



## ANNEX B3.2.6

### Habitats and Protected Species

This document has been written in line with the requirements of the RAPID gate two guidance and to comply with the regulatory process pursuant to Severn Trent Water's and Affinity Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Severn Trent Water and Affinity Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.



# **Grand Union Canal Strategic Resource Option**

Habitats and Protected Species Desk Study

July 2022



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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Background	1
1.2	Grand Union Canal SRO	1
1.3	Scheme description	3
1.4	Purpose of the report	4
1.5	Assumptions and Limitations	5
<b>2</b>	<b>Methodology</b>	<b>6</b>
2.1	Desk Study	6
2.1.1	General	6
2.2	Habitat Mapping using OS MasterMap Data	7
2.2.1	Pipeline	7
2.2.2	Coventry Canal, Oxford Canal and Grand Union Canal	7
2.3	Identifying the potential presence of protected species	8
2.3.1	Pipeline	8
2.3.2	Coventry Canal, Oxford Canal and Grand Union Canal	8
2.4	Limitations to the methodology	9
<b>3</b>	<b>Results</b>	<b>11</b>
3.1	Desk study – Pipeline	11
3.1.1	Statutory designated sites	11
3.1.2	Other Desk Study Data	11
3.2	Desk Study – Coventry Canal, Oxford Canal and Grand Union Canal	12
3.2.1	Statutory designated sites	12
3.2.2	Other Desk Study Data	16
3.3	UKHabs Mapping using MasterMap	17
3.3.1	Pipeline	17
3.3.2	Coventry Canal, Oxford Canal and Grand Union Canal	18
3.4	Potential for Presence of Protected Species – Pipeline Corridor	19
3.4.1	Description of habitats	19
3.4.2	Bat habitat assessment	19
3.4.3	Badger habitat assessment	19
3.4.4	Reptile habitat assessment	19
3.4.5	Breeding and wintering bird habitat assessment	20
3.4.6	Other protected species	20
3.5	Potential for Presence of Protected Species – Coventry Canal, Oxford Canal and Grand Union Canal	20
3.5.1	Predicted increases in water levels	20
3.5.2	Potential effects on protected species	21
3.5.3	General riparian habitat preferences of protected species	23

3.5.4	Potential presence of protected species at sampling locations	24
3.5.5	Summary of findings	30
<b>4</b>	<b>Recommendations</b>	<b>32</b>
4.1	Recommendations for terrestrial surveys for the pipeline section	32
4.2	Recommendations for surveys on canals and associated waterbodies	32
4.2.1	Surveys in relation to raising towpaths and embankments	32
4.2.2	Surveys in relation to new infrastructure associated with water control at locks and similar locations	33
4.2.3	Identification of the potential presence of other protected species	34
4.3	Recommendations for potential mitigation measures	34
4.3.1	Construction phase mitigation	34
4.3.2	Operational phase mitigation	34
<b>A.</b>	<b>Desk Study Results</b>	<b>36</b>
A.1	Statutory Designated Sites Map	36
A.2	Ancient Woodland Map	37
A.3	Priority Habitat (Habitats of Principal Importance) Maps	38
A.4	Designated Site Citations	39
<b>B.</b>	<b>Maps</b>	<b>40</b>
B.1	Pipeline Habitat Map	40
B.2	Canal Network Habitat Maps	41
<b>C.</b>	<b>Lengths of Canal to be Affected</b>	<b>45</b>
C.1	Map of predicted water levels increases	45
C.2	Table of predicted water level increases	46
<b>D.</b>	<b>Canal Bank Engineering</b>	<b>55</b>
D.1	Map of Embankment Height Increases – Oxford and Coventry Canals	55
D.2	Map of Embankment Height Increases – Grand Union Canal	56
D.3	Map of Areas of Predicted Water Level Rises, where Soft Engineered Banks are present	57
<b>E.</b>	<b>Species Survey Forms</b>	<b>58</b>
E.1	Otter	58
E.2	Water vole	59

## Tables

Table 2.1: Locations on the Canal Network for Habitat Mapping	8
Table 2.2: Locations on the canal network assessed for potential protected species presence	9
Table 3.1: Statutory designated sites within 2km of the pipeline	11
Table 3.2: Ancient woodland within 500 metres of the pipeline	11
Table 3.3: Statutory designated sites within 2km of the canals	13
Table 3.4: Ancient woodland within 500 metres of the canal	16
Table 3.5: Bank engineering types and total lengths	22
Table 4.1: Water level modelling output	46

## Figures

Figure 1.1: Gated process for potential strategic regional water resource solutions	1
Figure 1.2: Environmental Assessment Integration with SRO Gates	2
Figure 1.3: The scheme	4

# 1 Introduction

## 1.1 Background

Owat, the economic regulator for the water and sewerage sectors in England and Wales, has identified the potential for water companies to jointly deliver strategic water resource schemes to secure long-term water supply resilience while protecting the environment.

To support the progression of these Strategic Resource Options (SROs), the Regulatory Alliance for Progressing Infrastructure Development (RAPID) has been established, comprised of representatives from Ofwat, the Environment Agency and the Drinking Water Inspectorate. RAPID has produced guidance for progressing each SRO which is aligned to a formal gated process to ensure that at each gate:

- Companies are progressing strategic water resource solutions that have been allocated funding at PR19 or have subsequently joined the programme.
- Costs incurred in doing so are efficient.
- Solutions merit continued investigation and development during the period 2020 to 2025.

The timelines for the assessment gates are shown in Figure 1.1 below; the Grand Union Canal (GUC) SRO is on the standard gate timeline and is currently at Gate 2.

**Figure 1.1: Gated process for potential strategic regional water resource solutions<sup>1</sup>**



## 1.2 Grand Union Canal SRO

The GUC SRO has been jointly developed in partnership between Severn Trent Water (STW), Affinity Water (AW) and the Canal and River Trust (the Trust). At the start of Gate 1 a long-list of sub-option routes were derived for the GUC SRO. The discharge options were then shortlisted to three route options by the start of Gate 2 based on the following criteria: environmental and societal impacts; operational flexibility and resilience; operational and embedded carbon; and

<sup>1</sup> Source: Regulators' Alliance for Progressing Infrastructure Development, Forward programme 2021-22, March 2021, available online at [https://www.ofwat.gov.uk/wp-content/uploads/2021/03/RAPID-Forward-programme-2021\\_22.pdf](https://www.ofwat.gov.uk/wp-content/uploads/2021/03/RAPID-Forward-programme-2021_22.pdf), accessed 07/03/2022

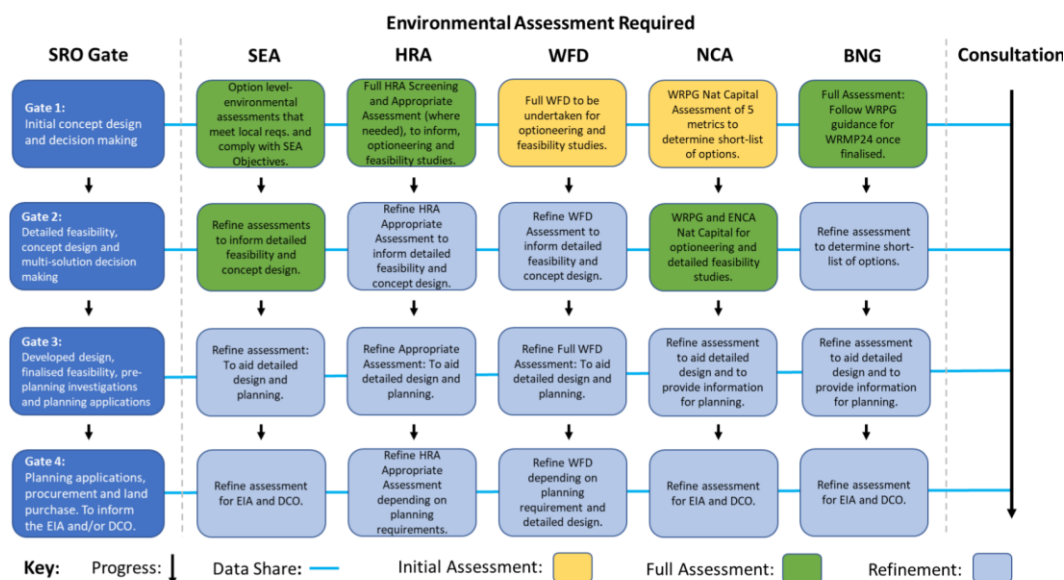
cost. Of these, Option Route 3 was selected. Optioneering was also undertaken with regards to abstraction locations. A site at Leighton Buzzard was ultimately selected, further details on the optioneering process can be found in the Gate 2 submission.

The single solution assessed at Gate 2 includes the pipeline from Minworth to Atherstone (Route 3), the canal transfer to Leighton Buzzard and the abstraction and treatment works at this location (hereafter referred to as 'the scheme') and will be assessed in the following Gate 2 Environmental assessments:

- Natural Capital and Biodiversity Net Gain (BNG) (Annex B3.3.2);
- Environmental Appraisal Report (EAR) (Annex B3.3.5);
- Fish survey report (Annex B3.2.3);
- Habitats and protected species desk study (Annex B3.2.6);
- Habitats Regulations Assessment (HRA) (Annex B3.3.3);
- Invasive and non-native species (INNS) survey report (Annex B3.2.4);
- Sediment report (Annex B3.2.5);
- Strategic Environmental Assessment (SEA) (Annex B3.3.1);
- Waterbody connections report (Annex B3.2.1); and
- Water Framework Directive (WFD) Assessment (Annex B3.3.4).

This report forms the Habitats and Protected Species Desk Study. Figure 1.2 below shows the integration of the statutory assessment reports (i.e. SEA, HRA, WFD, NCA/BNG) with the RAPID gated process. This schematic is taken from the All Companies Working Group (ACWG) guidance that was released in Gate 1. While this is still largely relevant and followed, it has been somewhat superseded by the RAPID Gate 2 guidance<sup>2</sup>, which the Gate 2 assessments have followed. In addition to the statutory assessments listed in Figure 1.2, the scheme has also carried out additional assessments, including this Habitats and Protected Species Desk Study.

**Figure 1.2: Environmental Assessment Integration with SRO Gates<sup>2</sup>**



<sup>2</sup> Source: All Companies Working Group, WRMP environmental assessment guidance and applicability with SROs, Mott MacDonald, 2020



### 1.3 Scheme description

The scheme is shown below in Figure 1.3 and described in detail in Annex A1, Engineering CDR (WSP, 2022). It will comprise a transfer rising main from Minworth Wastewater Treatment Works (WwTW) to the Coventry Canal at the top of Atherstone lock flight. Once outside the Minworth site, and past the M42 and HS2 corridors, the rising main will pass through agricultural land until reaching the outskirts of Atherstone, a small market town within North Warwickshire. The rising main will discharge to the canal side at Coleshill Road, via a new discharge structure sized to avoid deleterious flow velocities and shears.

Transferred water will then progress along the Coventry Canal by gravity into the Oxford Canal at Hawkesbury Lock. Flows will need to bypass the Hawkesbury lock via a low lift pumping station.

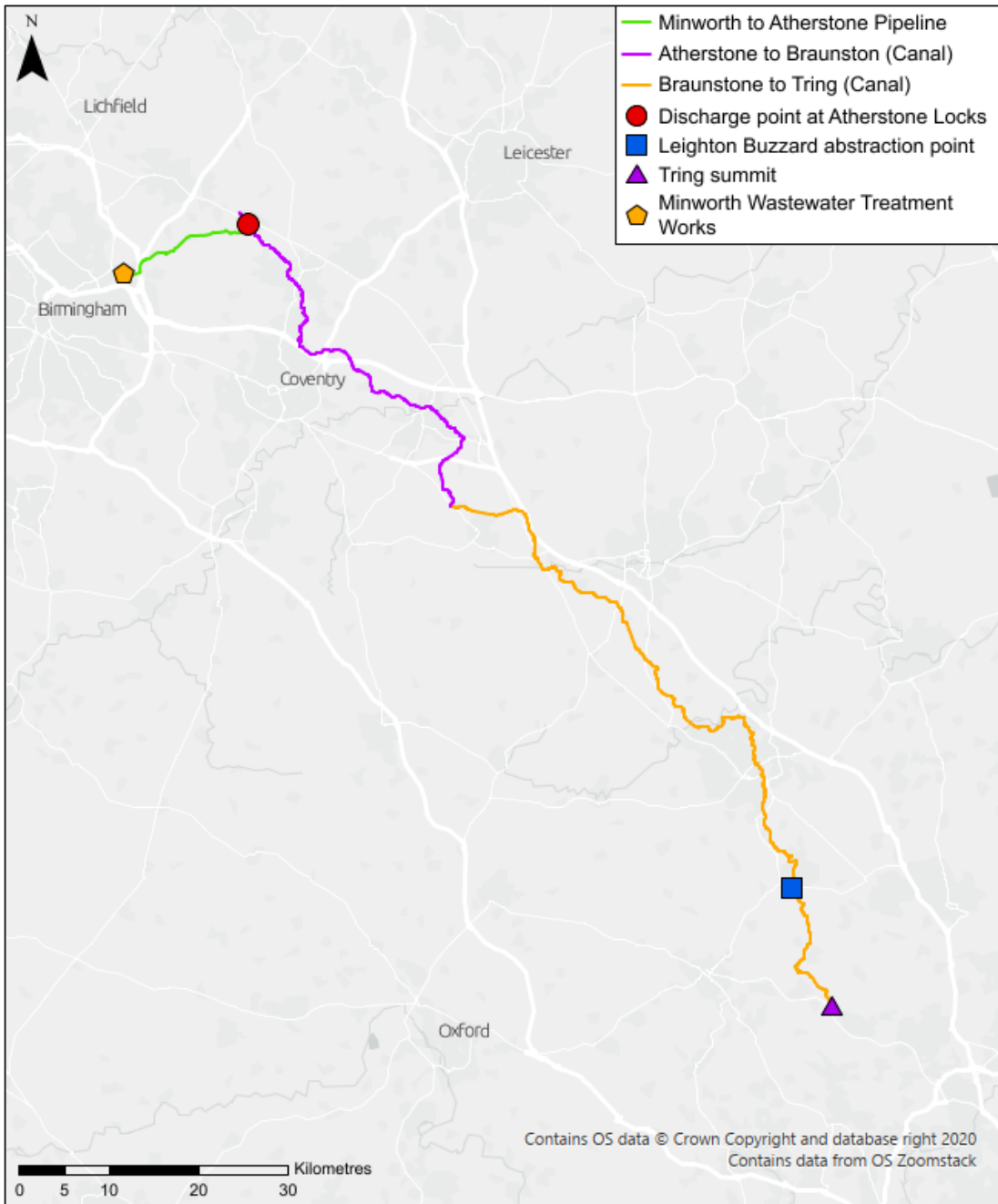
The Oxford Canal will then convey the water to the Grand Union Canal at Braunston. The majority of the flow along the Oxford Canal will be by gravity, however a pumping station will be required to bypass the locks at Hillmorton.

At Braunston a bypass pumping station will be required to lift flows from near Braunston Marina to the top lock just before Braunston Tunnel. From Braunston to the abstraction and treatment site at Leighton Buzzard, four additional lock bypass pumping stations will be required south of Milton Keynes at Fenny Stratford, Stoke Hammond, Three Locks and Leighton Buzzard. The Grand Union Canal section will also require eight gravity bypasses around “downflow” locks at the Wilton Marine Lock Flight, Stoke Bruerne Lock Flight and Cosgrove Lock.

Flow will be abstracted from the Grand Union Canal just south of the A4146 bridge, after the River Ouzel. The site currently proposed at Gate 2 for the treatment works is on relatively flat land slightly raised from the river and canal. Further investigations will be carried out at Gate 3 to determine the precise location. Flow will therefore need to cross the River Ouzel within a new, short pipeline and be pumped into an operational raw water storage reservoir before gravitating into the first stage of treatment. Additional interstage pumping in the treatment works will be required with final high lift pumps transferring potable treated water to a new clean water holding tank at the existing Chaul End Water Supply Reservoir (WSR).

During the option selection process, it was determined this option would have the least overall cost, lowest environmental impact and greatest opportunity for net gain and public benefit. The slightly higher operational cost when compared to Route 1, due to longer transfer from Minworth to Atherstone, can be partially offset by energy recovery from the break tank to outfall.

**Figure 1.3: The scheme**



### 1.4 Purpose of the report

This report has been produced to provide an indication as to the likely issues and constraints around protected and notable habitats, flora and fauna associated with the scheme. It has been based on a combination of desk-based work and a number of field surveys, to identify designated sites in the vicinity, carry out habitat mapping and habitat appraisals, and to identify the potential presence of protected species along the pipeline and canal corridors.

In terms of considering ecological issues associate with the scheme, this report sits alongside the following reports:

The Invasive and Non-Native Species Risk Assessment Report<sup>3</sup> establishes if the scheme will introduce any new hydrological connections between previously isolated catchments, to identify the presence of invasive and non-native species (INNS), to quantify the INNS risk associated with the scheme based on the conceptual design and to potential biosecurity options for implementation.

The Fish Assessment<sup>4</sup> includes information on both eDNA and electrofishing surveys, proposed to inform the fish baseline, on which assessment can be carried out.

Ecological Monitoring: Phase 2 Report<sup>5</sup> is also centred on the aquatic environment, and continues from Gate 1, addressing four areas of ecological survey to inform assessments on the potential effects on water quality, and hence the aquatic ecology of the canal and associated waterbodies. It includes Chironomid Pupal Exuviae Technique (CPET) monitoring, invasive non-native species (INNS) monitoring, and macrophyte surveys of and habitat transects of associated chalks streams.

## 1.5 Assumptions and Limitations

The following assumptions have been used within the Gate 2 assessment:

- The design assumptions stated in the WSP Gate 2 Position Paper - Route Selection<sup>6</sup> technical note can be applied to the Gate 2 Environmental Assessments, including assumption that >50mm depth change requires towpath raising is valid.
- The assessment is based on a 'worst-case' 100% utilisation of the SRO.
- Tring represents the SE limit of influence of the SRO.
- The volume of water passing NW (after discharging from pipeline) due to the locks opening at Atherstone is deemed to be of minimal change.
- The risk of fish and INNS travelling NW of Atherstone is not increased due to the scheme.
- This assessment has been based on the concept design appropriate for Gate 2. Pipeline routing will continue to be refined throughout planning and delivery.
- Timing of walkover survey in November was not optimal and some vegetation may have died back, therefore further assessment will be required at Gate 3.

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<sup>3</sup> B3.2.4 Annex Invasive and Non-Native Species Risk Assessment Report, Mott MacDonald (2022), document reference 100105044|GUC-MMD-ZZZ-XX-RP-N-0004|C|

<sup>4</sup> Fish Assessment, Mott MacDonald (2022), document reference 100105044 | GUC-MMD-ZZZ-XX-RP-N-0003 | C |

<sup>5</sup> Annex B2.1, Ecological Monitoring Report (2022)

<sup>6</sup> Gate 2 Position Paper - Route Selection, WSP Technical Note, 2022

## 2 Methodology

### 2.1 Desk Study

#### 2.1.1 General

The modelling results received<sup>7</sup> (reported in Appendix C) indicated that the scheme is likely to result in an increase in the water level in the canal network. In some locations, it is therefore likely to be necessary to increase the height of the canal's banks; this will require some potentially major engineering works.

Both of these aspects (the likely increase in water levels and the required bank raising works) mean that the riparian habitat is likely to be affected to varying degrees along much of the length of the affected canals.

The canal network included in the scheme has a number of connections to other waterbodies. These are listed, described and mapped in the Watercourse Connections report<sup>8</sup>.

As the canals are engineered watercourses, their water levels are well regulated, with many of the waterbody connections controlled by sluices, gates etc. It is anticipated that the scheme design will maintain this so as the water level rises, the heights of these control structures will also be increased, to ensure that water losses to the wider waterbody network between Minworth and Leighton Buzzard are minimised. However, there are existing connections between the canals and other waterbodies which could be affected by the predicted water level rise. It is anticipated that these would be very limited in scale, although detailed modelling would be required to quantify this.

Water level changes in the canals, and in connected waterbodies, have the potential affect the habitat for many protected species, including but not limited to otter (*Lutra lutra*), water vole (*Arvicola amphibius*) and great crested newt (*Triturus cristatus*). Initial assessment of the habitats likely to be used by these species has therefore been undertaken.

