition and use of the site when visited in August 2010.

Table 4.1 Site Condition and Use

Location	Description
Base	Generally grass. Potentially grazed.
North east boundary	As above. Partially fenced.
South east slope	Overgrown with stinging nettles and similar height vegetation. Grass growth sparse. Occasional Elderberry shrubs. Numerous animal burrows.
South west slope	Mainly good grass cover with occasional sparse patches under trees. Occasional Ash, English Elm and Hawthorn trees and Elderberry and Field/Dog rose bushes. Occasional animal burrows. Occasional areas covered in stinging nettles especially where burrows are present. Signs of slope movements observed.
North west slope	Covered in trees mainly English Elm, Ash and Hawthorn with a Walnut. Occasional Elderberry bushes. Stinging nettles also present. Extensive burrowing around tree roots. Slope covered in animal excavated gravel.
North west above slope	Along part of length a single lane concrete road parallel with crest of slope. Remainder open ploughed field.
South west above slope	Single lane concrete road parallel with crest of slope. At north west end concrete storage area. Remainder open arable field.
Access	Pedestrian access is via steps or a ramp cut into the soil forming the slope at the south-east / south-west corner. Vehicular access is from the northern side of the site.

- 4.1.2 Sheep are reported to graze the area (PBA, 2007). A water trough is present in the base of the pit.
- 4.1.3 The trees within the Traveller's Rest Pit SSSI are not subject to tree preservation orders (Lockhart Garratt Ltd, 2010).

Summary

- 4.1.4 A Biodiversity Guidance report by University of Cambridge Estate Management (2008) indicates that English Nature (now Natural England) rated the condition of the Traveller's Rest Pit SSSI as 'favourable' as all preservation targets had been met. Animals are excavating the Observatory Gravels.
- 4.1.5 The geological features listed in 3.2 above are currently covered in vegetation.

5 Objectives

5.1 Protect and Enhance

- 5.1.1 Planning Policy Statement 9 (PPS9) and the Natural England publication 'Geological Conservation - a Guide to Good Practice' highlight the requirement to mitigate potential damage to a SSSI caused by development and to protect and enhance the geological resource.
- 5.1.2 Protection is achieved by ensuring the condition and extent of the geological resource does not deteriorate. In part this is achieved through restricting development that may have a significant detrimental effect on the SSSI. Protective measures can also be implemented as part of the design of the Development or secured by way of planning condition or section 106 obligation in order to reduce the likelihood of a SSSI being adversely affected by development.
- 5.1.3 To avoid damage to the Observatory Gravels, observations and records of the geology will be made in the event that any excavations are permitted by Natural England.
- 5.1.4 Enhancing the geological resource can be achieved by implementing measures that improve and maintain the condition of the resource and its accessibility for scientific research as well as increasing public awareness and understanding of the importance of the site through improved public access to the Traveller's Rest Pit SSSI.

6 Site Management Proposals

6.1 General

- 6.1.1 All proposals for the Traveller's Rest Pit SSSI, including the future management regime, are included in this Geological Site Management Plan, which is subject to consultation with Natural England. All proposals for the Traveller's Rest Pit SSSI are subject to formal consent and approval by Natural England.
- 6.1.2 The measures to avoid, or manage, potential adverse effects on the Traveller's Rest Pit SSSI outlined in this Geological Site Management Plan will feed into the detailed masterplanning, engineering design, specification and construction of the Proposed Development. Compliance with this Geological Site Management Plan is expected to be enforced by means of planning condition.

6.2 Works Requiring Natural England's Consent

- 6.2.1 The operations listed below are extracted from the Traveller's Rest Pit SSSI notification as being potentially damaging to the features of interest of the Traveller's Rest Pit SSSI. Before any of these operations is undertaken within the Traveller's Rest Pit SSSI, Natural England must be consulted as their consent will be required in advance of any operation commencing:
- Cultivation, including ploughing, rotovating, harrowing, and re-seeding.
 - Dumping, spreading or discharging of any materials.
 - Tree and/or woodland management and alterations to tree and/or woodland management (including planting, felling, pruning and tree surgery, thinning, coppicing, changes in species composition, removal of fallen timber).
 - Draining (including the use of mole, tile, tunnel or other artificial drains).
 - Infilling or digging of ditches, dykes, drains, ponds or pits.
 - Extraction of minerals, including hard rock, sand, gravel, silt, clay, topsoil, subsoil, chalk and spoil.
 - Destruction, construction, removal, rerouting or regarding of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, including soil and soft rock exposures or the laying, maintenance or removal of pipelines and cables, above or below ground.
 - Storage of materials.
 - Erection of permanent or temporary structures, or the undertaking of engineering works, including drilling.
 - Modification of natural or man-made features, (including cave entrances) and clearance of boulders, large stones, loose rock or scree,
 - Battering, buttressing or grading of geological exposures and cuttings (rock and soil) and infilling of pits and quarries.
 - Removal of geological specimens, including rock samples, minerals and fossils,
 -

6.3 Planning and Design to Protect the SSSI

- 6.3.1 The following enhancement works will be incorporated into the detailed design of the Development Proposals so as to avoid likely significant adverse effects of the Proposed Development on the Traveller's Rest Pit SSSI.
- 6.3.2 As much as possible access will be made in areas outside the 2010 notified SSSI boundary. Ramps for disabled access will be formed outside the 2010 notified SSSI boundary.
- 6.3.3 **Any necessary** paths will preferentially be located on ground not underlain by Observatory Gravels. Where it is necessary for paths to cross areas underlain by Observatory Gravels, the form of path chosen should enable it to be moveable and/or demountable ('roll-up') to allow future access for research. Paths shall be raised to ensure that they do not introduce a requirement for the Observatory Gravels to be removed during their construction. Concrete or bituminous paths will not be permitted as they would effectively sterilise the ground below and thereby preclude future research
- 6.3.4 The design of any steps down the quarry slopes, within the Traveller's Rest Pit SSSI boundary, will be discussed and agreed with local planning authorities and relevant consultees, including Natural England, at the detailed planning stage. The use of steps formed by cutting into the slope will not be permitted as they could potentially destroy the local geology. Natural England will not permit Observatory Gravels to be re-used. Before the steps are installed, mitigation measures will be required, including a survey of the geology. Steps down the quarry slopes, within the Traveller's Rest Pit SSSI boundary, will be created by using structures such as wooden steps or localised earthworks which will be designed to ensure that:
- disturbance to the geology will be minimised and
 - access to the underlying geology is not permanently prevented.
- 6.3.5 Planting of deep rooting shrubs, plants and trees will not be permitted on areas within the Traveller's Rest Pit SSSI or the buffer zone to the Traveller's Rest Pit SSSI underlain by Observatory Gravels as roots penetrating into the Observatory Gravels could have the potential to disturb the sedimentary structures within the geological sequence and toppling trees could significantly disturb the sequence of strata within the root zone. Species outside the Traveller's Rest Pit SSSI and the buffer will be selected and positioned to ensure that their roots are unlikely to penetrate the buffer.
- 6.3.6 Any planting must not prevent access to the Observatory Gravels within the Traveller's Rest Pit SSSI. Planting and landscaping in the Traveller's Rest Pit SSSI or the Traveller's Rest Pit SSSI buffer must be agreed with Natural England.
- 6.3.7 No structures including lighting and street furniture will be constructed within the Traveller's Rest Pit SSSI. Information boards could be located within the buffer to the Traveller's Rest Pit SSSI.
- 6.3.8 Children's play areas and hard surface sports facilities will not be located within the Traveller's Rest Pit SSSI boundary as they would effectively sterilise an area of ground because of the need to break out, and later reinstate, the working areas during geological research.
- 6.3.9 Ponds will not be located within the Traveller's Rest Pit SSSI or in close proximity to the Traveller's Rest Pit SSSI as they have a high probability of disturbing or destroying the

geological resource and are likely to restrict access to significant areas of the resource for future research.

- 6.3.10 Drainage pipes and buried services will not be laid within or over the Traveller's Rest Pit SSSI as they have the potential to damage the geological resource during the trenching operation.

6.4 Construction Management

- 6.4.1 The contracts awarded for the Proposed Development will include a requirement for the appointed contractor to comply with the requirements of the GSMP.
- 6.4.2 Under standard conditions of contract the Contractors are required to comply with all relevant environmental legislation and to take account of published standards, accepted industry practice, national guidelines and codes of practice appropriate to the scheme. For the duration of the contract, the University of Cambridge will monitor the environmental performance of the Contractor through site inspections and audits. Natural England will be informed should issues arise in relation to the Traveller's Rest Pit SSSI.
- 6.4.3 The Contractor will operate an induction scheme to ensure all employees are aware of the site rules and their environmental responsibilities, to identify training needs for personnel and to provide appropriate training. The training will include 'toolbox talks' for site operatives to maintain an appropriate level of awareness of the importance of the Traveller's Rest Pit SSSI and the site rules in place to ensure it is not damaged or disturbed.

6.5 Work to Enhance the Site

- 6.5.1 Enhancing the geological resource will be achieved by implementing measures that improve the condition of the resource, and also by improving public awareness of the importance of the Traveller's Rest Pit SSSI and improving access to the Traveller's Rest Pit SSSI for study.
- 6.5.2 Existing fencing and gates will be removed from the edges of the Traveller's Rest Pit SSSI. The boundary of the Traveller's Rest Pit SSSI may be delineated in a form to be agreed with Natural England at the detailed planning stage.
- 6.5.3 The farm access road and storage area located on ground outside the pit but within the Traveller's Rest Pit SSSI will be removed once an alternative access has been established. The area within the Traveller's Rest Pit SSSI currently occupied by the road, storage area and farmland will be reinstated as grassland.
- 6.5.4 Vegetation within the Traveller's Rest Pit SSSI will be managed, in particular by removal of trees and shrubs in poor condition from the degraded quarry slopes and regular maintenance of grass and trees/shrubs to ensure that the geological resource is not damaged. Trees that need to be removed will be cut down to leave the roots and a stump. Full removal is not required as this could destabilise the pit faces and potentially damage the geological interest. Tree stumps will be treated to prevent re-growth. Exposed gravels on the slopes will be covered with topsoil and seeded to reduce erosion and help stabilise the slopes.
- 6.5.5 Ongoing maintenance will be required during the Proposed Development to maintain the grassed surface. Management and maintenance proposals will be agreed in detail with Natural England and formal consent obtained where required.