A desk-based assessment using publicly available data was carried out, to identify statutory (including potential and candidate sites) and non-statutory designated sites, habitats of principal importance etc. The study areas for the desk study are provided below in sections 2.1.1.1 and 2.1.1.2. The following data sources will be used for the desk-based assessment:

- The Government's 'Multi-Agency Government Information for the Countryside' (MAGIC) website for statutory designations.
- Joint Nature Conservation Committee (JNCC) and Natural England websites for descriptions of statutory designated site.
- Ordnance Survey (OS) Mapping and publicly available online aerial photography.

The desk study considered statutory designated sites and the potential for the presence of habitats and protected species,, as set out in the Sampling Methodology Report<sup>9</sup> which has been shared with regulators

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<sup>7</sup> Source Scott Bringlee, WSP, personal communication, 9<sup>th</sup> February 2022.

<sup>8</sup> Grand Union Canal Strategic Resource Option, Waterbody Connections Report, Mott MacDonald, 2022

<sup>9</sup> Sampling Methodology Report, 100105044 | 100105044A | P03, Mott MacDonald, 2022.

### 2.1.1.1 Statutory designated sites

Statutory sites include Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) and Local Nature Reserves (LNR). Statutory sites were identified within 2km of the proposed pipeline route.

### 2.1.1.2 Other Data

In addition to the above, datasets on ancient woodland and habitats of principal importance have been accessed, allowing us to provide information on their presence along and in the vicinity of the proposed route. This data has been collected for those sites with 500m of the route.

At this stage of the scheme, it was not considered necessary to obtain information from the various biological records centres. The volume of information would potentially have been very large, but the benefits would have been limited at best.

## 2.2 Habitat Mapping using OS MasterMap Data

### 2.2.1 Pipeline

An initial (first-pass) habitat map to the UKHabs classification system<sup>10</sup> was produced to inform the desk study. This was carried out in GIS using OS Mastermap data to provide an initial habitat map of an area 500m either side the pipeline route.

This method of producing habitat maps is increasingly used; the quality of the OS MasterMap data, and the ability of GIS specialists to interpret and analyse this data, means that this is far more efficient means of carrying out this type of exercise than starting the process in the field.

The exercise is usually then followed by time in the field, when the data is subject to ground truthing, adjusted and supplemented as necessary. This second part of the process allows for a higher level of detail than the first part. However, due to the early nature of the scheme, this field-based component has not been possible. It is therefore important to note that the habitat data provided in this report is indicative only, and should be followed at a suitable stage of the project with a detailed walkover.

### 2.2.2 Coventry Canal, Oxford Canal and Grand Union Canal

#### Habitat mapping

As with the pipeline above, we have undertaken first pass habitat mapping of a number of individual locations along the various canals that interact with the scheme. Due to the length of the canal network involved, full surveys along the whole route were not feasible. Instead, habitat mapping was carried out at a distribution of sites associated with the scheme to capture possible connections between the canal network and other major waterbodies. These sites were also surveyed for Invasive and Non-Native Species (INNS). This was to provide consistency across the various assessment types, and to provide as much information as we can about those selected sites. Additional surveys, to include greater coverage as the project develops, are considered in Sections 4.1 and 4.2, later in this document. Those locations where habitat mapping has been undertaken are provided in Table 2.1 below.

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<sup>10</sup> Source: UKHab website [ukhab – UK Habitat Classification](#), accessed 09 March 2022

Grid references for continued monitoring locations redacted

**Table 2.1: Locations on the Canal Network for Habitat Mapping**

Site		Connection/point
GUC @ Northampton arm intersection (GUC only)	Close to Gayton, near Northampton	
Confluence with the River Tove	Downstream of Stoke Bruerne	
Grand Union Canal close to the River Ouzel, Leighton Buzzard	Leighton Buzzard	
Grand Union Canal at Tring (GUC only)	Marsworth, north of Tring	
Tringford Reservoir	Tringford, north of Tring	
Startopsend Reservoir	Tringford, north of Tring	
Marsworth Reservoir	Tringford, north of Tring	

## 2.3 Identifying the potential presence of protected species

### 2.3.1 Pipeline

An assessment of the habitat map, and other freely available online resources has been undertaken to identify at a high level, the types of protected species and habitats that are likely to be present along and in the vicinity of the pipeline route.

This has then been followed with an indication as to where, along the pipeline route, these species and habitats could potentially be found. This information should then be used to inform subsequent surveys and assessment, as the project moves forward. This information has been provided to at least partly compensate for the absence of the field-based walkovers, which would usually be undertaken to provide this information.

### 2.3.2 Coventry Canal, Oxford Canal and Grand Union Canal

#### 2.3.2.1 Initial walkover surveys

Initial walkover surveys were undertaken in November 2021. Surveys were undertaken at the specific sampling locations described in Table 2.1. The aim of the surveys was to identify any protected species constraints and undertake habitat assessments specifically for otters, water voles and great crested newts.

The purpose of the survey was to:

- Supplement initial baseline information on the habitats and species present or likely to be present along the canal routes and connected waterbodies.
- Make an assessment of the nature conservation value of the above habitats and species which have the potential to be present (ecological receptors).
- Identify potential constraints that could influence design, programme, construction timing, methods and working areas on site.
- Identify what additional surveys are required, if any, to inform appropriate mitigation measures.

#### 2.3.2.2 Initial protected species assessments

Targeted surveys were undertaken from public rights of way around the seven sampling locations in Table 2.1 above. A walkover was undertaken along the watercourse for 500m either side of the sampling location where access allowed. These surveys were specifically to highlight potential presence of suitable habitat and signs of otters, great crested newts and water voles.

Evidence suggesting the presence of other protected species was recorded during the walkover survey. Whilst any field signs indicating presence for each species were sought, a robust survey was not undertaken as it was not appropriate for this level of assessment. For each species, a range of information was collected that would allow predictions as to potential presence to be made.

For otters, as well as specific field signs/evidence of presence, notes were taken on whether suitable habitat is present, adjacent land use, levels of disturbance, connectivity, any potential barriers to dispersal, signs of pollution etc.

When considering water voles, notes were taken on channel width, depth, flow speed, adjacent land use, bank substrate, riparian vegetation cover (type and proportions), habitat descriptions, level of shading, connectivity and disturbance.

Any ponds or other waterbodies with the potential to support great crested newts were identified during the walkover. This information was combined with desk study data available on MAGIC to determine potential presence of great crested newts.

Data collected on site was then used alongside desk-based sources to determine potential suitability for otters, water voles and great crested newts.

### 2.3.2.3 Supplementary protected species assessments

As a number of surveyed sites were not taken forward as they were on deselected options, an additional desk-based assessment was carried out using online resources. The aim of this desk-based assessment was to provide an initial assessment of the suitability for protected species. The quality and coverage of information from online mapping and photography, has allowed a good level of information to be gleaned, and an assessment as to the potential presence of protected species.

The potential for protected species has therefore been described for both the sites subject to desk-based assessments and those sites visited, (with the exception of the Tring reservoirs, as these are beyond the extraction location, so changes here are likely to be negligible). The list of sites described is shown in Table 2.2 below (refer to Appendix B for maps of these locations).

**Table 2.2: Locations on the canal network assessed for potential protected species presence**

Grid references for continued monitoring locations redacted

Location	Grid Reference
Coventry Canal, north of the M6	
Oxford Canal, north of Rugby	
Oxford Canal, southeast of Rugby	
Grand Union Canal, Nether Heyford	
GUC @ Northampton arm intersection (GUC only)	
Confluence with the River Tove	
Grand Union Canal, Milton Keynes	
Grand Union Canal, Bletchley	
Grand Union Canal, Stoke Hammond	
Grand Union Canal close to the River Ouzel, Leighton Buzzard	

## 2.4 Limitations to the methodology

Note that recommendations will be based on those findings for the sites visited, and not for the canals as a whole. As such, the results and recommendations should be treated as indicative.



Results can be extrapolated to other parts of the canal network, but this must be done with extreme caution, as it is likely that additional habitats, and therefore additional ecological constraints and risks, are found along the affected canal network. At subsequent stages of the project, more complete survey coverage should be sought.

Desk based mapping is usually followed by time in the field, when the data is subject to ground truthing, adjusted and supplemented as necessary. This second part of the process allows a higher level of robustness than just the first part. However, due to the early nature of the scheme, and the fact that land access is generally unavailable, this field-based component has not been possible. It is therefore important that the habitat data provided in this report is indicative only, and should be followed at a suitable stage of the project with a detailed walkover.

At this stage of the scheme, data from the various biological records centres was not sought. Biological Records Centre data is reliant on submission from third parties, and as such is very variable in terms of geographical coverage and species/species groups represented. The volume of information would potentially have been very large, but the benefits would have been limited at best. It is instead recommended that this could be sought as the design evolves, to focus on those stretches of GUC that are likely to be affected.

## 3 Results

### 3.1 Desk study – Pipeline

#### 3.1.1 Statutory designated sites

Three statutory designated sites with UK level designations were identified within 2km of the pipeline route. All three are SSSIs. No statutory sites with international or European designations were identified within 2km of the pipeline route. Details of the designated sites can be found in Table 3.1 below and the full citations for the SSSIs are included in Appendix A.

**Table 3.1: Statutory designated sites within 2km of the pipeline**

Designation and site name	Distance to pipeline (km)	Reason for citation
Whitacre Heath SSSI	0.96	Whitacre Heath is within the flood plain of the River Tame and is one of a chain of waterbodies created by gravel extraction. Notified for its wetland breeding birds.
Kingsbury Wood SSSI, LNR	0.89	Lowland broadleaved, mixed and yew woodland. Kingsbury Wood is an ancient woodland, which is recorded in the Domesday Book and this together with its diverse bird breeding community accounts for the designation.
Bentley Park Wood SSSI	0.15	Lowland broadleaved, mixed and yew woodland. This site is a large and important ancient woodland in north Warwickshire. On this site there is an unusual and widespread juxtaposition of sessile oak and alder and there is a wider ecological range of alder woodland than possibly any other wood in Britain.

Source: Natural England SSSI Citations, MAGIC

#### 3.1.2 Other Desk Study Data

There are 11 areas of ancient woodland within 500m of the pipeline route. These include five ancient and semi-natural woodlands and six ancient, replanted woodlands. Details are given in Table 3.2 below.

**Table 3.2: Ancient woodland within 500 metres of the pipeline**

Designation and site name	Distance to pipeline
Dunton Coppice Ancient & Semi-Natural Woodland	85 metres
Drybrooks Wood Ancient Replanted Woodland	75 metres
Wheatleys Wood Ancient Replanted Woodland	480 metres
Holly Thicks Ancient Replanted Woodland	20 metres
Bentley Park Wood Ancient Replanted Woodland	135 metres
Bentley Park Wood Ancient & Semi-Natural Woodland	195 metres
Gallops Hill Wood Ancient Replanted Woodland	0 metres
Gallops Hill Wood Ancient & Semi-Natural Woodland	0 metres
Upper Coal Spinney Ancient & Semi-Natural Woodland	485 metres

Designation and site name	Distance to pipeline
Quarries Wood South Ancient & Semi-Natural Woodland	335 metres
Quarries Wood South Ancient Replanted Woodland	390 metres

Within 500m of the pipeline route there are several different types of Priority Habitat. They are as varying in frequency and location but are as follows:

- **Grassland habitats – floodplain grazing marsh.**  
This habitat is defined by proximity to water, topography, and management rather than the underlying substrate or the vegetation. Just east of Minworth Wastewater Treatment Works there are several patches of floodplain grazing marsh.
- **Woodland habitats – deciduous woodland.**  
This habitat is characterised by broadleaved trees such as oak, beech, hornbeam, elm, and lime species. There are several occurrences of this habitat type within 500m of the pipeline route, for example Drybrooks Wood east of Hurley.
- **Woodland habitats – traditional orchards.**  
Traditional orchards are plantations of mature, open-grown fruit-producing trees which are managed in a low intensity way, and currently without the use of pesticides and fertilisers. The ground vegetation beneath and in between the trees is most commonly some kind of neutral grassland whether unimproved or agriculturally improved, but can also include other types of grassland and patches of bramble.
- **Woodland habitats – wood pasture and parkland.**  
Wood pasture and parkland is land that has been managed through grazing. They can be ancient, or of more recent origin. Trees in wood pasture and parkland are often pollarded. This is an ancient form of management where trees are grown within grazed pastures. The crown was regularly cut at around eight feet high, above the browsing height of the stock below. There is a large section of this habitat type located north of Coleshill Road near the eastern end of the pipelines route through Monk’s Park wood.
- **Wetland habitat – reedbed.**  
This habitat is found between water and land as they are transitional habitats. Reedbeds can form extensive areas of habitat in lowland floodplains or fringe streams, rivers, ditches, ponds, and lakes with a thin feathery margin of reeds. Reedbeds are dominated by common reed, almost to the exclusion of other species.
- **Other priority habitats – without main classification.**  
These are other high-quality habitats that do not come under any of the main habitat types.

The Tame Valley Wetland Landscape would be bisected by the pipeline. This area includes a valuable mosaic of habitats, and is an important area for overwintering birds, being recognised in the Warwickshire County Council Green Infrastructure Strategy as such.

### 3.2 Desk Study – Coventry Canal, Oxford Canal and Grand Union Canal

#### 3.2.1 Statutory designated sites

Three statutory designated sites with UK level designations were identified within 2km of the canals, between the pipeline’s proposed outfall on the Coventry Canal and the extraction location at Leighton Buzzard.

Only statutory designated sites designated for biodiversity were included in the search. Two SACs were identified, ten SSSIs and nine LNRs. Details of the statutory designated sites can be found in Table 3.3 below and the full citations for the SACs and SSSIs are included in Appendix A.

**Table 3.3: Statutory designated sites within 2km of the canals**

<b>Designation and site name</b>	<b>Distance to canals (km)</b>	<b>Reason for citation</b>	<b>Likely connectivity to the canals<sup>11</sup></b>
Aldbury Nowers SSSI	0.77	This site contains areas of unimproved calcareous grassland and ancient semi-natural woodland which have developed on the western slopes of a chalk scarp to the northeast of Tring. These habitats have declined dramatically in recent decades in the county through changes in agriculture and woodland management practices. Aldbury Nowers contains one of the best remaining areas of chalk downland in the county as well as one of the finest examples of ancient 'beech hanger' woodland in Hertfordshire.	No connections identified in the Waterbody Connections Report <sup>12</sup> .
Ashlawn Cutting LNR	0.52 and 0.02	Steep sided disused railway cutting consisting of limestone grassland with scrub. 24 butterfly species have been recorded including Common Blue, Marbled White and Small Copper. Diverse sightings of birds. The site supports many plants normally associated with unimproved grassland and hay meadows and include Green Winged Orchid and Yellow Rattle. The pools support frogs, toads and newts as well as dragonflies.	Potential connectivity to the canal, due largely to proximity. Requires further assessment at Gate 3.
Ashridge Commons and Woods SSSI	0.63	Ashridge Commons and Woods is an extensive area of mainly semi-natural vegetation on the Hertfordshire/Buckinghamshire border. Situated towards the northern end of the Chiltern escarpment on wet, acidic Clay with-Flints plateau soils and more base rich flinty chalks of the scarp slopes, the site comprises a mosaic of different habitats: a mixture of ancient semi-natural and secondary woodland, plantation, scrub, a more open component dominated by bracken, and grassland. The site supports an exceptionally rich breeding bird community including both county and national rarities.	No connections identified in the Waterbody Connections Report.
Bedworth Sloughs LNR	1.60	Bedworth Sloughs is an area of water and wetlands created originally by mining subsidence.	No connections identified in the Waterbody Connections Report.
Bentley Park Wood SSSI	1.6	Lowland broadleaved, mixed and yew woodland. This site is a large and important ancient woodland in north Warwickshire. On this site there is an unusual and widespread juxtaposition of sessile oak and alder and there is a wider ecological range of alder woodland than possibly any other wood in Britain.	No connections identified in the Waterbody Connections Report.
Blue Lagoon LNR	0.92	The lake, which is around 18m deep, has exceptionally clean water and is rich in fish and other creatures. Around the Blue Lagoon natural colonisation of the spoil heaps has formed grassland	Potential connection via existing watercourse and River Ouzel to canal.

<sup>11</sup> Connectivity to the scheme is based on information provided within the Waterbody Connections Report, Annex B3.2.1. Further assessment of waterbody connections will be carried out at Gate 3 and should this identify further connections, then additional designated sites may be added to those that require analysis at Gate 3.

<sup>12</sup> Grand Union Canal Strategic Resource Option, Waterbody Connections Report, Mott MacDonald, 2022, Annex B3.2.1.

Designation and site name	Distance to canals (km)	Reason for citation	Likely connectivity to the canals <sup>11</sup>
		and scrub woodland. The grassland is especially rich in plants and animals including some typical of chalk downland but very rare in North Bucks.	Requires further assessment at Gate 3.
Bugbrooke Meadows SSSI	0.96	The site contains a group of low-lying meadows alongside the River Nene which have escaped drainage and improvement. They tend to flood in winter and often remain wet well into the growing season. As a result, they support a range of damp grassland communities which are remarkably diverse and rich in species.	Potential connection via River Nene. Requires further assessment at Gate 3
Chilterns Beechwoods SAC	0.63	The Chilterns Beechwoods represent a very extensive tract of ancient semi-natural beech <i>Fagus sylvatica</i> forests in the centre of the habitat's UK range. The woodland is an important part of a mosaic with species-rich chalk grassland and scrub. A distinctive feature in the woodland flora is the occurrence of the rare coralroot <i>Cardamine bulbifera</i> . Standing and fallen dead timber provide habitat for dead-wood (saproxylic) invertebrates, including stag beetle <i>Lucanus cervus</i> .	No connections identified in the Waterbody Connections report.
Daventry Country Park LNR	0.80	The Country Park is centred on the old Daventry Reservoir. The irregular shape of the reservoir, the undulating nature of the topography and presence of mature trees give the appearance of a natural lake, pleasant views both of the surrounding countryside and to the town centre are seen from many points on the banks.	Potential connection via existing watercourse. Requires further assessment at Gate 3.
Ensor's Pool SAC, SSSI, LNR	1.0	This lowland site in central England represents white-clawed crayfish <i>Austropotamobius pallipes</i> in standing water. Ensor's Pool lies on the western edge of Nuneaton in the north of Warwickshire and formed in an abandoned clay pit. It is about 220m long, 50m wide with an average depth of 8m and is fed by groundwater. The pool overlies Etruria Marl which was extracted for brickmaking earlier this century. Ensor's Pool holds a very large and healthy population of native white-clawed crayfish <i>Austropotamobius pallipes</i> estimated at 50,000 individuals. It is of national importance as one of the best lake populations of crayfish in England.	Unlikely to be connected to canals, due to distance and apparent absence of pathways.
Kings and Bakers Wood and Heaths SSSI and LNR	1.39	The site represents the largest area of woodland in Bedfordshire as well as remnants of lowland heath and acidic grassland. It lies on the Boulder Clay passing to Lower Greensand, producing an outstanding series of soil types ranging from slightly calcareous to acid and from wet to well drained. This exceptional range is reflected in the rich variety of species and habitats.	Potential connectivity via River Ouzel, as identified in the Waterbody Connections Report. Requires further assessment at Gate 3.
Linnell Road LNR	0.12	This large area of over 26 acres consists of open grassland, scrub areas, mature trees, riverside, wetlands and a willow copse.	No connections identified in the Waterbody Connections report.
Mill Crook SSSI	0.78	Mill Crook is a traditionally managed hay meadow situated on alluvial soils in the valley of the River Tove. The grassland is floristically diverse and an outstanding example of the meadow foxtail <i>Alopecurus pratensis</i> -great burnet <i>Sanguisorba officinalis</i> flood-meadow community type.	Potential connection via River Tove, as identified in the Waterbody Connection report. Requires further assessment at Gate 3.