- 6.5.6 Currently there are extensive animal burrows on the slopes that are actively disturbing the structure of the Observatory Gravels in some areas. The effects and extent of the burrowing will be monitored in conjunction with Natural England during the implementation of the Proposed Development; it is not currently considered necessary to define a disturbance threshold although, dependent on the results of the monitoring, this may be required at some stage in the future.
- 6.5.7 The monitoring will be carried out in accordance with the Biodiversity Strategy and Badger Strategy, and will form part of a management agreement for the site.
- 6.5.8 If deemed necessary public access to the most sensitive areas, such as the slopes could be controlled or discouraged by designating accesses and routes and by use of barriers or planting. This will be agreed with Natural England and formal consent obtained where required.
- 6.5.9 **Any necessary** paths will be formed around (but generally not within) the SSSI to facilitate access by the general public, students and researchers. Paths that cross areas underlain by Observatory Gravels within the SSSI will be moveable and/or demountable ('roll-up'). Where it is necessary for paths to cross areas underlain by Observatory Gravels in the Traveller's Rest Pit SSSI, the form of path chosen should enable it to be relocated to allow future access for research.
- 6.5.10 Public information that explains the importance of the geology in its regional and national context will be provided within the buffer of the Traveller's Rest Pit SSSI. The appropriate experts within Natural England and the University of Cambridge will be consulted on the content of the information points. It has been agreed with Natural England that an exposure of the geology is not appropriate.

6.6 Work to Protect the SSSI during Construction

- 6.6.1 The boundary of the Traveller's Rest Pit SSSI and the associated 10m buffer zone will be established and physically marked on the ground prior to any construction work commencing.
- 6.6.2 No construction activities (e.g. storage of materials, access for movement of construction traffic) will take place in the SSSI without the consent of Natural England.
- 6.6.3 No storage of fluids, waste, soil, construction materials or vehicles will take place within the SSSI or the 10m buffer zone.
- 6.6.4 A control strategy will be set up in conjunction with University of Cambridge, Natural England and the World Conservation Monitoring Centre to manage access to the Traveller's Rest Pit SSSI for:
- work on mitigation and enhancement measures and
 - study and research purposes.
- 6.6.5 If the contractor deems it necessary in order to prevent damage or disturbance to the Traveller's Rest Pit SSSI during construction, the Traveller's Rest Pit SSSI will be securely fenced.
- 6.6.6 Where the Traveller's Rest Pit SSSI is fenced during construction, gates will be provided to ensure access only takes place at designated locations in accordance with the control strategy.

- 6.6.7 Everything listed within section 6.2 of this document requires the consent of Natural England.
- 6.6.8 Controlled vehicular access into the base of the pit to carry out mitigation and enhancement measures will be provided using the existing access adjacent to the WCMC and Agronomy Centre. This route does not cross the pit slopes within the Traveller's Rest Pit SSSI. The arrangements for access will be included within the specific consent (from Natural England) for each operation.

6.7 Work to Mitigate disturbance during Enhancement Works

- 6.7.1 If during enhancement works there is potential to encounter Observatory Gravels within the Traveller's Rest Pit SSSI, a Quaternary Geologist shall be available to survey and record the geology prior to and during this construction. This will help to reduce risk of potential loss of areas of the Observatory Gravels within the Traveller's Rest Pit SSSI, or to reduce accessibility for future research. The requirements of such surveys shall be agreed with Natural England but are likely to include mapping, sketches, photographs and descriptions of the strata, fossils, sampling, and sedimentary structures.
- 6.7.2 If during enhancement works sands and gravels are encountered at locations where they are not anticipated, the work shall be stopped until the geology and any archaeological deposits have been assessed by appropriate professionals. Where the soil within the Traveller's Rest Pit SSSI is Observatory Gravels it shall be recorded as outlined above. Archaeological deposits should be recorded as outlined in the Archaeology and Built Heritage Management Plan.
- 6.7.3 Where Observatory Gravels are encountered unexpectedly within the Traveller's Rest Pit SSSI, type and locations of the enhancement works will be reviewed.
- 6.7.4 These operations would be subject to specific consent from Natural England.
- 6.7.5 Bona fide scientific access for further research and survey work (e.g. via excavating faces, trenching, trial pits, borehole survey, non destructive survey such as ground penetrating radar) along with any necessary remediation/reinstatement works will be accommodated at the Traveller's Rest Pit SSSI.

6.8 Maintenance

- 6.8.1 Ongoing maintenance will be required to maintain the grassed surface established during the Proposed Development. Undergrowth, trees and shrubs will not be allowed to re-establish after removal during the Proposed Development.
- 6.8.2 If areas of gravel become exposed these should be treated with topsoil and grass seed to reduce erosion and if located on disused quarry sides help stabilise the slopes.
- 6.8.3 Additional information will be provided to Natural England to secure consent for these operations.

7 Other Management Plans

7.1 Introduction

- 7.1.1 The actions required in the GSMP must be carried out in conjunction with the requirements of other site Management Plans presented in the Construction Environmental Management Plan including the Biodiversity Strategy and the Archaeology and Built Heritage Management Plan (which will be prepared before construction activities commence). The broad objectives, measures and recommendations of these plans are outlined below:

7.2 Biodiversity Strategy

- 7.2.1 The objectives of the Biodiversity Strategy are to enhance nature conservation within the Application Site, and control and limit disturbance to areas of nature conservation interest and protected species in accordance with relevant legislative requirements and accepted industry practice.
- 7.2.2 The Strategy includes the monitoring of both on and off-site biodiversity mitigation/compensation measures.
- 7.2.3 The Strategy includes details of action to be taken and mitigation measures to be employed if protected species are located on the Application Site.

7.3 Badger Strategy (confidential)

- 7.3.1 The Badger Strategy contains recommendations concerning appropriate timing and licences required to close badger setts, clear vegetation and update badger surveys.

7.4 Archaeology and Built Heritage Management Plan

- 7.4.1 The objective of the Archaeology and Built Heritage Management Plan (ABHMP) is to ensure that works are carried out in such a way as to avoid or minimise, as far as practicable, potential damage and disturbance to scheduled monuments, archaeological sites and deposits, and buildings of historic interest. These resources will be managed in accordance with accepted industry practice guidance and relevant standards.
- 7.4.2 There is potential for archaeological remains to be found in the Observatory Gravels at the Traveller's Rest Pit SSSI.
- 7.4.3 The ABHMP will contain recommendations on recording and, where necessary, recovering any archaeological remains.

8 References and Bibliography

Cambridge City Council

- Traveller's Rest Pit SSSI, Cambridgeshire Notifications (1983) (www.cambridge.gov.uk - 2010)

Natural England

- Traveller's Rest Pit SSSI, Cambridgeshire Notifications (2010)
- Traveller's Rest Pit SSSI – supporting information (2010)
- Further protection for an important Ice Age site in Cambridge (www.naturalengland.org.uk - 2010)

Natural Environment Research Council

- British Regional Geology – East Anglia and adjoining Areas (1961)
- Geology of the Country around Cambridge, Worssam and Taylor (1969)
- Geological map: Cambridge, Sheet 188 Solid and draft edition (1981)

Peter Brett Associates (PBA)

- Preliminary Geotechnical and Geoenvironmental Baseline Condition Study (2007). Project Reference 12992.

QUEST, University of Reading

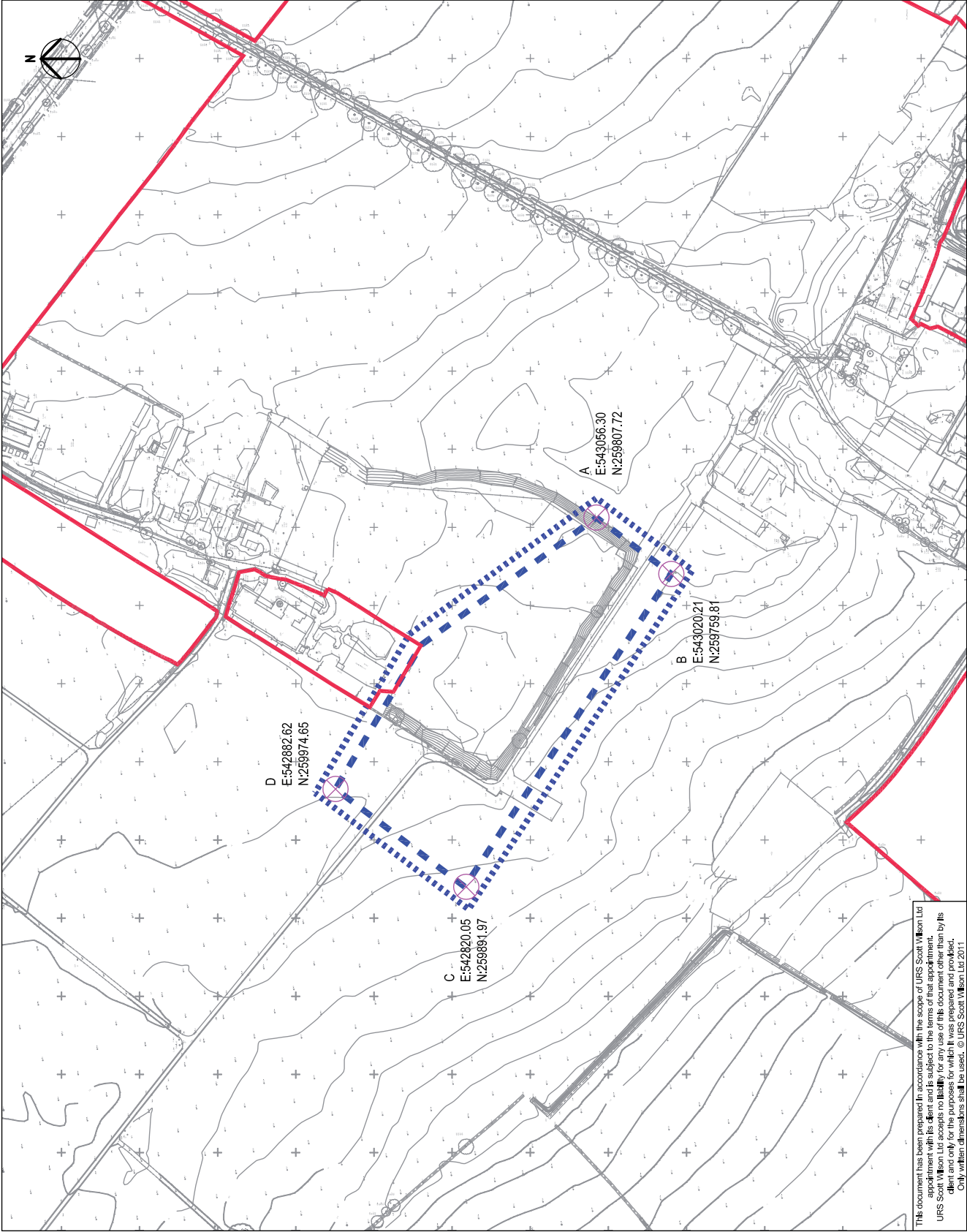
- Traveller's Rest Pit, Girton, Cambridgeshire: Report on the Field and Laboratory Investigations by CP Green (2008)