<b>Designation and site name</b>	<b>Distance to canals (km)</b>	<b>Reason for citation</b>	<b>Likely connectivity to the canals<sup>11</sup></b>
Nares Gladley Marsh SSSI	0.21	Nares Gladley Marsh is situated on the alluvial deposits which overly the Lower Greensand in the valley of the River Ouzel in Bedfordshire, about 3 km north west of Leighton Buzzard. A series of springs emerging from the Greensand form a complex of wet flushes surrounded by marshy grassland which have developed rich plant communities. These grade into unimproved acidic grassland on the drier slopes.	Potential connectivity via River Ouzel, as identified in the Waterbody Connections Report. Requires further assessment at Gate 3.
Newbold Quarry Park LNR	0.01	A limestone quarry for the cement industry until the 1920s after which it was flooded and used as a top up reservoir for the adjacent Oxford Canal. A large quarry pool with a thriving population of native white clawed crayfish and toads. Limestone spoilheaps support many lime loving plants such as wild carrot and bee orchid. Invertebrates include a good range of butterflies including large and small skippers, common blue and holly blue.	Potential connectivity to the canal, due largely to proximity. Requires further assessment at Gate 3.
Oddy Hill and Tring Park SSSI	1.62	This site consists of two areas of calcareous grassland situated on a chalk scarp to the south of Tring and further areas of calcareous grassland on undulating parkland at the foot of the scarp. These grasslands support a diverse range of grasses and flowering plants including locally uncommon and rare species. The combined area of calcareous grassland comprises one of the most extensive areas of unimproved chalk downland in Hertfordshire.	No connections identified in the Waterbody Connections Report.
Poker's Pond Meadow SSSI	1.06	Poker's Pond Meadow is one of the last remaining fragments of ancient hay meadow to be found in the Vale of Aylesbury. The herb-rich dry grassland community which covers the majority of the field is of a type that is now rare in lowland Britain. It has only been maintained by continuous traditional management usually involving a late annual hay cut, followed by stock grazing, with no fertiliser or herbicide applications	No connections identified in the Waterbody Connections Report.
Swift Valley LNR	0.30	The reserve includes lowland neutral grassland with pronounced ridge and furrow, hedgerows, woodland and wetland adjacent to River Swift and a disused canal. A very dense bird population exists especially around the pools. Birds include lapwing, snipe and song thrush. Dragonflies and damselflies are abundant and in 2004 the small red eyed damselfly was recorded here for the first time in Warwickshire.	No connections identified in the Waterbody Connections Report.
Tiffield Pocket Park LNR	1.90	This LNR is a former railway, resulting in the appearance and impression of the site as a woodland track. Active scrub control has given rise to flower-rich limestone grassland. The park has mixed habitats which have been improved by volunteer conservation work to create the right conditions for wildlife to thrive. Three species of orchid in April, May and June.	Unlikely to be connected to canals, due to distance and absence of pathways
Tring Reservoirs SSSI	0	These four reservoirs are situated on the Lower Chalk at the foot of the Chilterns escarpment and, although artificial, are fed by natural springs. Waterbodies on the chalk of south-east England are scarce, and these reservoirs shows typical characteristics of shallow marl lakes. The clear eutrophic waters support diverse communities of	Despite not being identified as being connected in the Waterbody Connections report, the close proximity means that further

Designation and site name	Distance to canals (km)	Reason for citation	Likely connectivity to the canals <sup>11</sup>
		plants and animals, and the reservoirs are located on sites of ancient marshes, still retaining elements of the original flora. The marginal vegetation is dominated by tall fen communities with some marshy grassland, both threatened and declining habitats in the county which support locally rare plant species. These habitats, together with the open water, represent an important area for breeding, passage and wintering birds, and for interesting invertebrate communities.	assessment at Gate 3 is recommended.
Wyken Slough LNR	0.28	The reserve attracts wintering birds such as snipe and reed bunting.	No connections identified in the Waterbody Connections Report.

Source: Natural England SSSI, NNR and LNR citations, MAGIC.

### 3.2.2 Other Desk Study Data

There are 12 areas of ancient woodland within 500m of the affected canals. These include eight ancient and semi-natural woodlands and four ancient, replanted woodlands. Details are given in Table 3.4 below.

**Table 3.4: Ancient woodland within 500 metres of the canal**

Designation and site name	Distance to canal
Quarries Wood South Ancient & Semi-Natural Woodland	405 metres
Quarries Wood South Ancient Replanted Woodland	405 metres
Purley Park Ancient & Semi-Natural Woodland	145 metres
Purley Park Ancient Replanted Woodland	145 metres
Hartshill Hayes Ancient Replanted Woodland	360 metres
Unnamed Ancient & Semi-Natural Woodland (east of Haye)	165 metres
Turnthorn's Wood Ancient & Semi-Natural Woodland	415 metres
All Oaks Wood Ancient & Semi-Natural Woodland	30 metres
Stokepark Wood Ancient & Semi-Natural Woodland	450 metres
Unnamed Ancient & Semi-Natural Woodland (north of Milton Keynes)	240 metres
Linslade Wood Unnamed Ancient & Semi-Natural Woodland	155 metres
Unnamed Ancient & Semi-Natural Woodland east of Tring	420 metres

Within 500m of the pipeline route there are several different types of Priority Habitat. They are as varying in frequency and location but are as follows:

Woodland habitats – deciduous woodland



This habitat is characterised by broadleaved trees such as oak, beech, hornbeam, elm, and lime species. There are numerous locations where this habitat is found along the route, including clusters between Atherstone and Nuneaton, northeast and east of Coventry, to the north and east of Milton Keynes and north of Leighton Buzzard.

Grassland habitats – floodplain grazing marsh.

This habitat is defined by proximity to water, topography, and management rather than the underlying substrate or the vegetation. One notable area is along the valley of the River Avon, northeast of Rugby, with other areas close to Grafton Regis and Castlethorpe, north of Milton Keynes, both associated with the River Tove. A final cluster of this habitat type is on the northern fringes of Leighton Buzzard, along the banks of the River Ouzel.

Lowland Fens

These habitats exist on peatlands that receive nutrients and water from rainfall as well as groundwater. They typically support a diversity of plant and animal communities, sometimes up to 550 species of higher plants. They are valuable habitats for invertebrates, including dragonflies and aquatic beetles.

Lowland Meadows

These habitats are generally unimproved neutral grassland in a lowland setting. They are often dominated by a combination of crested dogstail *Cynosurus cristatus* and black knapweed *Centaurea nigra*, meadow foxtail *Alopecurus pratensis* and great burnet *Sanguisorba officinalis*, or crested dogstail and marsh marigold *Caltha palustris*, depending on the setting.

Woodland habitats – traditional orchards.

Traditional orchards are plantations of mature, open-grown fruit-producing trees which are managed in a low intensity way, and currently without the use of pesticides and fertilisers. The ground vegetation beneath and in between the trees is most commonly some kind of neutral grassland whether unimproved or agriculturally improved, but can also include other types of grassland and patches of bramble.

Purple moor grass and rush pastures

This consists of vegetation dominated by swards of purple moor grass *Molinia caerulea*, with various rush species also present. They exist on moist to wet soils, with varying pH levels, and have characteristic communities of flora depending on this. They are also excellent habitats for bird species of note, but are often at risk of excessive drainage.

Other priority habitats – without main classification.

These are other high-quality habitats that do not come under any of the main habitat types.

### 3.3 UKHabs Mapping using MasterMap

#### 3.3.1 Pipeline

Digital habitat mapping was undertaken using OS MasterMap data to create a first pass UKHabs habitat map.

There is a range of habitats present along the proposed route of the pipeline transfer from Minworth to Atherstone. Predominantly this habitat is comprised of arable land with associated hedgerows and ditches. At a broad scale there are three main areas that present higher quality habitat.

The area of land south of Curdworth at the western extent of the pipeline route is a heterogeneous mix of scattered scrub, young woodland stands and grassland habitats with a range of linear features such as ditches, tracks, and treelines. Further south still this area of land is bounded by the River Tame. There are at least two ponds presents on this site. This area is likely to be part of the existing Waste Water Treatment Plant.

The second area that presents a broader range of habitats outside of arable is the southern extent of the gravel pit lake complex north east of Lea Marston. This area of habitat is located approximately one third of the pipeline's length from the west. It is located south of Marston and north of Lea Marston. Large lakes, likely to be disused gravel pits, are the prominent habitat feature. Alongside this main habitat there are grassland habitats, scattered scrub and woodlands as well as smaller lakes and the River Tame. North and north west of Lea Marston the pipeline runs through a complex of ponds and small waterbodies that present ideal terrestrial and aquatic habitat for great crested newts. The lakes at this site have helped to clean the River Tame for decades and were dredged to remove harmful silts from upstream that settled in the lakes. The site has been left to rewild naturally and is now at SSSI standard due to the varied habitat mosaic. The lakes offer overwintering bird habitat and are part of the Tame Valley Wetlands Landscape and are a Nature Improvement Area.

The third large area of habitat that the pipeline intersects is the woodland to the west of Atherstone Golf Club, part of which is designated as Bentley Park Wood SSSI. This woodland is a plantation with small openings, few in number. To the north of the pipeline route this woodland appears semi-natural with mature trees, tending towards parkland habitat. Also present is a large lake and small arable fields. It should be noted that the SSSI boundary does not incorporate a large part of the woodland which is ancient woodland.

Along the route of the pipeline, where the dominant habitat type is arable there are smaller sections of non-arable habitat. These habitats include rivers, woodland stands, urban developments and gardens, ditches and hedgerows, golf courses, railway lines, highway/road verges, and small bodies of water.

The first-pass habitat map, using the UK Habitats classification system, is included in Appendix B1.

### 3.3.2 Coventry Canal, Oxford Canal and Grand Union Canal

The habitats along the canal corridor itself are generally quite consistent and unvaried. The canal itself is running water, albeit very slow-moving. The water column is generally fairly turbid, especially when boating activity is high. The cross section of the canal, being an engineered watercourse, is artificial in form, with steep sided banks, often bounded by hard-engineered banks and/or quay headings, usually either concrete or wooden.

The artificial steepness of the canal edges means that macrophyte presence is limited, and the riparian habitats restricted in nature and size. Emergent vegetation, reeds, rushes and sedges often combine to create a very narrow strip of vegetation, if present at all. It is often bounded by the canal on one side and the towpath on the other, so is barely any wider than one metre.

The canal corridor often also incorporates a well-established hedgerow and/or line of trees as its boundary feature. The trees are often willow species or poplar.

The wider landscapes, and the associated habitats, are far more varied, however three main types are noted. Much of the route is through an agricultural landscape, with varying proportions of arable and pastoral land dominating the landscape. These are characterised by large, often homogeneous habitats, punctuated by linear features including hedgerows and ditches, both of varying quality.

The canals also pass through urban environments, where the mosaic of habitats include residential areas (housing, gardens, roads etc), as well as urban parks and recreational areas, which themselves can include grassland of varying (often good) quality, scrub, shrubs and woodland, hedgerows and treelines, ponds lakes etc.

The third main set of habitats is around wider river corridors, when the canal runs loosely parallel with other rivers. In these areas, the river corridor is often more semi-natural in nature, with an associated floodplain between the two that includes grassland, marsh, swamp, woodland, tall ruderals etc.

### **3.4 Potential for Presence of Protected Species – Pipeline Corridor**

#### **3.4.1 Description of habitats**

The pipeline corridor from where it begins in Minworth to where it terminates at Atherstone includes a range of habitat types, with varying levels of suitability for protected species. In the following sections the habitats that differing protected species can be found in are described.

#### **3.4.2 Bat habitat assessment**

Bats use a variety of habitats throughout the year as they feed, roost and travel. They use foraging habitats to find food and commuting habitats (linear features) to travel between roosts and foraging habitats. These habitats are vital for bats. Wooded areas are particularly important as they can provide roosting sites, hibernation sites, foraging habitat and breeding/maternity sites.

Bats are likely to be present along nearly all of the pipeline route in some capacity, the pipeline route offers potential roosting, foraging and commuting habitats. The pipeline route passes through habitats such as woodland, for example Monk's Park wood, and habitats such as arable field margins with associated ditches and hedgerows.

#### **3.4.3 Badger habitat assessment**

Badgers are found across the UK, with the highest numbers in southern England. Ideal badger habitat is comprised of a mixture of woodland and open country. Each badger territory will include a main sett and several smaller setts of differing type and function. Badgers are opportunistic foragers that make use of a range of habitats. They forage over a large area and as a result need a relatively large area of habitat for their home range.

Badgers have the potential to be present at nearly any point within the 500m buffer of the pipeline route. Badgers can even often be found in some of the suburban settlements that the buffer captures. As badgers often use a mixture of woodland and grassland habitats they may reside anywhere where there is a woodland stand with some adjacent foraging habitat. Furthermore, badgers can make their setts and home range on nearly entirely arable landscapes, therefore they have the potential to reside at any point within the buffer zone along the pipeline route.

#### **3.4.4 Reptile habitat assessment**

Reptiles are most widely distributed on large areas of habitat such as heathland, moorland, rough grassland, and sand dunes. They are often present locally in a range of other land covers. For example, ideal land covers may include railways and disused railway lines, roadside embankments and verges, churchyards/cemeteries, allotments, derelict/brownfield areas, neglected/overgrown land, rough pasture, scrub, quarries, woodland glades. Localised features and the correct vegetation cover/structure are important for reptile species to be present.

Reptiles are likely to be found in the areas of lowland meadow and lowland fens as well as Monk's Park woodland. The area of floodplain grazing marsh is located just to the east of the existing wastewater treatment plant at Minworth, which has a mosaic of habitat to the east of the sewage treatment plant. Areas of deciduous woodland such as Drybrooks Wood have the potential to support common reptile species.

#### **3.4.5 Breeding and wintering bird habitat assessment**

Breeding birds are found in nearly all UK habitats. Breeding birds in the UK are split into species assemblages. For example, farmland species assemblage, woodland species assemblage and wetland bird species.

Breeding birds, being found in nearly all UK habitats are likely to be a constraint anywhere there is suitable nesting habitat such as hedgerows, trees, ditches, and woodland. Areas that may present particularly high potential for breeding birds to be present is the Monk's Park wooded area and the adjacent wood pasture and parkland habitat, the disused gravel pit complex east of Marston and the disused/vacant land east of Minworth wastewater treatment works.

Several sites along the proposed route are likely to be of value for wintering birds too; these include, but are not limited to, Wyken Slough LNR and Tring SSSI.

#### **3.4.6 Other protected species**

As there are aquatic habitats present along the route of the pipeline there is the potential for otters and water voles to be present. Please refer to section 3.4.1 for further information.

Otters will use a broad variety of watercourses and waterbodies including rivers, lakes, canals and ditches. They have the potential to be present anywhere where there is suitable aquatic and terrestrial habitat. For example, the River Tame, which the pipeline will pass, and the disused gravel pit complex has the potential to support otter.

Water voles also use a variety of watercourses but generally prefer sites with earth banks for burrowing with significant swathes of vegetation for foraging. They generally prefer slower flowing watercourses. Any habitat on site that offers slower moving watercourses with the appropriate gradient embankment, if appropriate vegetative food sources are present and predation is low enough, has the potential to support water voles. Areas within the 500m buffer of the pipeline route that may offer these habitats, and as a result have the potential to have water voles present are (including but not limited to) the ditches and watercourses east of Lea Marston and the watercourses between Hurley and Baxterley.

Great crested newt are primarily terrestrial but use ponds and other waterbodies such as ditches for breeding. Great crested newt will hibernate on land and therefore require hibernacula such as logs, log piles and rubble to hibernate in. Woodland and scrub habitat will also be used for dispersal. Where these habitats are present on site there is the potential for great crested newts to be present.

### **3.5 Potential for Presence of Protected Species – Coventry Canal, Oxford Canal and Grand Union Canal**

#### **3.5.1 Predicted increases in water levels**

The canal corridor, from where the proposed pipeline would outfall close to Atherstone, to the Leighton Buzzard extraction point (and potentially beyond), includes a range of riverine, riparian and terrestrial habitat types, with varying levels of suitability for a wide range of protected species.

The project has the scope to alter the water level in the affected canals (Coventry Canal, Oxford Canal and the Grand Union Canal) which will have a number of consequential effects. In engineering terms, increases in water levels are likely to mean that the banks either side will need to be raised in some locations. This could involve potentially invasive engineering works over significant lengths, which will impact on habitats present, with adverse effects on those species using them for shelter, foraging, commuting etc.

In addition, as already described in Section 2 of this document, the increase in water level in the canal may result in the increase in water levels in adjoining and adjacent watercourses and waterbodies, with similar adverse effects also likely to be felt.

The increases in water level in the canals has been predicted, based on an initial round of hydrological modelling. Appendix C includes a map showing these lengths (Appendix C1), and a table indicating, link by link along the whole route, the predicted increase in water levels, with those links likely to be subject to engineering works to raise the banks clearly indicated (Appendix C2).

Effects on habitats and species, due to the impacts associated with the increases in water levels, can be split into two main areas. First are those areas where the increase is sufficiently limited that no engineering works are proposed to increase the heights of the banks. In general terms this threshold is 50mm; increases up to and including 50mm are not predicted to require any physical works, and so impacts will be limited to those caused by the increase in water level on habitats and species.

Secondly, increases over 50mm (and in some cases up to 200mm) will require engineering works. Effects here will be centred on the inevitable habitat loss during construction, with impacts on those habitats and species present. These impacts are clearly far greater in magnitude than where no engineering work is required.

### 3.5.2 Potential effects on protected species

Where no engineering works are required, the effects are limited to the riparian zones, and so the impacts on habitats protected species are likely to be fairly limited in magnitude. The canal system is an artificially maintained environment, with the water level kept at a loosely constant level. This is at odds with more naturally functioning rivers, where water levels fluctuate in response to rainfall and other variables, and where protected species are able to exist. The rate at which the increase took place would obviously influence the degree of impacts felt.

The same is true of the habitats and species associated with the adjoining/adjacent watercourses and waterbodies, where the change in water levels will have similar effects.

In these cases, with effects restricted to the riparian zone, of key concern is the potential presence of otters, water voles and great crested newts. Section 3.5.3 below details the general habitat preferences of these species, and hence informs the predicted impacts on these species.

Nesting birds are likely to use the affected riparian habitats along the canal. However, as was concluded at Gate 1, the limited increase in water level along these stretches is not predicted to have any adverse effects on nesting birds.

Where engineering works are required to raise banks, the effects are likely to be far greater. The footprints of the works would potentially require the loss of habitat beyond just the riparian zone, affecting areas of grassland, scrub, trees and shrubs plus potentially many more habitat types. This correspondingly means that the range of protected species and habitats that could be impacted is far higher, and comparable in many ways to the potential impacts of the construction of the pipeline discussed previously. These works could potentially affect breeding

and overwintering birds, bats, badgers, reptiles, dormice, and terrestrial invertebrates in addition to the previously mentioned otters, water voles and great crested newt.

The potential impacts on these species is of course dependent on the degree of habitat loss, disturbance, fragmentation etc that occurs. This in turn depends on the design of the increased banks, and the construction methodologies employed.

Key to the presence of the above protected species, and in particular water voles, is the type of banks along the canals; the method of engineering/construction will have a clear influence over their suitability for burrowing etc.

The Canal and River Trust has provided information on the construction type for the banks of the Oxford, Coventry and Grand Union Canals. The bank types (with left and right banks classified individually) are classified as one of the following types:

- Heavy Duty / Structural Piling
- Trench Sheet Piling
- Timber/Wooden/Plastic Piles
- Concrete “Sleeper” Planks
- Brickwork Walling
- Masonry Walling
- Concrete Walling
- Gabion Basket
- Revetment/Pitching
- Sandbags/Concrete Bags (etc.)
- Reed Fringe
- Geotextile/Coir Roll
- Unprotected Earth Bank
- Obscured

Table 3.5 below shows the total lengths of each bank type for the scheme, with summaries for hard and soft banks types.