United Nations Environment Programme – World Conservation Monitoring Centre

- History behind the Site (www.unep-wcmc.org - 2010)

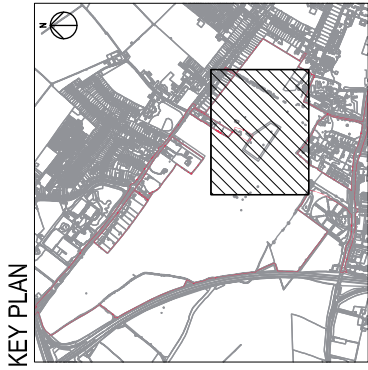
University of Cambridge

- Extract concerning Traveller's Rest Pit from Dr. Steve Boreham's PhD thesis 'The Pleistocene Stratigraphy and Palaeoenvironments of the Cambridge District' (2002), Open University
- Short Report on Ground Conditions at Traveller's Rest Pit, Girton, Cambridgeshire by Dr. Steve Boreham (2008). Included in Area Action Plan papers reference UoC/NWC/AAP/B8.
- Original and Revised SSSI Reason for Notification (unknown date)
- Report on Ground Penetrating Radar Investigations Adjacent to Traveller's Rest Pit, Girton, Cambs by Dr Steve Boreham (2008)
- Report on Ground Conditions in Archaeology Trenches Adjacent to Traveller's Rest Pit, Girton, Cambs by Dr Steve Boreham (2008)



KEY

- APPLICATION SITE BOUNDARY
- SSSI 2010 NOTIFICATION
- SSSI 2010 NOTIFICATION 10m BUFFER
- NATURAL ENGLAND CO-ORDINATES



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Number 010003673

Figure 2.1

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Chk	JSBR	Date	MAY 11	Date	-

UNIVERSITY OF CAMBRIDGE

NW CAMBRIDGE

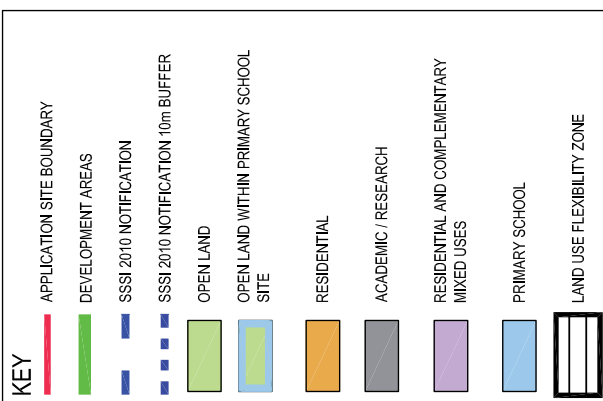
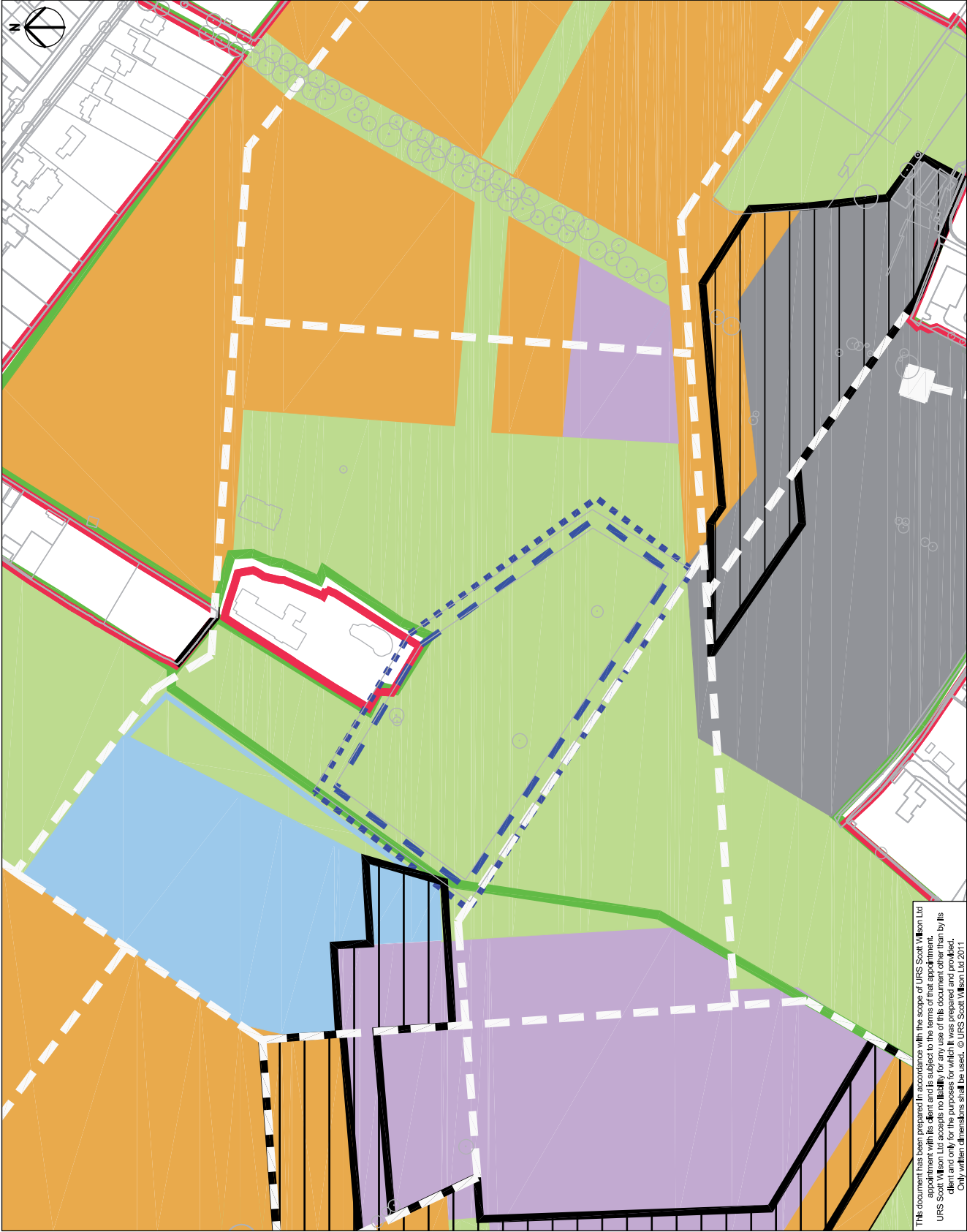
TRAVELLER'S REST PIT SSSI

LOCATION PLAN

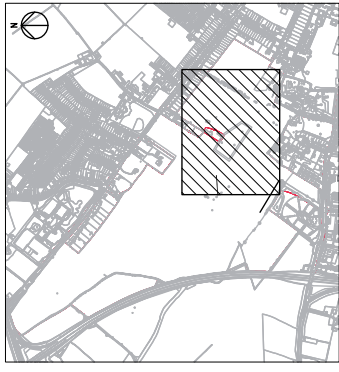
Drawing Title

Client

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KEY PLAN



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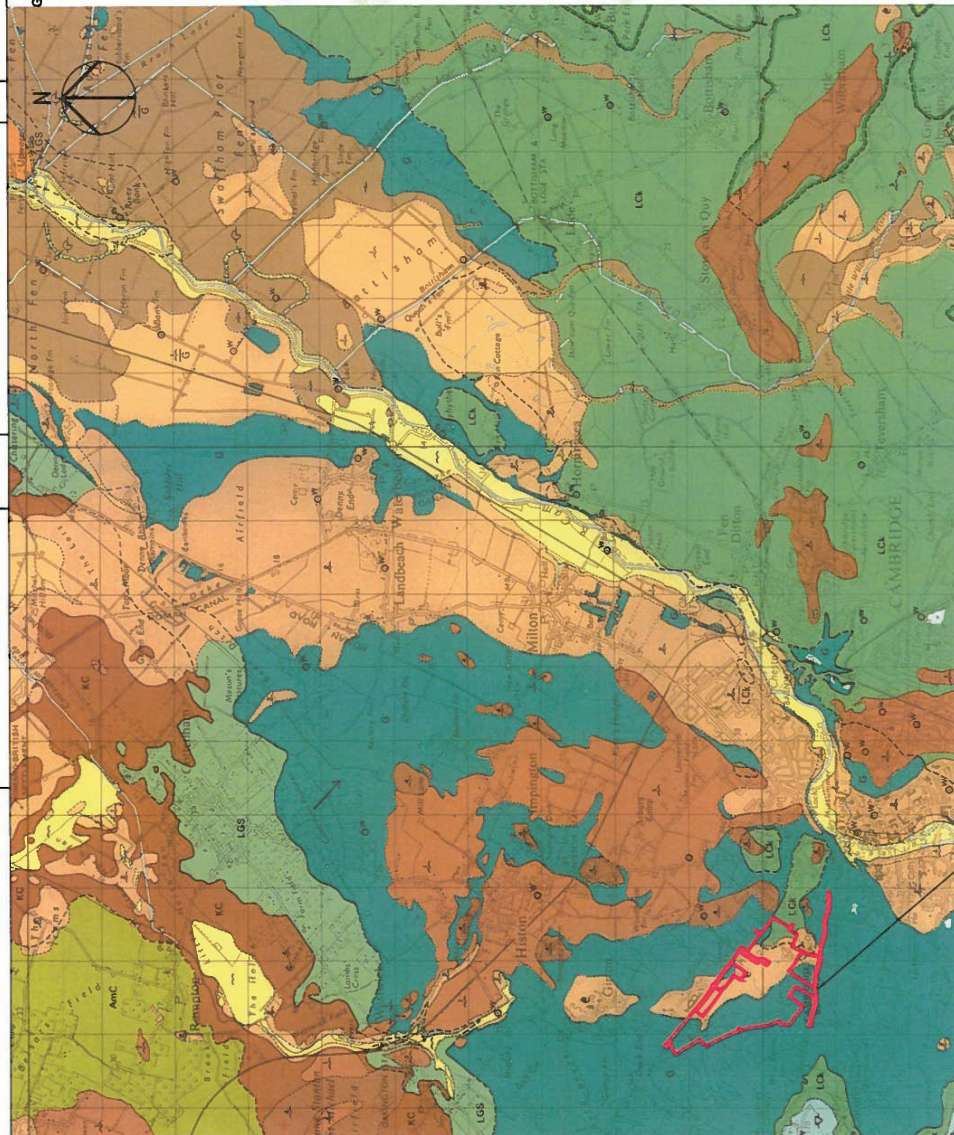
NW CAMBRIDGE
TRAVELLER'S REST PIT SSSI
WITH LAND USE PARAMETER PLAN