**Table 3.5: Bank engineering types and total lengths**

Protection Type	Left Bank Length (m)	Right Bank Length (m)	Total Length Both Banks (m)
Brickwork Walling	13,622.98	12,076.30	25,699.28
Concrete “Sleeper” Planks	42,357.28	38,265.31	80,622.58
Concrete Walling	9,675.12	9,716.66	19,391.78
Gabion Basket	100	124.98	224.97
Geotextile/Coir Roll	3,093.27	2,893.19	5,986.46
Heavy Duty / Structural Piling	5,186.26	5,912.92	11,099.18
Masonry Walling	9,348.14	13,591.38	22,939.52
Obscured	523.56	123.38	646.94
Reed Fringe	9,114.72	5,186.72	14,301.44
Revetment/Pitching	4,479.30	14,539.38	19,018.68



Protection Type	Left Bank Length (m)	Right Bank Length (m)	Total Length Both Banks (m)
Sandbags/Concrete Bags (etc.)	999.64	2,804.09	3,803.72
Timber/Wooden/Plastic Piles	1,175.74	850.17	2,025.91
Trench Sheet Piling	32,187.30	47,630.56	79,817.85
Unprotected Earth Bank	31,745.02	9,893.28	41,638.31
Not Recorded	4,598.54	4,598.54	9,197.08
#N/A	223.47	223.47	446.94
<b>Total</b>	<b>168,430.33</b>	<b>168,430.33</b>	<b>336,860.66</b>

In many areas the various types of hard engineered banks have the potential to be beginning to fail, or to incorporate gaps. In these locations, the potential for water vole presence is higher, as the earth substrate behind is accessible for burrow creation.

This information has been combined with the data provided on predicted water level rises, to identify those canal lengths where impacts on protected species associated with the canal edge are most likely to arise. Maps showing these areas are included in Appendix D3. The areas are mostly at the northern end of the scheme, from Atherton to Nuneaton, Coventry to Rugby, with just a small number of fragmented lengths to the southwest of Northampton.

It is these areas where adverse impacts on habitats and protected species are most likely, although it must be borne in mind that impacts are possible elsewhere too; if works to raise banks include construction behind the bank edge, then adverse effects are also likely to be felt. Construction works also have the potential to affect other protected species (e.g. bats, badgers, dormice) using habitats alongside and set back from the bank edge.

Information on construction methodologies, footprints etc are not yet available at this early stage of the scheme design. Therefore the potential impacts on these other species are not considered in detail at this stage and focus has been on otters, water voles, great crested newts; other species will be included in the assessments to be carried out at Gates 3 and 4.

### 3.5.3 General riparian habitat preferences of protected species

#### Otter habitat preferences

Otters can use a wide variety of watercourses and waterbodies for foraging and commuting including rivers, canals, ditches, and lakes. Otter also require terrestrial habitat for resting, holts and natal holts. Key characteristics of suitable habitat for otter includes:

- Availability of food sources including fish, amphibians, and crustaceans etc.
- Availability of terrestrial habitat for holts, particularly dense impenetrable cover, including woodland, mature trees, and scrub.
- Adjoining land use with low levels of disturbance, though otters can habituate to regular disturbance including noise, light and visual.
- Good connectivity to watercourses and waterbodies within the wider landscape and terrestrial habitat for resting.

#### Water vole habitat preferences

Water voles also use a variety of watercourses but generally prefer sites with earth banks for burrowing with significant swathes of vegetation for foraging. They generally prefer slower



Grid references for continued monitoring locations redacted

flowing watercourses. They also rely on the absence of American mink (*Neovison vison*), as predation of water voles can have significant impacts on populations. Key characteristics of suitable habitat for water vole includes:

- Earth banks (or other substrates suitable for burrowing), preferably with a steep profile for burrowing.
- Availability of vegetative food sources including sedges, grasses, rushes and herbaceous plants.
- Absence of American mink.
- Banks with limited shading from trees and scrub to allow vegetation growth.

### Great crested newt habitat preferences

Great crested newts are primarily terrestrial, but use ponds and other waterbodies such as ponds and ditches for breeding. They will hibernate on land and therefore require hibernacula such as logs, log piles and rubble to hibernate in. Woodland and scrub habitat will also be used for dispersal. Key characteristics of suitable habitat for great crested newts includes:

- Waterbodies for breeding.
- Absence or low populations of predators such as fish.
- Aquatic vegetation suitable for laying eggs in.
- Terrestrial habitat suitable for dispersal and hibernation.

### 3.5.4 Potential presence of protected species at sampling locations

The results of the site surveys are given below. The aim of these surveys was to provide an indication of the potential suitability of the canal corridor for protected species, most notably otters, water voles and great crested newts, at selected locations along the scheme route. As described above in Section 2.4, these surveys were not intended to represent full protected species surveys due to the early stage in the scheme design development and further surveys will be carried out at later gate stages to inform the Environmental Statement (ES).

For those site visits undertaken in conjunction with the INNS surveys, pro formas were completed. These can be found in Appendix E. The results of these visits have been incorporated into the descriptions and assessments below.

#### Location 1: Coventry Canal, north of the M6.

Grid Reference: [REDACTED]

General Site Description: Canal runs through a largely arable landscape, with the M6 bridging to the immediate south. Canal bounded by narrow belts of trees/shrub to both banks, up to the canal edge on the eastern bank. Towpath/long distance footpath on the western bank. Engineering to banks hard to define. Very narrow strip of riparian vegetation – semi-aquatic/emergent vegetation – along the eastern bank, with grassland and scrub also present.

Otter: Generally good habitat for otters. Accessible habitat to both banks, providing shelter, commuting opportunities, locations for holts etc. Food sources from canal itself.

Water vole: Moderate suitability for water voles; a narrow strip of riparian vegetation to east bank, presumably due to the artificially steep bank form. Also, moderate level of disturbance from people, dogs etc. Very few associated watercourses/waterbodies to provide additional habitat.

Great crested newt: Terrestrial habitat generally good for great crested newts, although breeding ponds etc seem very infrequent in the landscape.

Grid references for continued monitoring locations redacted

**Location 2: Oxford Canal, north of Rugby. Southeast of the B4112 bridge over the canal.**

Grid Reference: [REDACTED]

General Site Description: Largely agricultural landscape, with mix of arable and pastoral land uses adjacent. Smallholder/allotment also adjacent. Canal itself largely in cutting in the landscape, with mature trees and shrubs to both banks, providing shading.

Otter: This location includes habitat that is of moderate suitability for otters. Canalside vegetation to the western bank limited by presence of towpath, with tree-lined steep sided banks beyond this. Trees to the eastern bank also present, providing shading that means that ground level habitats generally limited. This in turn means limited scope for holts, although the canal remains largely suitable for commuting, foraging etc.

Water vole: Low to negligible suitability for water voles. Bank form steep, and of limited height. Very little riparian vegetation between canal and adjacent towpath. Habitat for shelter, foraging etc very limited. Very few associated watercourses/waterbodies to provide additional habitat.

Great crested newt: Terrestrial habitat of the canal corridor itself generally moderate to good for great crested newts, although ponds suitable for breeding etc seem very infrequent in the landscape.

**Location 3: Oxford Canal, southeast of Rugby, south of the Rugby Road bridge.**

Grid Reference: [REDACTED]

General Site Description: A very flat agricultural landscape, with the canal bounded on either side by grazed fields and/or fields used for hay production. Small copses of woodland/scrub are present, and a hedgerow runs along the western bank, with the towpath also present this side of the canal. Riparian habitats are either exceptionally narrow or absent completely, and banks are generally steep in form, and of limited height above the water level.

Otter: Suitability for otter along this stretch is limited to commuting and possibly foraging; the limited availability of suitable canalside habitat means that potential locations for holts are sparse. Foraging could take place in the canal itself for fish, crustaceans etc, and along the banks for amphibians etc, although the limited quality of the terrestrial habitat means the potential for this is reduced.

Water vole: Varied scope for water vole presence along this stretch. Suitable riparian habitats are often limited in quality, and very narrow in width, if present at all on either bank. Disturbance is generally high on the western bank where the towpath is frequently used. Much of this length of canal has hard engineered banks, further reducing scope for water vole presence, although where this is failing, the potential for water vole presence increases. Also scope for presence in ditches in adjoining farmland.

Great crested newt: This open, arable landscape provides limited suitable habitat for great crested newts. The open grassland provides little shelter from predation, although a handful of ponds do exist in the wider landscape, some distance from the canal. Rains Brook potentially offers some suitable habitat for dispersal, although is likely to be too fast flowing for breeding. The low number of ditches, hedges etc provide limited means of dispersal through the landscape, although one adjacent field does have longer grass underneath planted Spruce (*Picea* spp) trees.

**Location 4: Grand Union Canal, Nether Heyford, north of Furnace Lane bridge.**

Grid Reference: [REDACTED]

General Site Description: Rolling agricultural landscape, with a mix of arable and pastoral/grassland land uses adjacent to the canal. Parts of the canal in this location are tree-

Grid references for continued monitoring locations redacted

lined, others with occasional shrubs, or just grassland/riparian vegetation. Both banks over much of this stretch appear hard engineered.

**Otter:** Whilst the eastern bank has limited riparian habitat present, and experiences disturbance from people using the towpath, the western bank offers far more in the way of usable habitat for otters. The areas of tree cover provide the seclusion and the potential habitat for holts, laying up sites etc, and the lower-level grassland and ruderal habitats offer good opportunities for foraging as well as commuting.

**Water vole:** Habitat suitable for water voles along this length is generally fairly limited. For most of this length the banks are hard engineered, with little or no riparian vegetation present. Occasional stretches include overhanging grasses, bramble etc, and stands of reed are present towards the northern end, but without burrowing opportunities, the potential presence of water voles along the canal corridor itself is low. Luddle Brook, which runs perpendicular to the canal, may offer greater scope for water voles to be present, although public access to this was not available.

**Great crested newt:** The canal corridor itself is of limited value for great crested newts. Fish are likely to be present, which predate on young newts and eggs, and the disturbance from boats and the very limited presence of macrophytes on which to lay eggs also means that suitability is generally low. Adjacent ditches and ponds in the wider landscape may offer more suitable habitat, although access to these was unavailable. The belt of trees, scrub and grassland along the canal edge does offer the scope for terrestrial habitat for great crested newts, although the degree of usage will be proportionate to the amount of breeding opportunities elsewhere in the landscape.

**Location 5: Grand Union Canal junction with Northampton Arm, north of Bilsworth, close to the A43 bridge.**

Grid Reference: [REDACTED]

**General Site Description:** This location centres on a pair of marinas/boat yards servicing the boating industry. The A43 dual carriageway passes by on a flyover, and a main train line also crosses the canal. The arable landscape is punctuated by small rural developments; there are a number of buildings associated with the boat yards, and a small settlement is located south of the railway. There are a number of areas of woodland and shrubs, and an area of grassland/tall ruderal habitat between the canal and railway. Ditches, hedgerows and trees border the fields. The canal banks away from the boat yards and marinas appear mostly soft, where around the marinas they are hard engineered.

**Otter:** The heterogeneity of the habitats along the canal corridor infer a good level of suitability for otters in this general location. The habitats on the western bank, east of the A43, provide cover for potential holts and laying up sites, as well as for commuting and foraging, for which the canal itself will also be used. Towards the boat yards the semi-natural habitats give way to more formal, manicured plots behind hard engineered banks and quay heads. The marina to the south of the canal includes large areas of mown amenity grassland with little or no value for otters, and those to the north, along the GUC Northampton Arm include properties right up to the canal edge. West of this area the canal banks are still hard engineered, with regular mooring of narrowboats, towpaths and frequent disturbance. However, the habitat remains of use for otters as foraging and commuting habitat, particularly in darkness when they are most often active. Adjacent habitats, including mature, well-established hedgerows etc also offer foraging habitat and shelter.

**Water vole:** Those areas of apparently soft banks, to the east of the A43, offer plenty of potential habitat for water voles, particularly along the edge of the field of ruderal habitat and scrub. Whilst the actual banks could not be seen due to vegetation and limited access (it being on the

Grid references for continued monitoring locations redacted

opposite side of the canal from the towpath), it is assumed that their nature and form, in conjunction with plenty of shelter and foraging habitat, means that this specific area is of good suitability for water voles. Elsewhere, where the banks are hard engineered, their suitability is far less as there are no burrowing opportunities and no viable riparian habitat in which to feed and shelter from predation. The perpendicular brook that runs north/south, between the junction with the GUC Northampton Arm and Milton Road, appears to offer far better water vole habitat, although access was not available. There appears to be a narrow band of suitable vegetation in between the arable fields, with the occasional cover from trees/shrubs.

Great crested newt: As with many of the previous locations, the potential presence of great crested newts along the canal in this general location is limited. Hard banks, disturbance of the water due to boats, very little in the way of macrophytes on which to lay eggs, and a fish population that would predate on young newts mean that their presence is of limited likelihood. In the wider landscape they may be present; access beyond the towpath and public highways was limited, but areas with ponds surrounded by suitable terrestrial habitat will mean that their presence is more likely. The terrestrial habitats along the canal corridor may therefore be used by newts in their terrestrial phase.

#### **Location 6: Confluence with the River Tove**

Grid Reference: [REDACTED]

General Site Description: The canal is set in an arable landscape here, with comparatively small fields bounded by hedgerows, ditches, and occasional trees/shrubs. In this location the River Tove flows into the GUC from the west, and then around 200 metres downstream it diverges again, much smaller in volume, width etc. The riparian habitats along the canal here are generally of moderate ecological value; the form of the bank allows emergent variegation to grow into a useful width between the canal and the tow path. This is then accentuated by the River Tove itself, which runs parallel to the canal for a few hundred meters, in more of a cutting and with far more naturalised habitats, including aquatic and semi-aquatic swards, some areas of tall ruderals, and a belt of trees/shrubs.

Otter: The parallel corridors of the GUC and the River Tove combine to create very good habitat for otter. Despite the inevitable disturbance from the towpath, the overall suitability is high, with a range of habitats, good food sources from both watercourses, and a number of areas of habitat that could be used as laying up sites, holts etc.

Water vole: The majority of the canal corridor along this length appears to have good potential for water vole to be present. The bank form appears generally to be suitably sloped and with plenty of burrowing opportunities, with little hard engineering evident. The riparian habitats on both sides, and along the River Tove, appear to offer good opportunities for shelter, foraging etc, with the canal less shaded than the River Tove. Usage of the footpath is likely to cause some levels of disturbance from walkers, dogs etc, but the opposite bank also appears to have plenty of suitable vegetation and a moderate sized buffer between canal edge and the adjacent arable fields.

Great crested newt: Potential great crested newt presence is again restricted to terrestrial habitat usage, if there are sufficient /breeding ponds in the wider landscape to sustain a population. The canal, as with previous survey locations, is of limited suitability for newts due to the fish predation, disturbance of the water due to boat traffic, limited macrophyte presence etc.

#### **Location 7: Grand Union Canal, Milton Keynes, north of the H3 Monks Way**

Grid Reference: [REDACTED]

General Site Description: A suburban/urban fringe setting in the north of Milton Keynes. Residential areas to the immediate east of the canal, with grassland floodplain and sports

Grid references for continued monitoring locations redacted

pitches to the west, punctuated by well-established hedgerows and treelines. At its southern end, the eastern bank includes a wide area of amenity grassland with scattered semi-mature parkland trees between the canal and the residential area. Further north this narrows down, such that the towpath is closely bounded by canal and tree belt. The bank is consistently hard engineered. To the western bank is a sizeable marina-type area with numerous narrowboats moored end on, in front of a small car park and more amenity grassland.

Otter: This whole section is likely to be subject to high levels of disturbance, being a suburban setting. The canal remains of use for commuting and potentially foraging, although holts or laying up sites in this stretch are extremely unlikely in the southern half. Further north the vegetation becomes more naturalised along the western bank, offering shelter and seclusion although public access around these areas is still likely to mean that holts etc are of limited likelihood.

Water vole: Habitat for water voles is found on the western bank of this stretch of canal, particularly in the northern half, where the adjacent parks and public access areas become more semi-natural in nature, with the riparian vegetation beginning to form a wider, more useable corridor. The bank here is generally obscured by vegetation so it was not possible to tell whether it was hard or soft, but the extent and nature of the riparian habitats would imply that it was soft. If this were the case, then the suitability for water voles is generally high. The east bank throughout this stretch was entirely hard engineered, with mooring and a metalled towpath, meaning that on this side of the canal, water vole presence is not likely.

Great crested newt: Just one area offered viable great crested newt habitat. This centred on the pond adjacent to the canal at the northern end of this stretch, on the edge of the Great Linford Playing Fields. The pond appears to have plenty of macrophytes on which egg laying could take place. Several other parameters also indicated that newt presence could be likely. It is also surrounded on three sides by extensive suitable terrestrial habitat: grassland, riparian habitats, scrub, pockets woodland etc.

#### **Location 8: Grand Union Canal, Bletchley, from Mill Road south to A4146**

Grid Reference: [REDACTED]

General Site Description: This section includes marks the boundary between the edge of the urban area of Bletchley and the adjacent rural areas to the immediate east. On its western bank the canal is bounded by areas of suburban housing, with a mix of hard engineered and soft banks, and corresponding amounts of riparian vegetation. In parts, gardens abut the canal edge, whereas elsewhere there is public open space, including grassland (mostly semi-improved, but generally mown), scrub, bankside trees and emergent vegetation. The eastern bank, which is mostly hard engineered with the towpath immediately adjacent, abuts a mature hedgerow and tree line, which in turn adjoins areas of public park. This public park is linear in nature, with the River Ouzel on its eastern side, beyond which is arable farmland. An area of allotments is located at the southern end of this stretch between canal and river.

Otter: The canal, and the nearby River Ouzel, both represent good habitat for otter. Both are likely to provide plentiful food sources and foraging opportunities, with commuting along both highly likely. The canal itself is likely to be subject to higher levels of disturbance to otter than the river corridor, with the urban areas offset to the west, and a narrow but well-used towpath to the east. The line of bankside trees to the western bank provides shelter, with overhanging branches obscuring the water's surface. The public park area to the east does provide cover, with opportunities for otter to create holts, laying up sites etc, although this value is depleted by the high disturbance rates from people enjoying this fairly formal and heavily managed parkland area for walking, exercising their dogs etc.

Grid references for continued monitoring locations redacted

**Water vole:** Those portions of this stretch of canal with hard engineered banks are of limited value for water vole, with little scope for them to create burrows etc, except where failures have occurred. Those areas along the western bank where the bank appears soft, with riparian vegetation implying a more naturalised bank form, could feasibly provide water vole habitat. There is a degree of disturbance from people, dogs etc, and the grass beyond the immediate canal edge does appear to be mown fairly regularly by the local authority, so this potential is not as high as it could be. Where this vegetation type gives way to bankside lines of trees, the potential for water vole presence reduces, as ground level vegetation for them to shelter in is far less frequent.

**Great crested newt:** The potential for presence of great crested newts is low along the canal corridor. The profile of the canal means that macrophyte presence is limited, which means that there is limited scope for egg laying. The disturbance from boats is fairly high, and the presence of fish in the canal means that predation on newts would be high too. These factors combine to mean that great crested newt presence is of limited likelihood. The River Ouzel is likely to be too fast flowing for newts, and there appear to be a very small number of ponds in the immediate area, in which great crested newts could potentially breed. This means that the terrestrial habitats along and adjacent to the canal have limited scope for newt presence.

#### **Location 9: Grand Union Canal, Stoke Hammond**

Grid Reference: [REDACTED]

**General Site Description:** This stretch of canal, south from Stoke Hammond, runs through a rural landscape, with a multitude of adjacent land uses. Arable land dominates to the immediate west, with a mature tree line and hedgerow separating it from the canal. On the eastern bank the land use is more slightly formal. The northern half is characterised by broadleaved plantation, in a semi-ornamental layout of straight rows of trees, over what appears to be semi-improved grassland. A line of scrub/shrubs intermittently separates this from the canal. The River Ouzel is located to the east of this land, running loosely parallel with the canal but in a far more sinuous, meandering form. The river itself appears to be lined with semi-natural mature trees and shrubs for much of its length. To the southern half of this stretch, the Ouzel is located close to the canal, with associated blocks of tree belt/broadleaved woodland. A golf course is located to the immediate east of the river. Its layout and form is typical, including the standard variation of short grass, longer grass, occasional ponds, shrub and trees.

**Otter:** The canal corridor is likely to be used by otter. This likelihood is enhanced by the River Ouzel being in close proximity; the two corridors, with their combined heterogeneity of habitats, combine to create a wealth of opportunities for sheltering, commuting and foraging. The canal's east bank, with its mosaic of land uses, and habitats would appear more preferable than the west, which is closely bounded by farmland and also has the towpath alongside.

**Water vole:** Much of the eastern bank along this stretch is of limited suitability for water vole. The bank appears to be hard engineered – which generally limits opportunity for burrowing – over much of its length, although for large proportions of this stretch it is obscured by banks of overhanging bramble etc, so it is not possible to be sure. The west bank appears slightly different in that in many locations old wooden piling appears to have failed, leaving earth banks suitable for burrowing, although they are not particularly tall, and have only a very narrow strip of emergent vegetation associated with them. Some portions do still have intact hard engineered banks. The towpath here also equates to a moderate level of disturbance,. The wider landscape is likely to offer more enhanced opportunities for water voles, with the corridor of the River Ouzel, ditches and brooks potentially offering areas of sufficiently slow-moving water, wider areas of bankside vegetation and less direct/regular disturbance.

**Great crested newt:** In common with most previous sample locations, the suitability of the canal itself for great crested newt is generally low. Adjacent farmland to the west is also of low



Grid references for continued monitoring locations redacted

suitability. The adjacent terrestrial habitat does offer some scope as terrestrial habitat, but that is dependent on there being sufficient breeding opportunities in ponds etc being present to sustain a population. Mapping indicated that one pond is located around 500 metres to the west, but with intensive arable land between it and the canal corridor, connectivity is limited. Larger ponds are found in the golf course, which may be suitable, depending on parameters like the number of fish and/or waterbirds present, amount of macrophytes, level of shading etc. The River Ouzel, depending on its velocity etc, may act as a barrier to dispersal from those ponds as far as the canal.

#### **Location 10: Grand Union Canal close to the River Ouzel, Leighton Buzzard.**

Grid Reference: [REDACTED]

**General Site Description:** This area of urban fringe, on the edge of Leighton Buzzard, includes once again the canal and the River Ouzel flowing through the landscape in tandem, the latter far more meandering than the former. To its western bank lies, from north to south, a water treatment works, fields of improved/poor semi-improved grassland (presumably grazed), and residential areas on the very edge of the town. To the east is the towpath, hedgerows and trees, small blocks of deciduous woodland, floodplain grassland and the River Ouzel. Beyond the river corridor lies further urban/suburban land use, mostly residential, with one moderate sized area of industry, a furniture factory.

**Otter:** As with those examples above, where the canal exists in the landscape alongside another river, the resultant mosaic is of high suitability for otter, offering a myriad of opportunities for foraging, commuting, resting/sheltering etc. The comparatively sheltered nature of the habitats, with lots of opportunities for escaping disturbance, means that otter presence is likely. Given that the disturbance is likely to be highest close to the town/residential areas, and lower as distances from residential areas and areas of frequent mooring increase, the northern part of this section offers the best potential. Commuting and foraging is feasible throughout this stretch.

**Water vole:** The canal along this stretch flows between hard engineered banks of almost all of its length, to both banks. The towpath, itself a metalled surface, is offset from the canal side by little more than a metre, with a semi-improved grass sward between the two. Very little if any emergent/riparian vegetation exists, and so the suitability for water vole is low. To the western bank, where it abuts residential areas, the bank is hard engineered, with only occasional areas of riparian vegetation. Suitability is generally low. The more northern portion, however, does include more semi-natural banks, both in form and in habitats present. Banks of reeds/rushes, tall ruderal vegetation, scrub, shrubs and trees. Here water vole presence is more likely, especially when tree and shrub cover is limited and not too dominant. Wider presence of water voles in suitable habitats in the floodplain between canal and the Ouzel, is likely, particularly along the Ouzel where localised conditions permit.

**Great crested newts:** The suitability of the canal itself remains low for great crested newts, for much the same reasons as previously described. Bankside areas offer moderate terrestrial habitat, but their presence is depending on suitable locations for breeding in the vicinity. These could be ponds, or ditches with sufficiently slow-moving water that is present throughout the breeding season.

#### **3.5.5 Summary of findings**

For much of its length, the canal provides suitable habitat for otters to commute and forage. The canal corridor, and adjacent land parcels, contain abundant suitable habitat for otters to create and maintain holts, couches, laying up sites etc

Impacts on otters are likely to be dependent on the extent of the works, the construction methodologies, and on how much bank is affected in any otter territory at any one time. Recommendations for further surveys are given in the next section.

The canal corridor is of varying suitability for water voles. Their ranges are far smaller than otters, and so in areas where habitat is suitable, they are likely to be found at high densities.

Presence of water voles in the canal banks is sometimes limited by hard engineering, although where hard engineered banks are beginning to fail, and/or where gaps are present, water voles may be present. Where banks appear not to be hard engineered, suitability for water voles is generally consistently higher, although in some locations this could be limited due to other factors, for example disturbance along the towpath, the limited breadth of riparian habitat the limited height of the banks in which to burrow (although this is lessened slightly by the artificially maintained water levels which is assumed to be fairly constant despite rainfall).

Potential presence is also likely in those habitats set back from the canal edge (and hence in private ownership), where similar suitable conditions are potentially found. In many of these locations, without the restrictions of the canal's necessary functionality, banks into which to burrow are also likely to be of suitable substrate, height, angle etc, swathes of suitable vegetation are likely to be wider, with more space for foraging and sheltering, and disturbance levels are likely to be far lower.



## 4 Recommendations

### 4.1 Recommendations for terrestrial surveys for the pipeline section

The pipeline route should be subject to proportionate surveys throughout the remaining stages of design and planning. The assessment has been based on concept design appropriate for Gate 2 and pipeline routing will continue to be refined throughout planning and delivery.

The installation of the pipeline will predominantly cause construction-phase effects on ecological assets and constraints, with few operational phase effects, as obviously the majority of the infrastructure will be below ground. Even if there is little scope for refinement of the pipeline route, further surveys for protected flora and fauna will identify constraints that will inform programme and construction methodology.

Some impacts may require Natural England wildlife licences to be sought (e.g. for otters, water voles and great crested newts); this process places some defined demand in terms of survey effort, frequency etc, and mitigation measures are likely to be needed. Early commencement of surveys, in a proportionate manner corresponding with the level of detail of the design, and with the project stage, will help to reduce risk by identifying as yet unknown issues.

It is recommended that the approach for these surveys be given consideration, not least around access to land to carry out surveys. A first action should be the ground-truthing and refinement of the habitat map; this would confirm or correct any allocated habitat types, and supplement with the necessary detail of linear features, which the current process does not provide.

It is also recommended that proposed surveys include consideration of watercourse and waterbodies that may be hydrologically connected, where for example white clawed crayfish may be present, as alteration to the groundwater regime could impact on these species.

An additional scheme requirement is for a biodiversity net gain (BNG) of 10% over the baseline. A separate BNG report<sup>13</sup> is being prepared. The overlap between the habitats assessment in this report and any next steps, and the BNG work is notable, so this should be drawn out and joint benefits actively sought out. It is recommended that condition assessments to inform the BNG metric should ideally be undertaken at the same time as the habitat mapping ground truthing, to avoid having to undertake duplicate visits.

Further surveys should be scoped by also referencing online resources such as the Warwickshire Green Infrastructure mapping system and other similar tools, to ensure the data already captured in these is incorporated.

### 4.2 Recommendations for surveys on canals and associated waterbodies

#### 4.2.1 Surveys in relation to raising towpaths and embankments

As soon as it is appropriate, more detailed surveys should begin on those lengths of canal that are likely to be subject to engineering works to increase the bank height. Consideration should be given to the construction methodologies in order that realistic works footprints (as multiple locations are likely to be affected) can be gauged. These footprints - which should also include temporarily affected areas like haul roads, materials storage areas, site offices and welfare facilities – and the applicable Zone of Influence (ZoI) should then be surveyed to give more detail than is currently available. The ZoI will depend on the likely construction methodology etc;

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<sup>13</sup> Natural Capital and Biodiversity Net Gain Report, Mott MacDonald, 2022

if this is not available or could be subject to change later in the design process, then the extent of the Zol/survey areas should include sufficient precaution such that nothing is excluded.

Potential surveys include:

- More comprehensive coverage of the first pass habitat mapping, to address all those areas likely to be subject to physical change such as those lengths of the canal where banks are likely to be raised to account for the increased water level, or the entire length of the canals.
- Habitat mapping ground truthing, and condition assessments to inform BNG calculations.
- Great crested newt Habitat Suitability Index assessments, leading to eDNA surveys where appropriate.
- Bat potential roost assessment surveys.

As the scheme design evolves, and more certainty around the footprint/landtake is available, more detailed surveys could take place. These include (but are not limited to):

- Botany (National Vegetation Classification) surveys – to provide more detail as to those habitats that could be affected by the scheme.
- Bats – emergence/re-entry and/or hibernation surveys of trees and other features that could potentially be used by bats.
- Badgers – searches for field signs and setts, to identify whether badger populations would be affected by the scheme.
- Breeding birds – to allow assessments to be carried out as to the likely impacts on breeding birds. Waterbirds etc could be affected by works to the canal, as could other species if works to adjacent habitats are proposed.
- Wintering birds – to allow assessments on wintering birds, and the habitats they use, to be completed.
- Great crested newts – further surveys to provide information on population sizes in any waterbodies identified during the eDNA surveys.
- Reptiles – to identify any habitats used by reptiles, that could be affected by the scheme.
- Otters – to identify any areas used as holts, couches, laying up sites etc, and to understand populations sizes, and general levels of usage to inform assessments.
- Water voles – to identify those areas of suitable riparian habitat with water vole populations, and to inform assessments and conversations on likely mitigation requirements. The surveys should include all affected lengths of canal, irrespective of bank type.
- White clawed crayfish – to assess potential impacts on crayfish populations in nearby watercourses/waterbodies, if there is a known or potential hydrological connection.

Any future surveys would require additional access to be arranged; the information needed to take the project forward is likely to include areas beyond the immediate canal corridor, and potentially into areas under private ownership. The degree to which this transpires will depend on the amount of raising needed, and the method by which it is proposed that this be achieved.

#### **4.2.2 Surveys in relation to new infrastructure associated with water control at locks and similar locations**

It is acknowledged that as well as works to embankments, which in some stretches will need raising to give the required additional capacity in the affected canals, some infrastructure work will be required at locks etc to allow the water movements and volumes to be controlled as necessary. This may include, for example, backflow pipes, new inflows and outflows, mechanical and/or electrical equipment, new buildings to house this equipment etc. The

footprint of these new facilities could potentially be quite extensive, and so could lead to habitat loss, disturbance of adjacent habitats, fragmentation, severance etc.

As these types of features begin to appear in the design process, specific surveys should be undertaken to identify any ecological constraints that would need to be considered. The mitigation hierarchy should be applied, with constraints avoided as far as possible, with effects then minimised, restoration of affected areas, and then ideally some form of net gain process also being included.

#### **4.2.3 Identification of the potential presence of other protected species**

It is assumed that the freshwater ecology workstream will pick up potential impacts on freshwater/aquatic species e.g. aquatic invertebrates etc.

### **4.3 Recommendations for potential mitigation measures**

#### **4.3.1 Construction phase mitigation**

It is recommended that potential mitigation measures be given early consideration, particularly those construction-phase mitigation processes that will be required should protected species like otter or water vole be identified in areas where construction works are unavoidable.

The size of the scheme means that lengths of canalside could be affected at any one time and it is likely that a Conservation Licence would be required from Natural England, to allow the works affecting water voles to take place. This would need to be based on extensive survey data. A detailed methodology would be required, that would detail the large-scale trapping and relocation of water voles, to ensure that all individuals were removed before construction works begin. This would likely involve fencing off sections at a time, with several weeks of trapping effort by ecologists. There would likely be specific windows in the year when this would be permitted. Additional enhancements would also need to be identified and incorporated, as the Conservation Licence process requires that a conservation net gain is maintained post-works. This may require the inclusion of additional footprint, and/or collaboration with adjacent landowners.

Mitigating for the presence of otters will depend on the exact impacts being felt. Loss of habitat in areas used by otters will require that the construction programme/sequencing is planned to minimise these effects as far as possible. Other mitigation measures may also be required. Effects on holts, laying up sites etc are far more onerous, depending on whether they would just be disturbed or would need to be destroyed to facilitate the works. These works are likely to require that the project secures a European Protected Species licence. If the holt were to be lost to the scheme, then alternative holts etc would need to be created, prior to any construction work beginning, with careful monitoring of these new features to ensure uptake, and of the existing features, to ensure that otters had left them prior to any sort of damage or removal. Physical exclusion measures may also be required. The licencing process, to allow this to happen, would need to demonstrate that all other alternatives had been considered. There would be an expectation that increased costs, unless prohibitively expensive, could not be used as justification for discounting alternative construction methodologies or scheme designs.

#### **4.3.2 Operational phase mitigation**

Mitigation to improve the canal environment, once construction is finished, is limited in scope due to the operational constraints of the canal itself, and the limited footprint of the canal corridor, bounded on either side by land usually under private ownership.

Adjacent areas of land under the ownership of other organisations should be identified and collaborative opportunities explored to increase biodiversity value. Similarly, it may be possible

under evolving farm subsidy schemes to work with adjacent landowners to collaboratively enhance adjacent habitats, both in terms of habitat value and suitability for protected species.

The canal itself could be enhanced by including softening banks wherever possible. The scope for providing acceptable defined banks using bioengineering could be explored, where species like willow and similar are used to provide structure, rigidity, and a defined edge in addition to biodiversity value, in place of steel, wood or concrete.

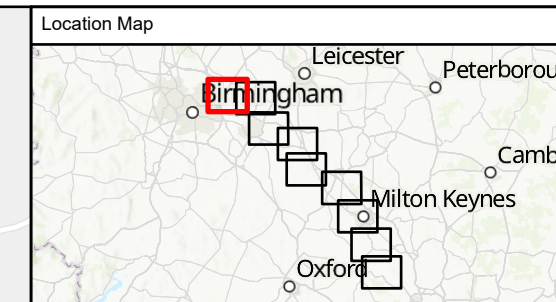
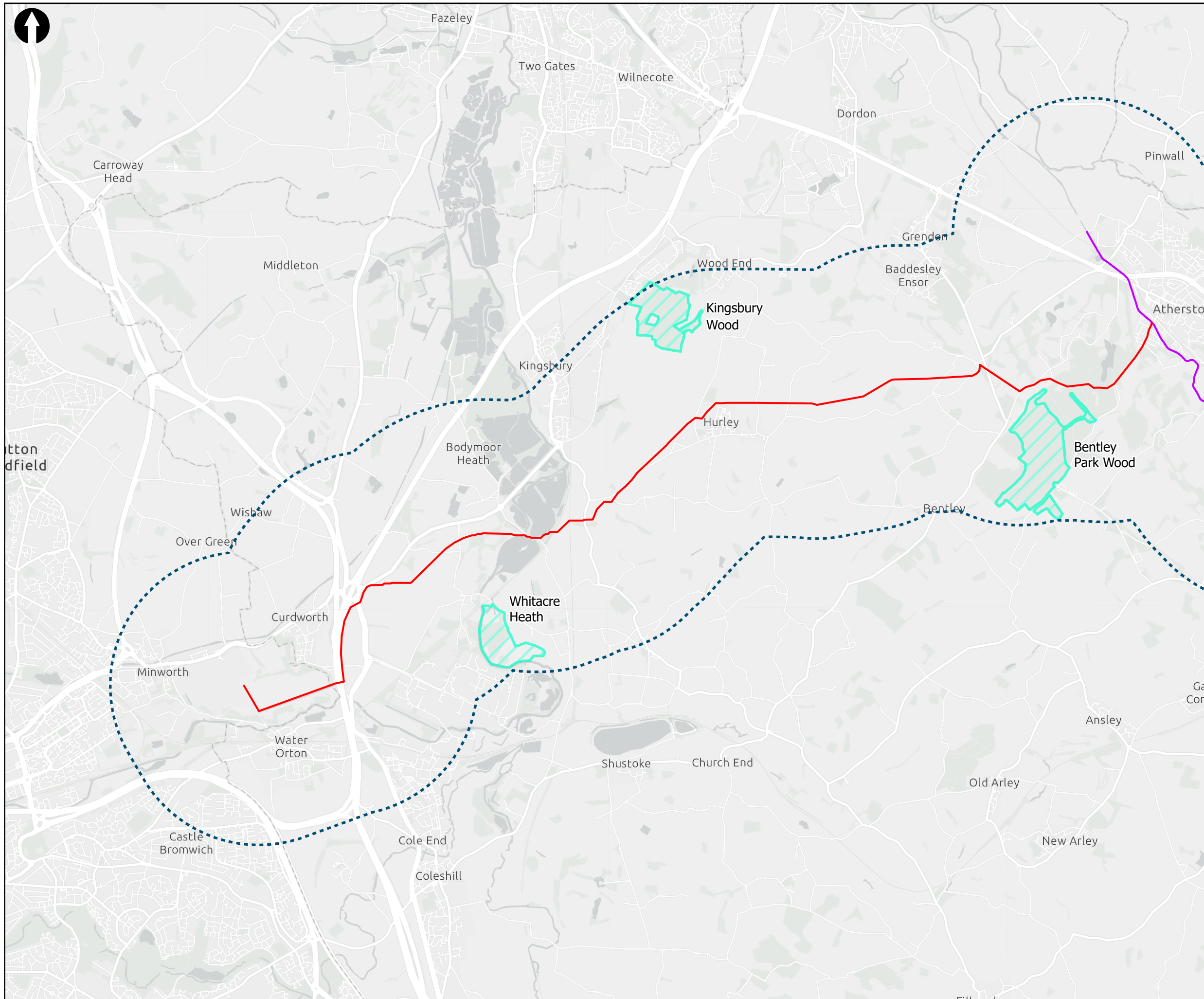
Further enhancements such as floating habitat could also be explored. This would lend itself to the linear nature of the canal nicely, by providing secured, pre-seeded floating mats along the canal edge, that would develop very quickly into viable banks of wetland vegetation. This could potentially be used quite extensively along areas where boat mooring is not required. The narrow, linear nature would go some way to enhancing the existing, often restricted riparian vegetation along the canal corridor, where the hard engineered banks offer only limited scope for habitats to exist currently.

If land is available, then areas alongside the canal could be created whereby the edges become scalloped and softened, some heterogeneity incorporated, and wetland features installed that received their water from the canal itself. The scope for enhancement here is proportionate to the amount of land that could be secured, and could include ponds, linear wetland features, swamp and fenland habitats for example.