Figure 2.2



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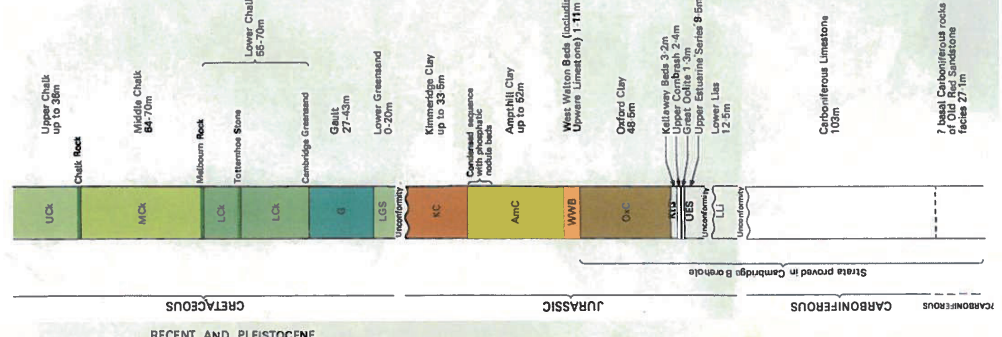
NORTH WEST CAMBRIDGE APPLICATION SITE BOUNDARY

INDEX AND EXPLANATION OF GEOLOGICAL SYMBOLS AND COLOURS

- DRIFT QUATERNARY**
- Blown Sand
 - Lacustrine Deposits
 - Shell Marl
 - Peat
 - Alluvium
 - 1st Terrace Deposits
 - 2nd Terrace Deposits
 - 3rd Terrace Deposits
 - 4th Terrace Deposits
 - Head
 - Head Gravel and Observatory Gravel
 - Glacial Sand and Gravel
 - Boulder Clay
 - Glacial Silt
- SOLID CRETACEOUS**
- Upper Chalk
 - Middle Chalk
 - Lower Chalk
 - Melbourn Rock
 - Cambridge Greensand
 - Gault
 - Lower Greensand
- JURASSIC**
- Kimmeridge Clay
 - Anglii Clay
 - West Walton Beds including Upward Limestone
 - Oxford Clay
- See also Generalized Vertical Section
- Horizontal strata
 - Inclined strata, dip in degrees
 - Anticline
 - General or regional dip of strata
 - Geological boundary, Drift
 - Geological boundary, Solid
 - Fault, surface crossmark indicates downthrow side
 - Broken lines denote uncertainty
 - Borehole
 - Water well or borehole

GENERALIZED VERTICAL SECTION

Scale 1cm to 20m (1:2000)



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

NOTES: THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RISK REGISTER AND SAFETY PLAN. THE HAZARDS NOTED ARE IN ADDITION TO THE NORMAL HAZARDS AND RISKS FACED BY A COMPETENT CONTRACTOR WHEN DEALING WITH THE TYPE OF WORKS DETAILED ON THIS DRAWING.

CONSTRUCTION RISKS

MAINTENANCE/CLEANING RISK

DEMOLITION RISKS

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Scale at A2
1:50000

Client
UNIVERSITY OF CAMBRIDGE

Drawing Title
NORTH WEST CAMBRIDGE GEOLOGY

Revision Details

By	Date	Check	Suffix

Drawing Status
PRELIMINARY

Figure 3.1

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Figure 3.1	Figure 3.1

Annex A: SSSI Notification

Site name: Traveller's Rest Pit

County: Cambridgeshire

District: Cambridge

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981, and subsequently varied under Section 28A of the Wildlife and Countryside Act 1981, as inserted by Schedule 9 to the Countryside and Rights of Way Act 2000. Additional land notified under Section 28B of the Wildlife and Countryside Act 1981, as inserted by Schedule 9 to the Countryside and Rights of Way Act 2000.

Local Planning Authority: Cambridge City Council, Cambridgeshire County Council

National Grid reference: TL429598

Area: 2.25 ha

Ordnance Survey Sheet 1:50,000: 154

1:10,000: TL 45 NW

Date notified (under 1981 Act): 1 December 1983

Date of variation: 23 July 2010

Date additional land notified: 23 July 2010

Reason for notification:

This site provides a unique exposure in fossiliferous cold stage gravels, sands and silts of a high-level terrace (Observatory Gravels). The composition of non-marine molluscan assemblages from the silt bands implies deposition under cold climatic conditions. Ice wedge casts formed by the prising apart of sediments by ice as they were being deposited, and the subsequent infill and preservation of wedges by overlying sediments, indicate continuous permafrost. Traveller's Rest Pit is an important site preserving sediments that, on the currently available evidence, are most appropriately assigned to the Anglian Stage of the Pleistocene Period.

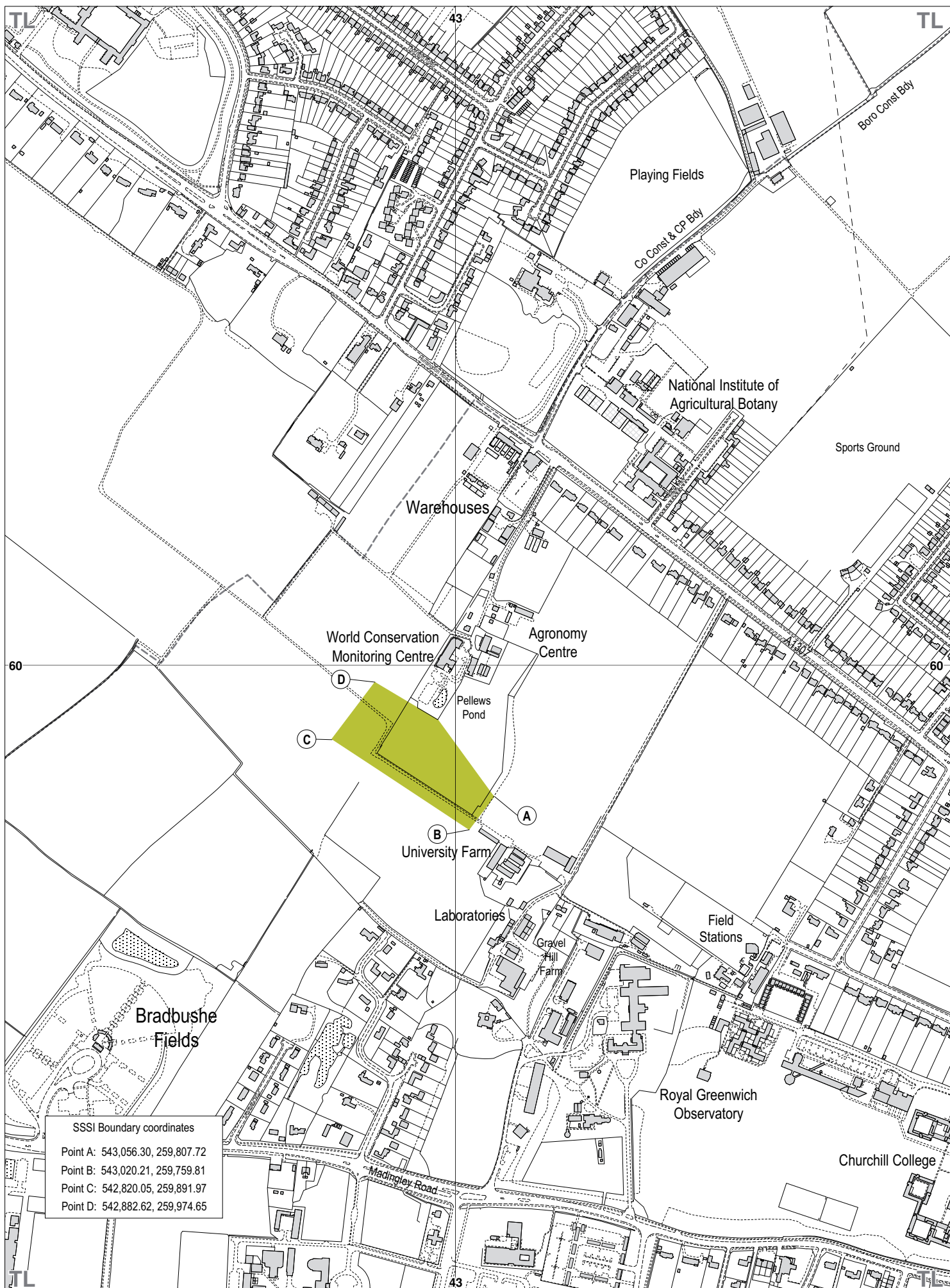
General description:

Traveller's Rest Pit lies just south of Huntingdon Road on the western outskirts of Cambridge. Its boundary comprises not only the grassed over remains of the old quarry floor and face but also an unexcavated finite reserve of Observatory Gravels.

This site preserves a unique sedimentary sequence of fossiliferous cold stage gravels, sands and silts known as the Observatory Gravels. At the base of this sequence, the richest Palaeolithic assemblage in Cambridgeshire has been found. These deposits were initially associated with an early terrace of the River Cam, but recent re-evaluation of the evidence suggests that a more satisfactory attribution would be outwash from the Anglian (Marine Isotope Stage 12) ice sheet. By implication therefore, the archaeology most likely records a pre-Anglian human presence (Marine Isotope Stage 13 or earlier).

Within the Observatory Gravels, thin seams of non-marine molluscs imply deposition under cold climate conditions. Occasional finds of large vertebrates have also been noted, and whilst climatic non-diagnostic, they broadly indicate an open landscape. The Observatory Gravels also record the occurrence of continuous permafrost as inferred from the presence of ice wedge casts (structures recognised for the first time at this site).

Beneath the Observatory Gravels, recent investigations have identified the presence of an earlier, infilled 'tunnel valley' channel feature that requires further investigation and may also have age implications for the dating of the Observatory Gravels.



Site of Special Scientific Interest

Traveller's Rest Pit
Cambridgeshire

Date notified: 1 December 1983

Date additional land notified: 23 July 2010

Site of Special Scientific Interest
2.25 Hectares

Theme ID:
1002848
Grid Ref:
TL429598
Version:
2011/12/24
Plotted:
24/11/2010
PlotID:
1363

Scale 1:5000 at A3

Map 1 of 1

0 100 200 300m
0 250 500 750ft

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