# A. Desk Study Results

## A.1 Statutory Designated Sites Map





**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- ⋯ 2km Study Area
- ▨ Sites of Special Scientific Interest (SSSI)

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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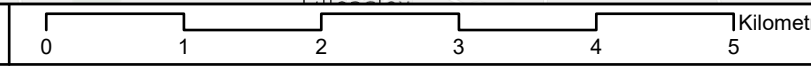
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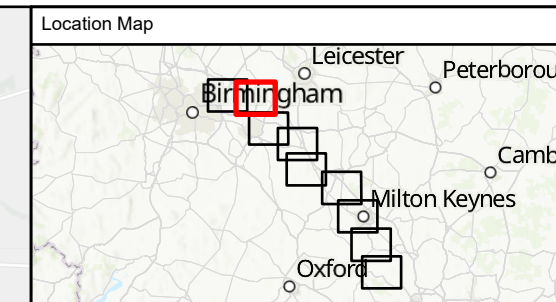
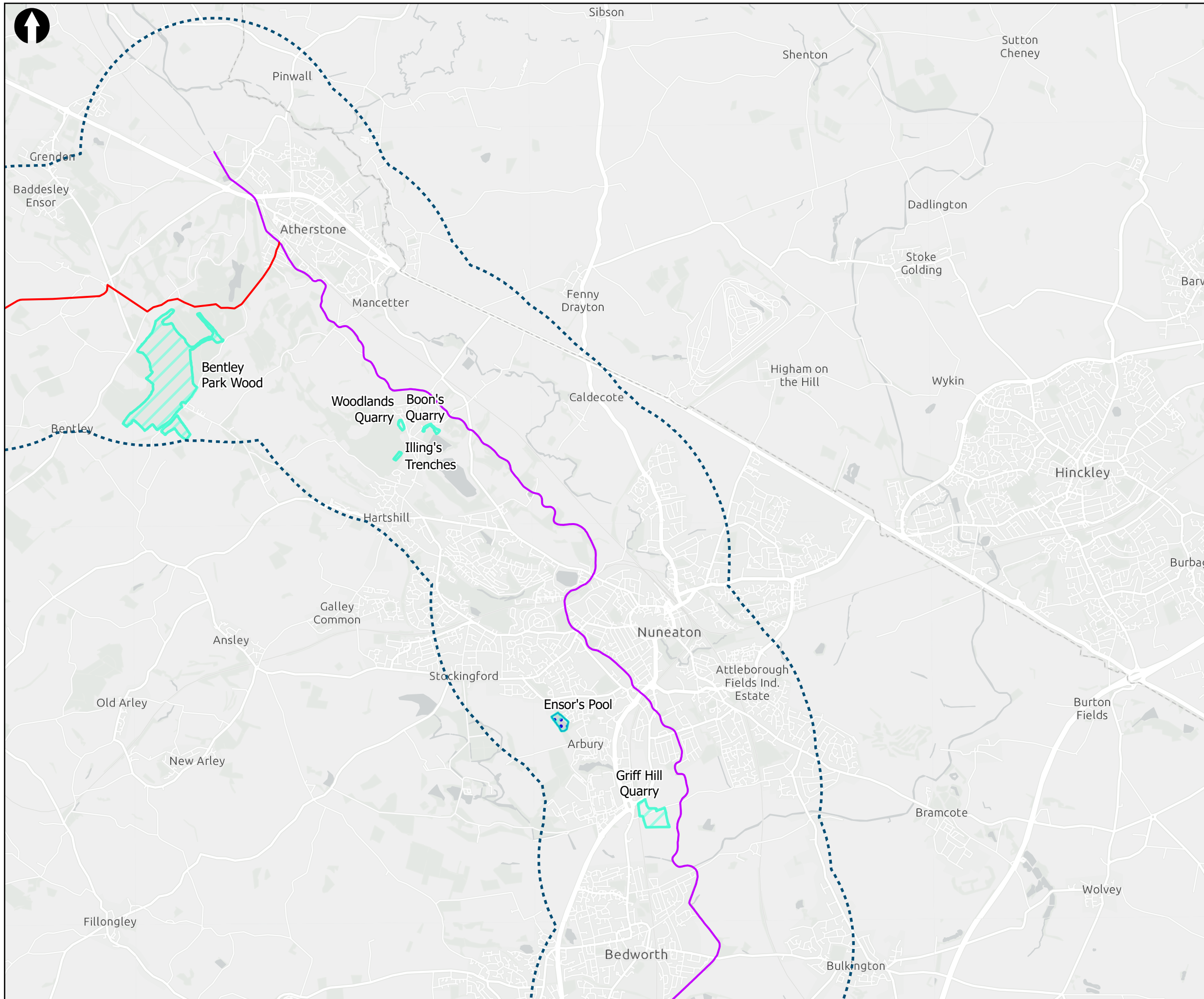
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**Title**  
 GUC  
 SSSI, SAC, SPA and Ramsar sites within  
 2km buffer from the pipeline and canal  
 Sheet 1 of 9

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**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 2km Study Area
- Sites of Special Scientific Interest (SSSI)
- Special Areas of Conservation (SAC)

**Notes**  
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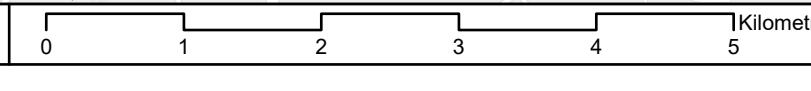
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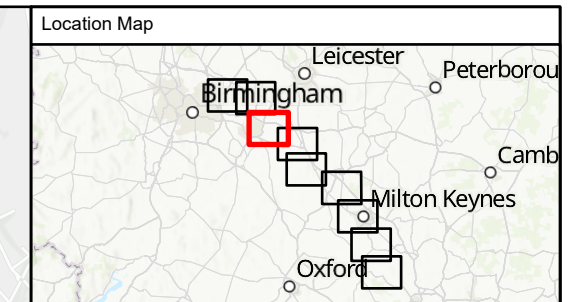
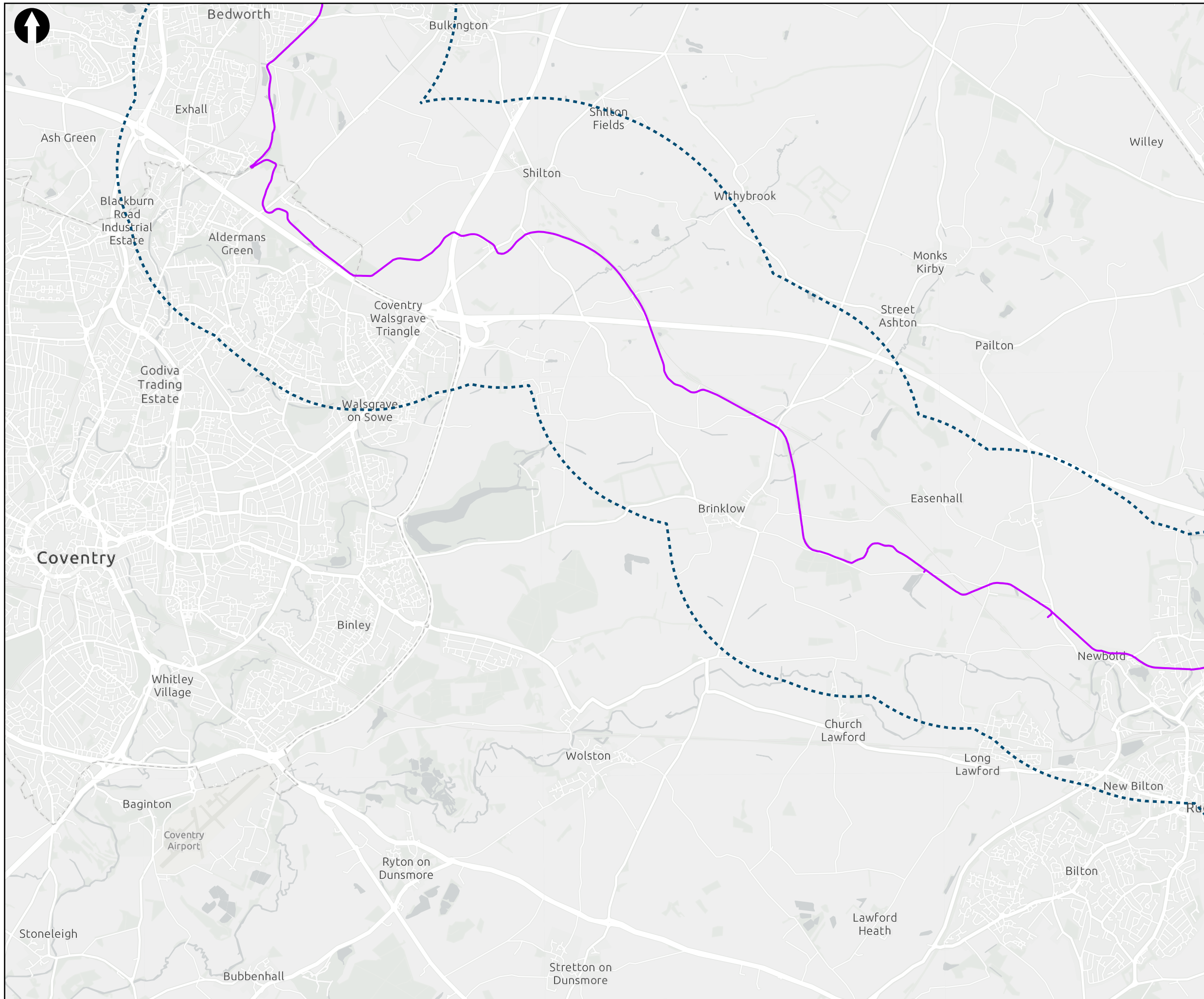
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 Sheet 2 of 9

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**Key to Symbols**

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2km Study Area

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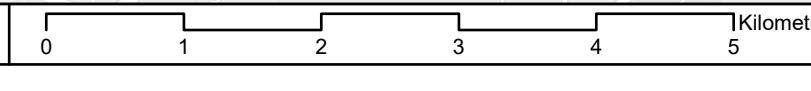
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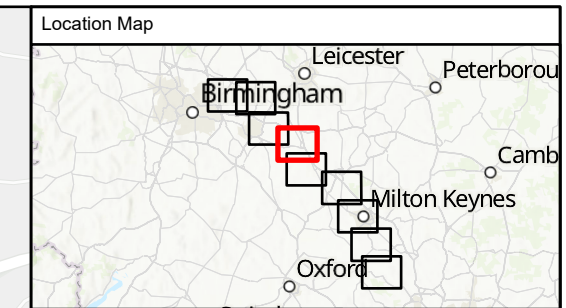
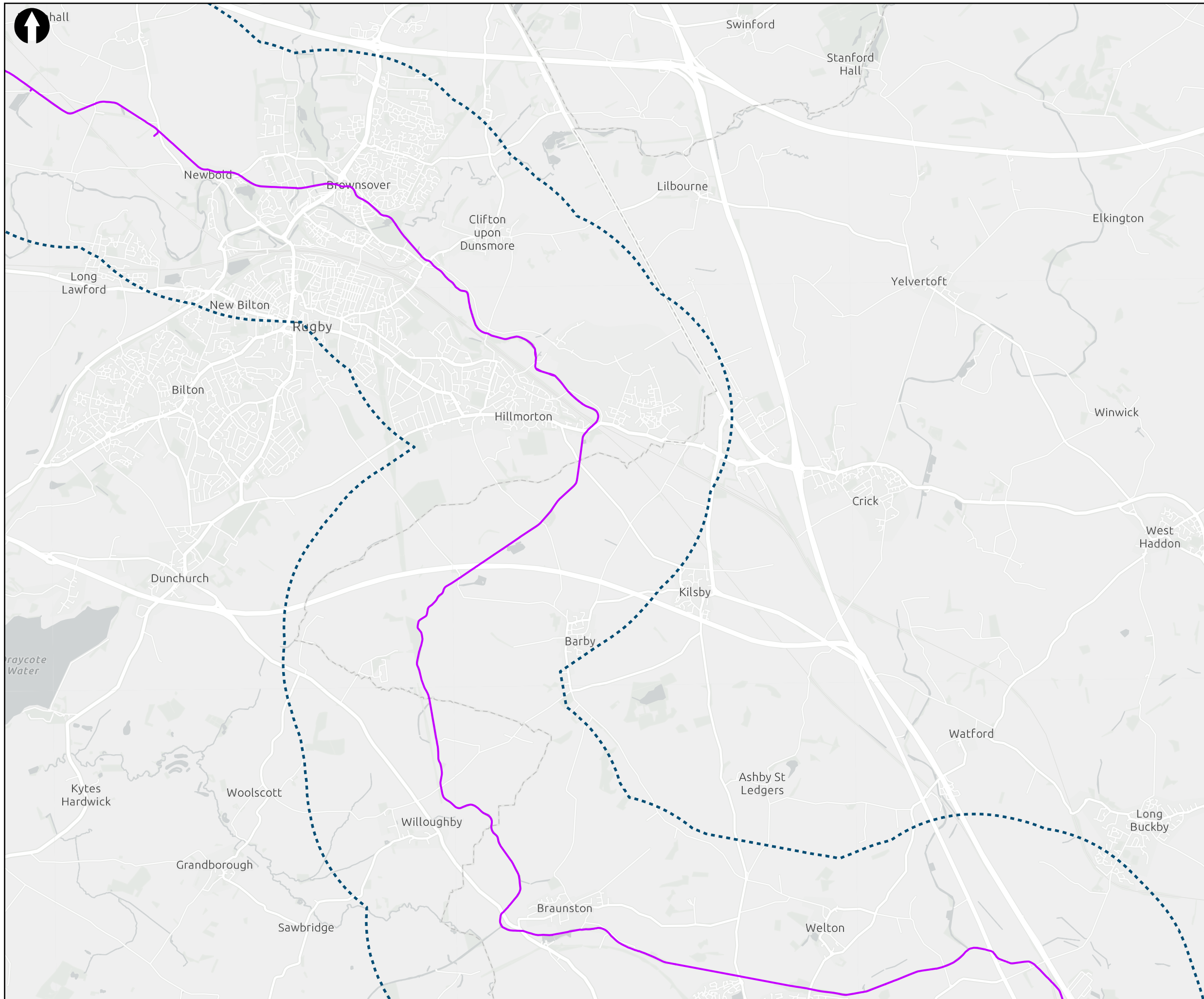
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**Title**  
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 Sheet 3 of 9

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**Key to Symbols**

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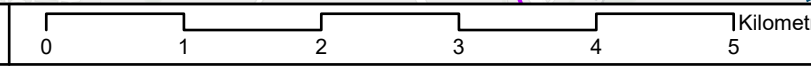
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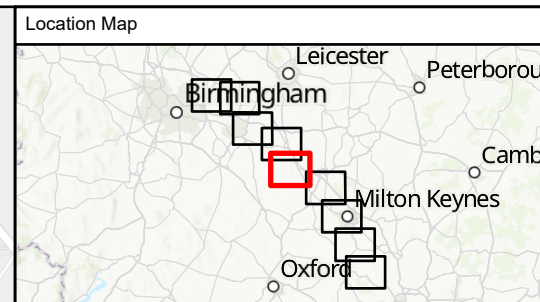
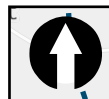
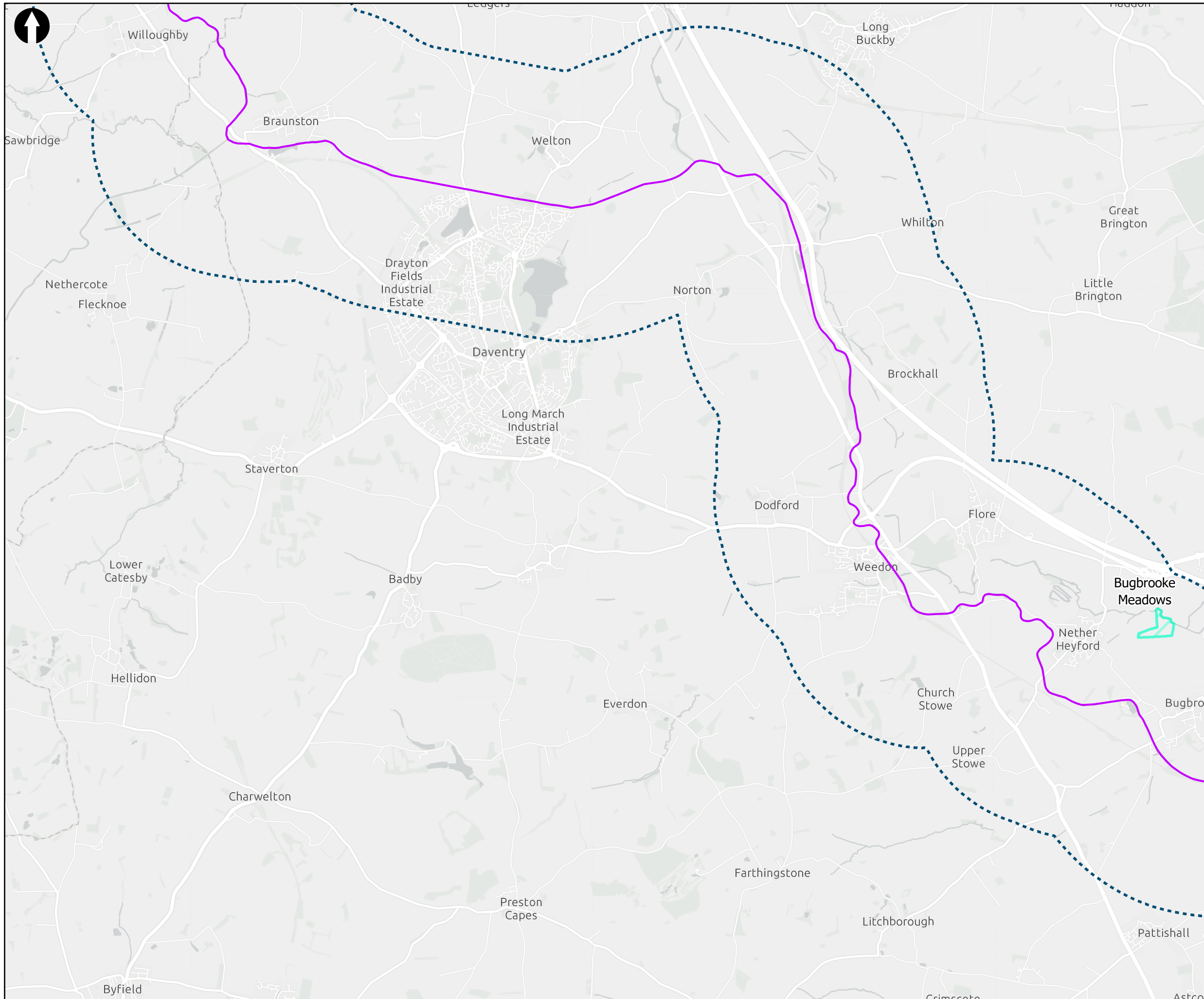
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 Sheet 4 of 9

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Key to Symbols

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 2km Study Area
- Sites of Special Scientific Interest (SSSI)

**Notes**  
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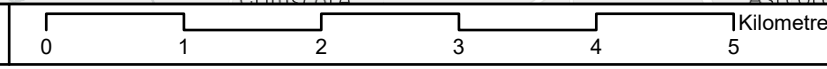
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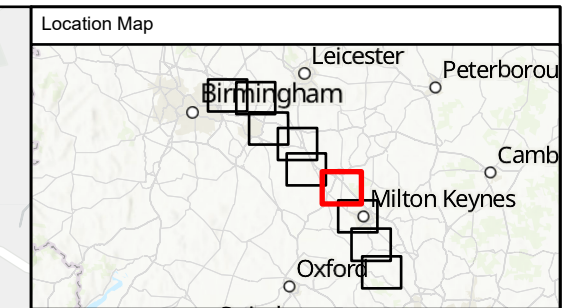
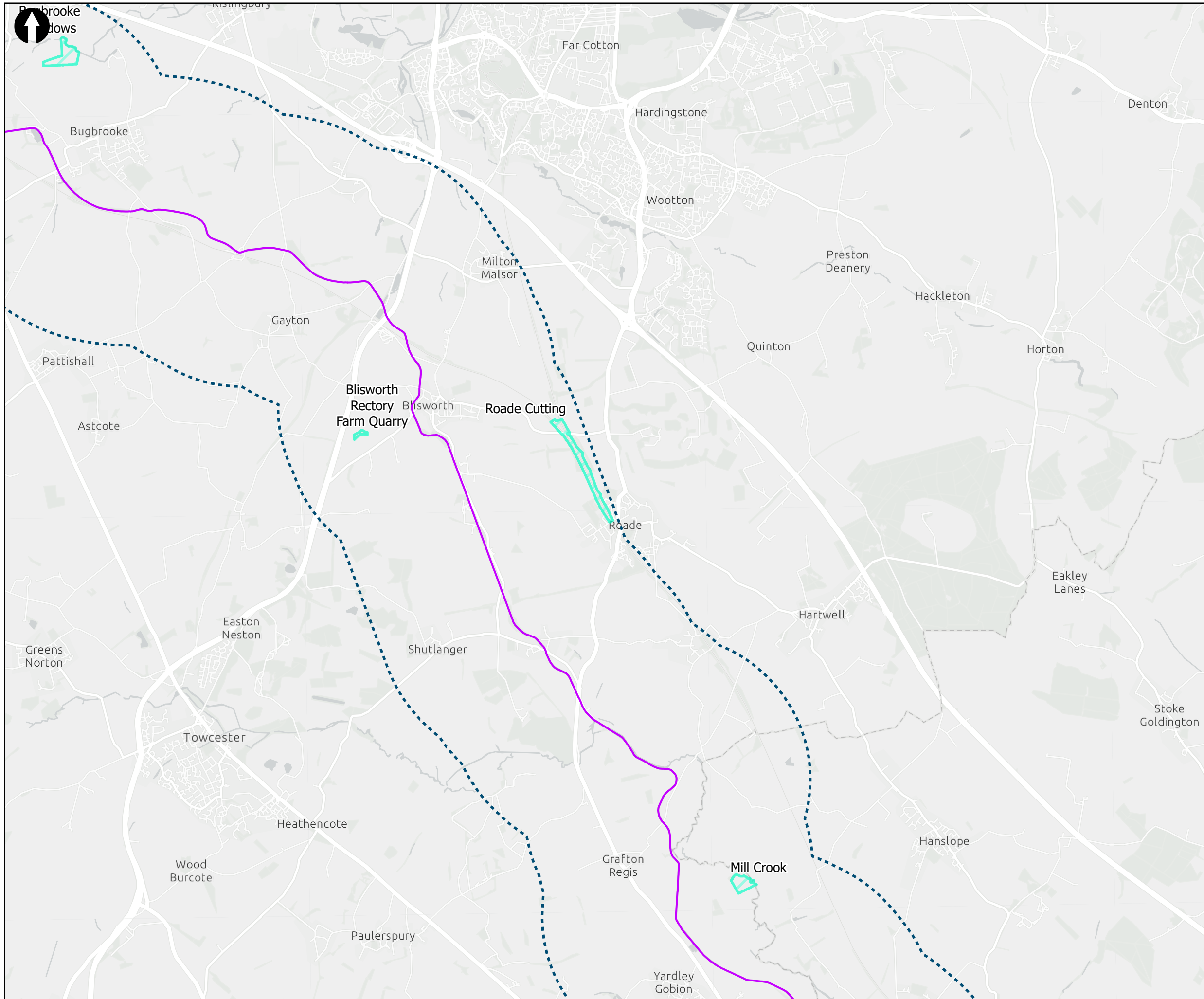


**Title**  
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 Sheet 5 of 9

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**Key to Symbols**

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- 2km Study Area
- Sites of Special Scientific Interest (SSSI)

**Notes**

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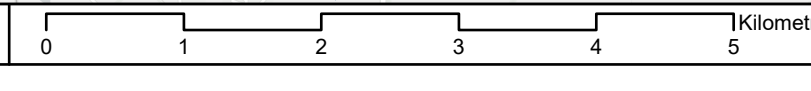
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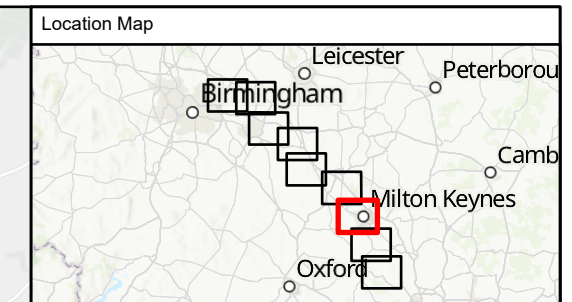
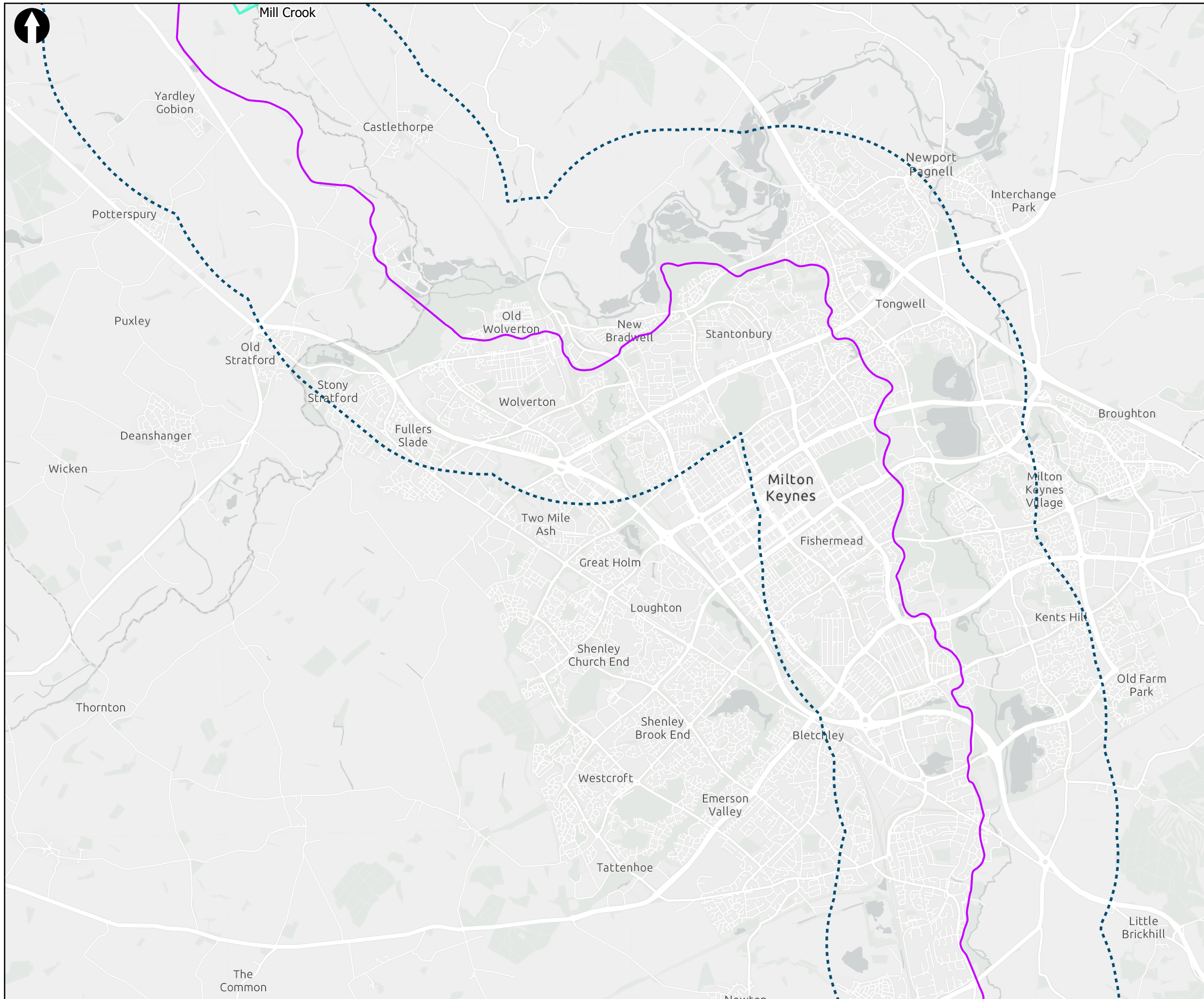
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 SSSI, SAC, SPA and Ramsar sites within  
 2km buffer from the pipeline and canal  
 Sheet 6 of 9

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**Key to Symbols**

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- 2km Study Area
- Sites of Special Scientific Interest (SSSI)

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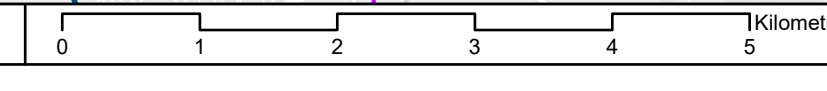
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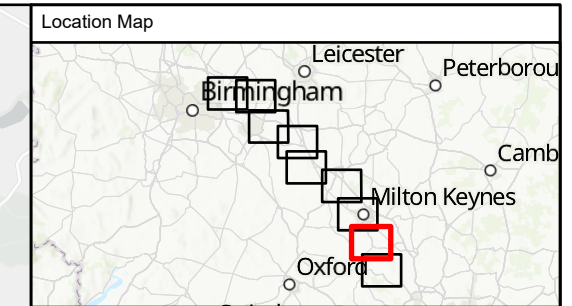
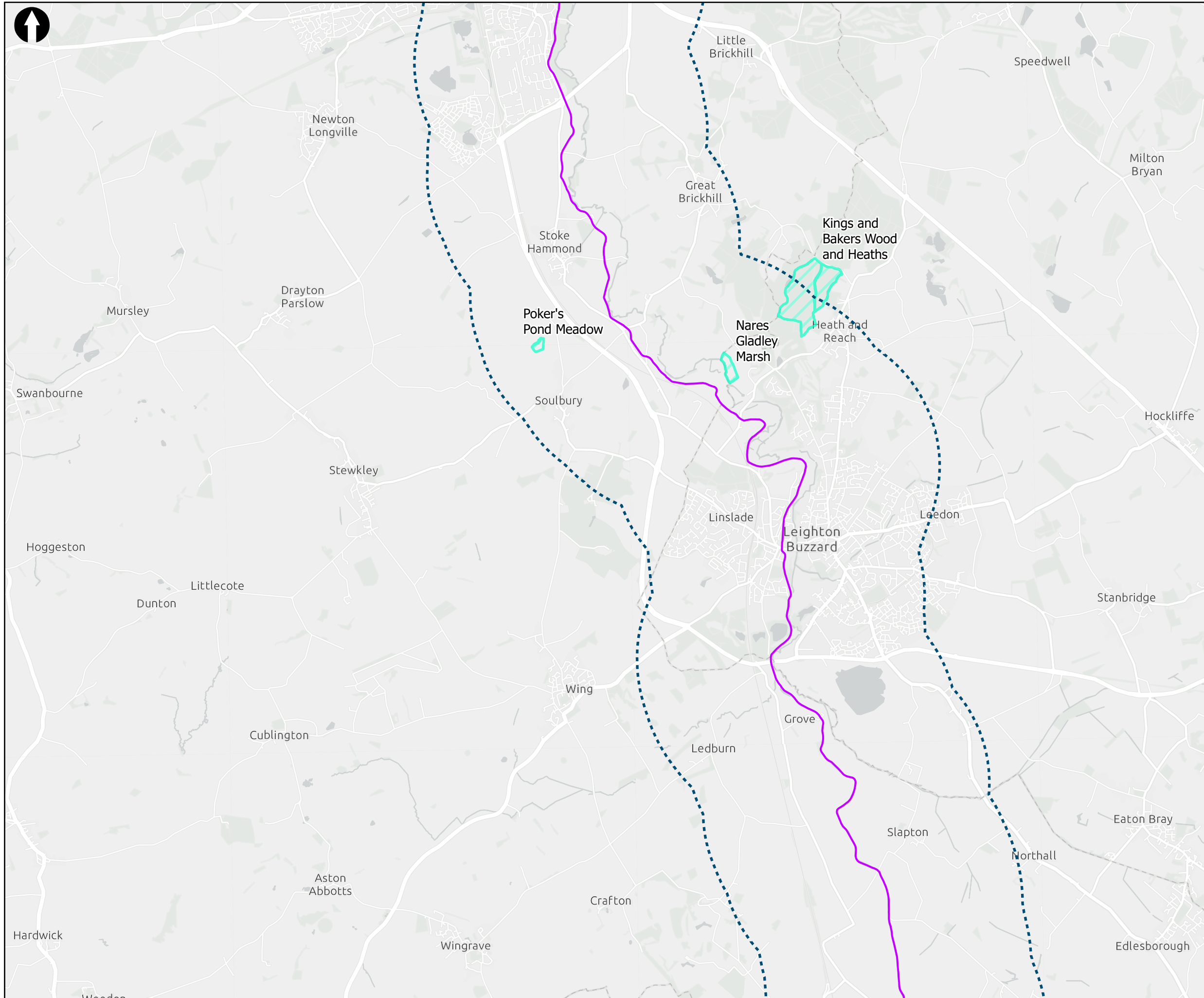
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 SSSI, SAC, SPA and Ramsar sites within  
 2km buffer from the pipeline and canal  
 Sheet 7 of 9

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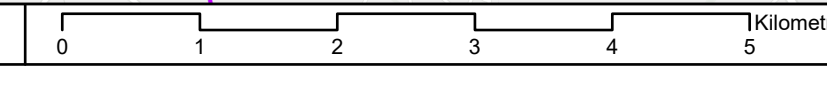
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 GUC  
 SSSI, SAC, SPA and Ramsar sites within  
 2km buffer from the pipeline and canal  
 Sheet 8 of 9

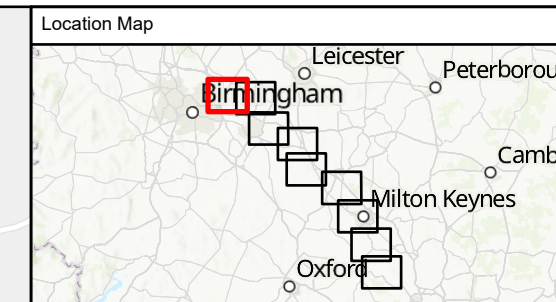
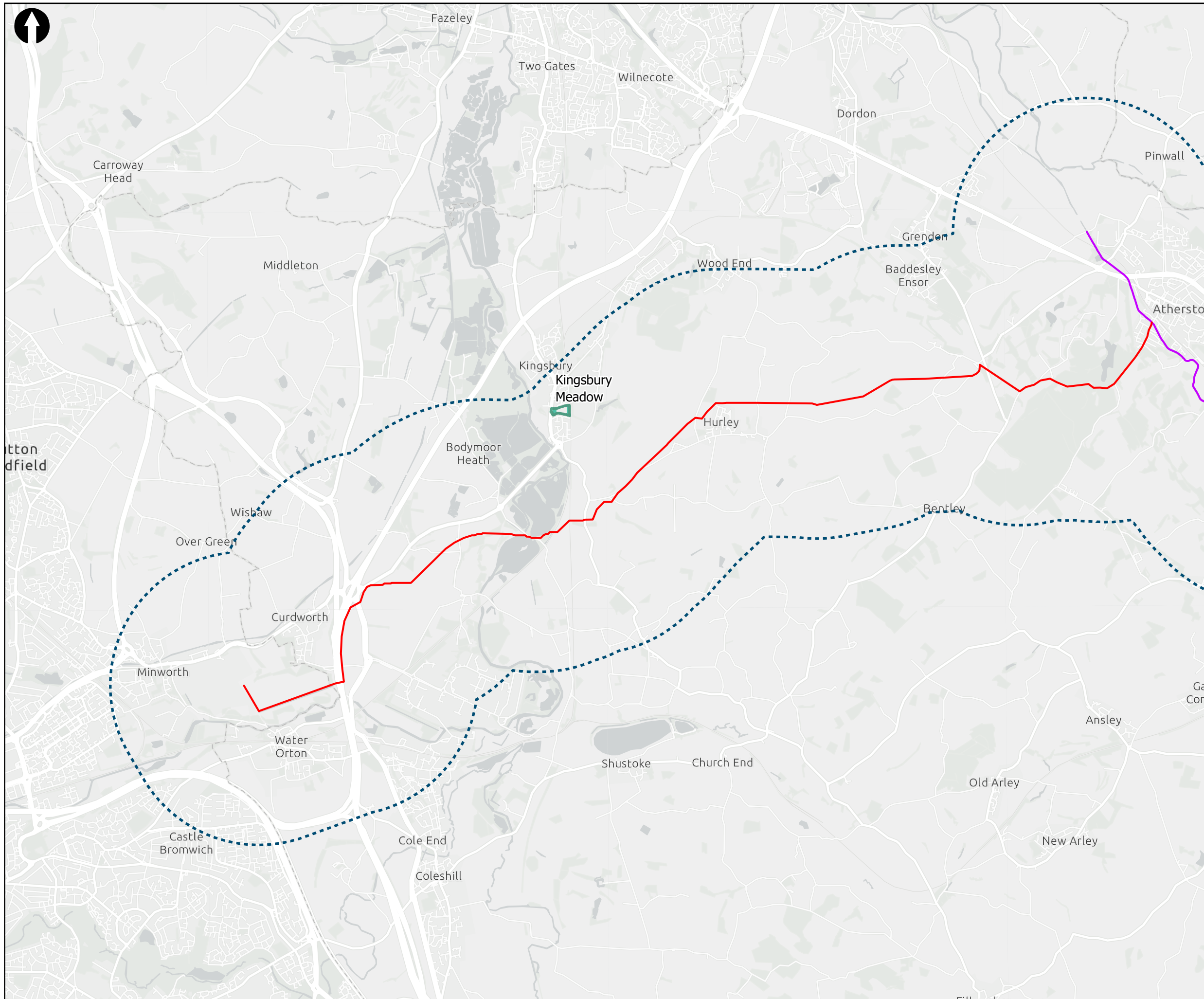
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**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- - - 2km Study Area
- ▭ Local Nature Reserve (LNR)

**Notes**  
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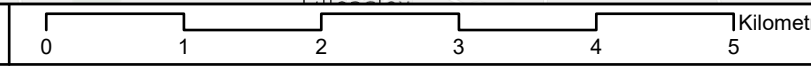
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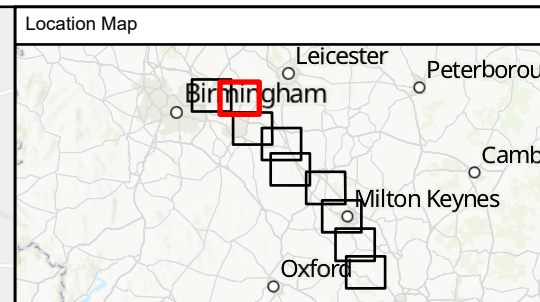
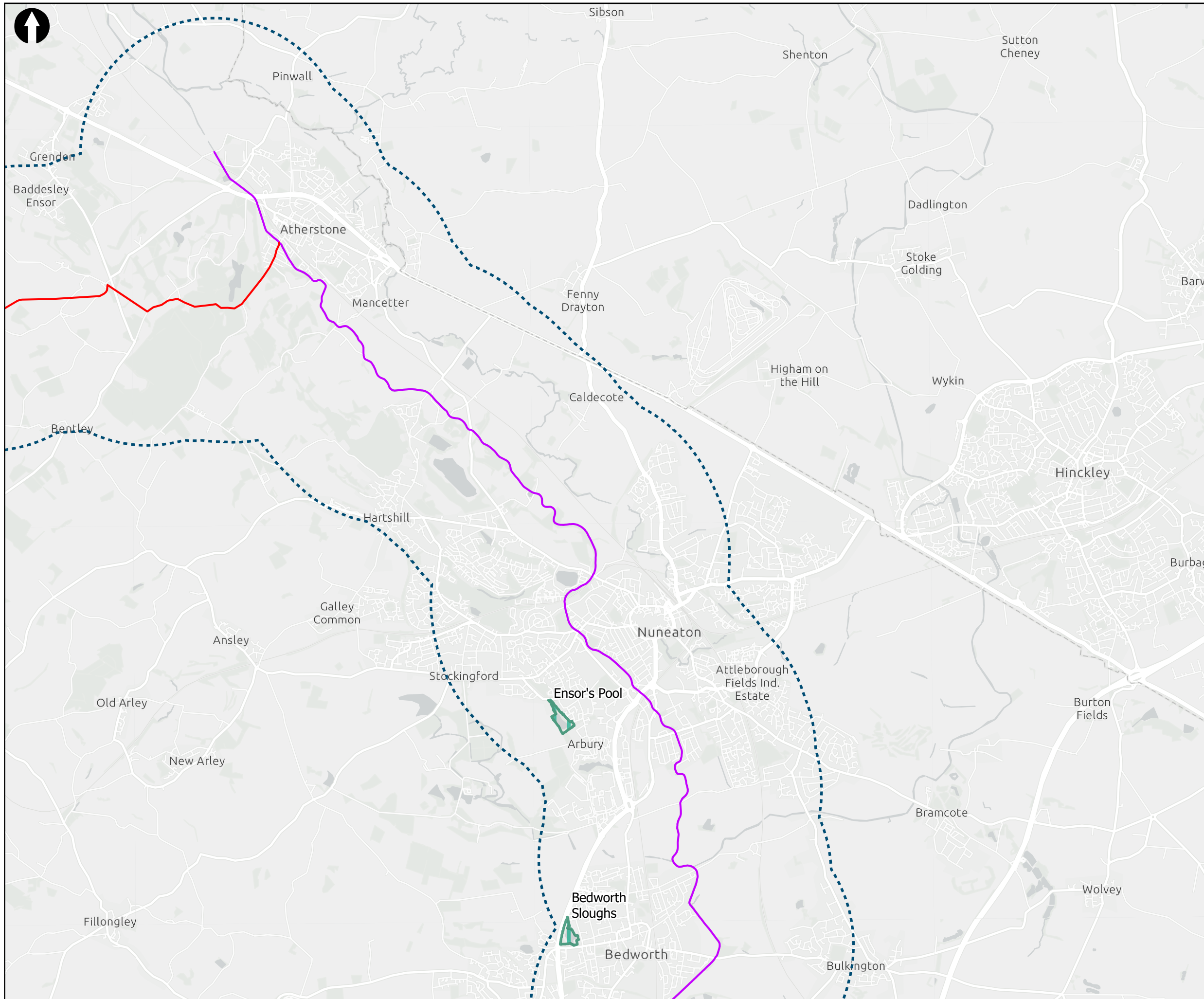
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**Title**  
 GUC  
 NNR and LNR sites within 2km buffer from the pipeline and canal  
 Sheet 1 of 9

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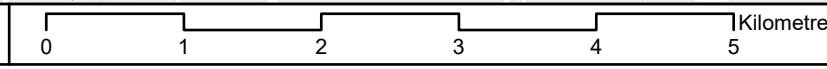
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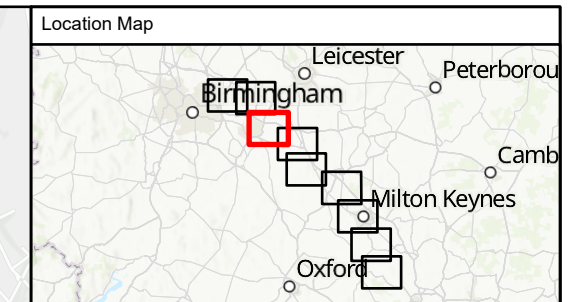
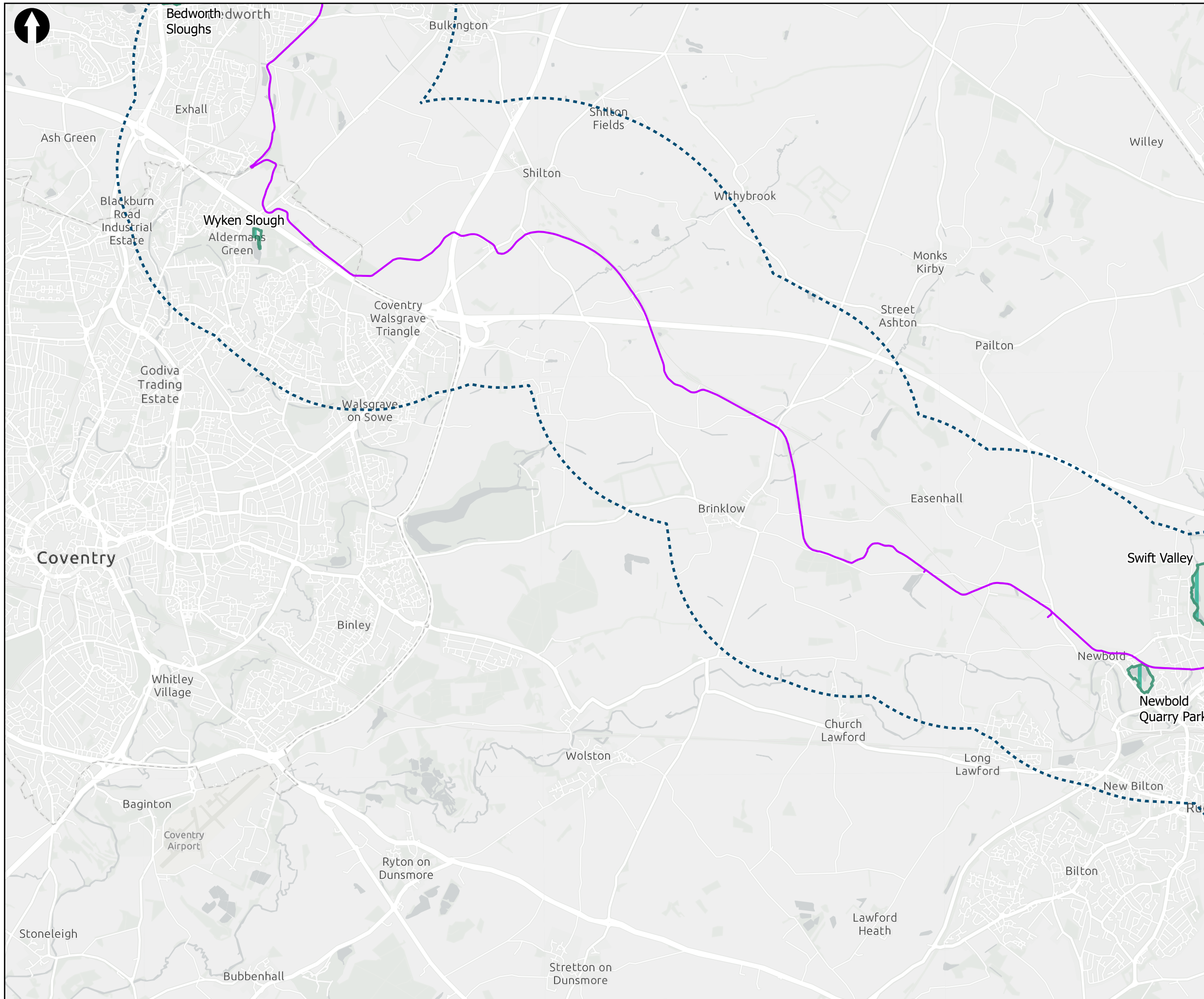
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 Sheet 2 of 9

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Drawing Number **GUC NNR and LNR**





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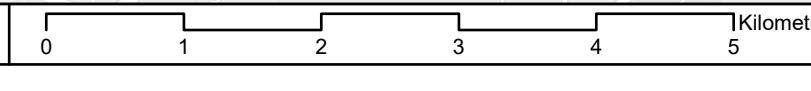
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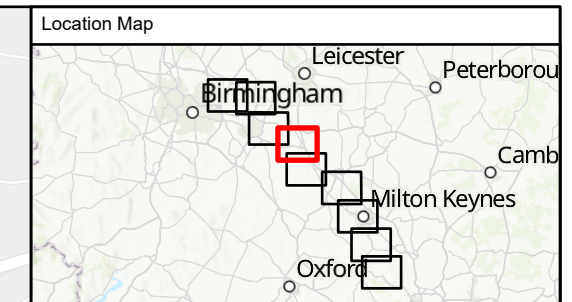
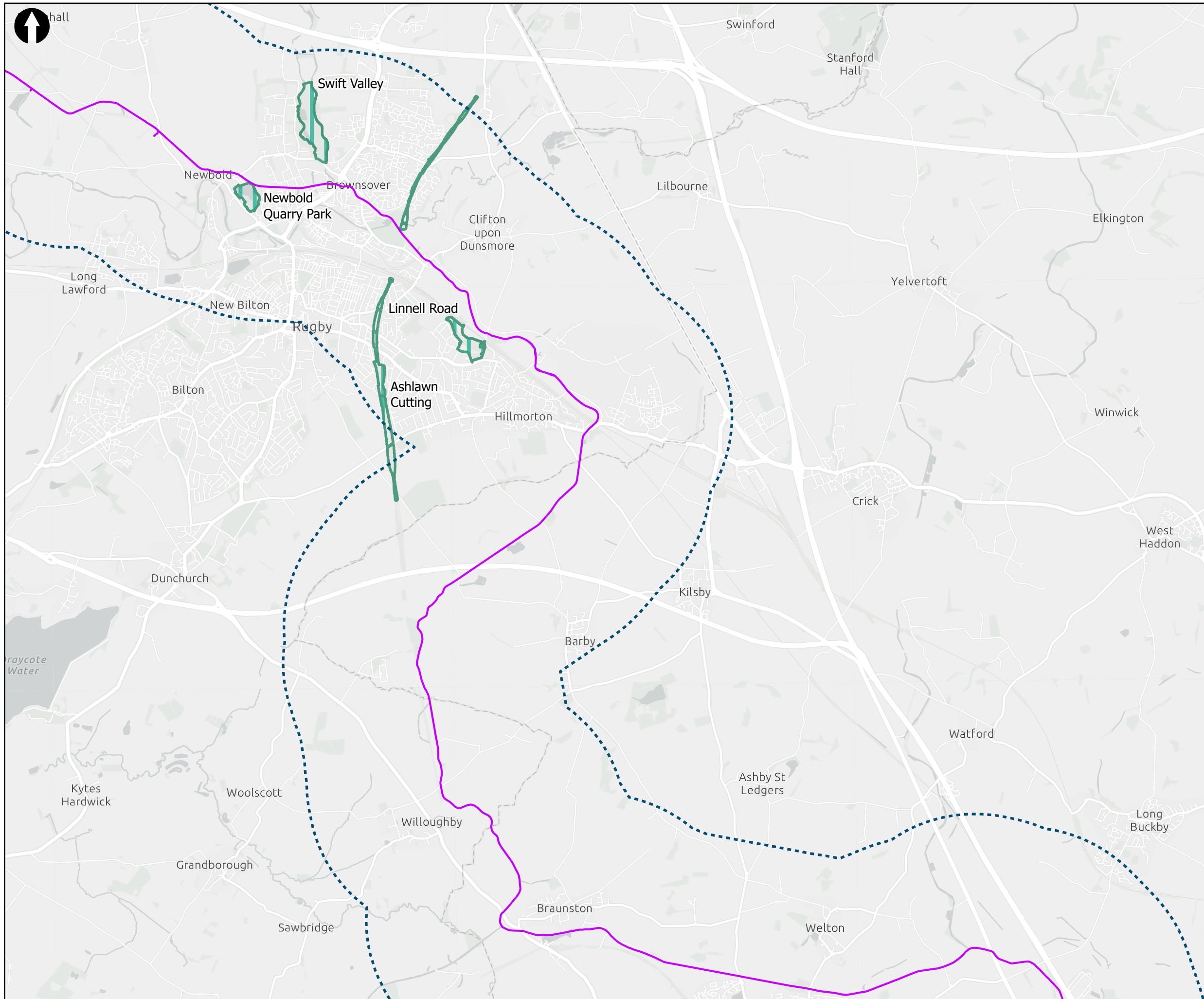
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 GUC  
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 Sheet 3 of 9

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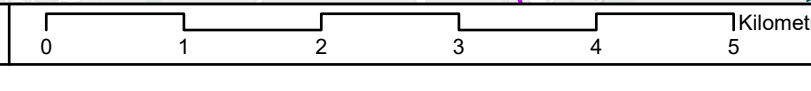
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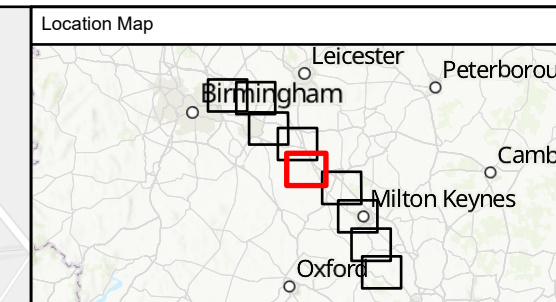
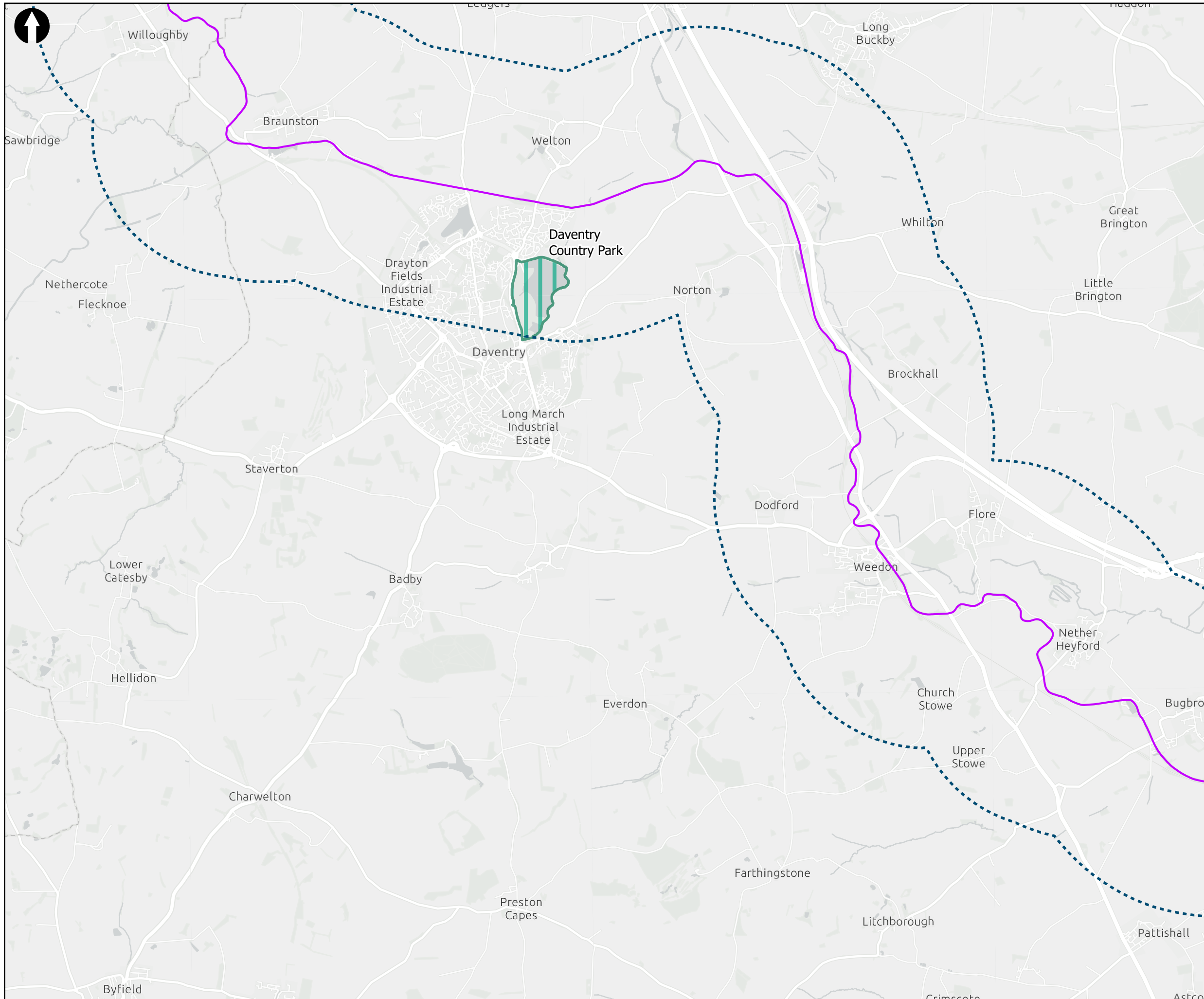
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 GUC  
 NNR and LNR sites within 2km buffer from the pipeline and canal  
 Sheet 4 of 9

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GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 2km Study Area
- Local Nature Reserve (LNR)

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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Author names redacted

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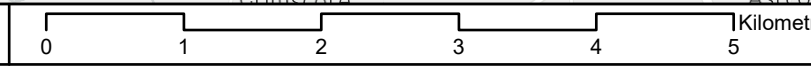
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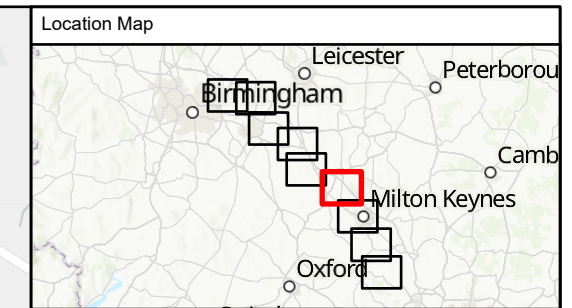
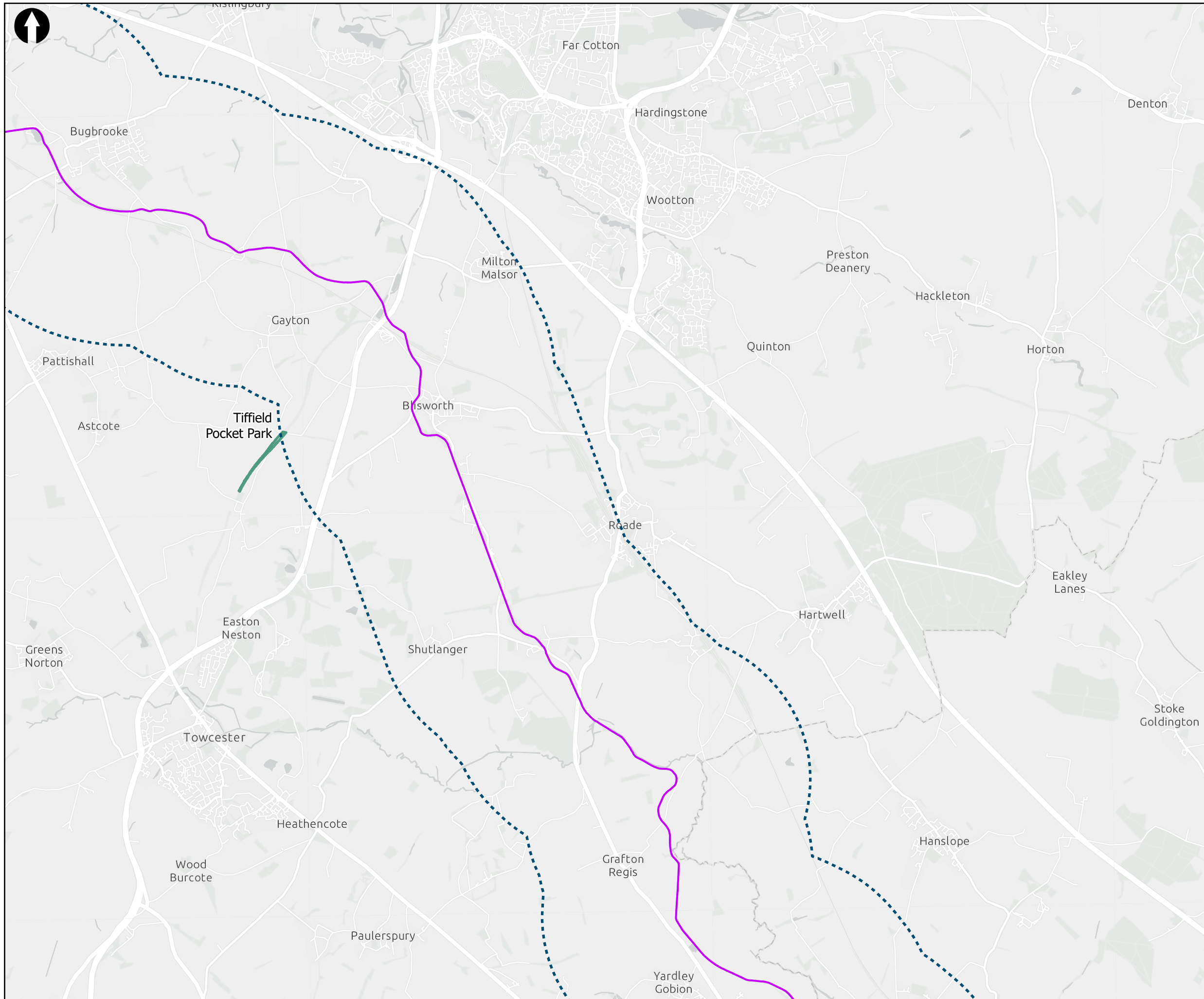
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**Title**  
 GUC  
 NNR and LNR sites within 2km buffer from the pipeline and canal  
 Sheet 5 of 9

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Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD

Drawing Number **GUC NNR and LNR**





**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 2km Study Area
- Local Nature Reserve (LNR)

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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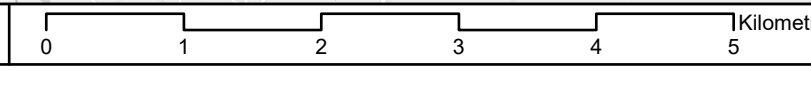
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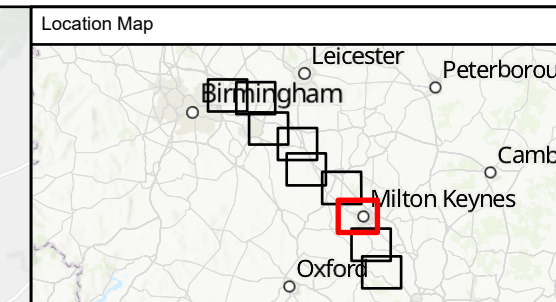
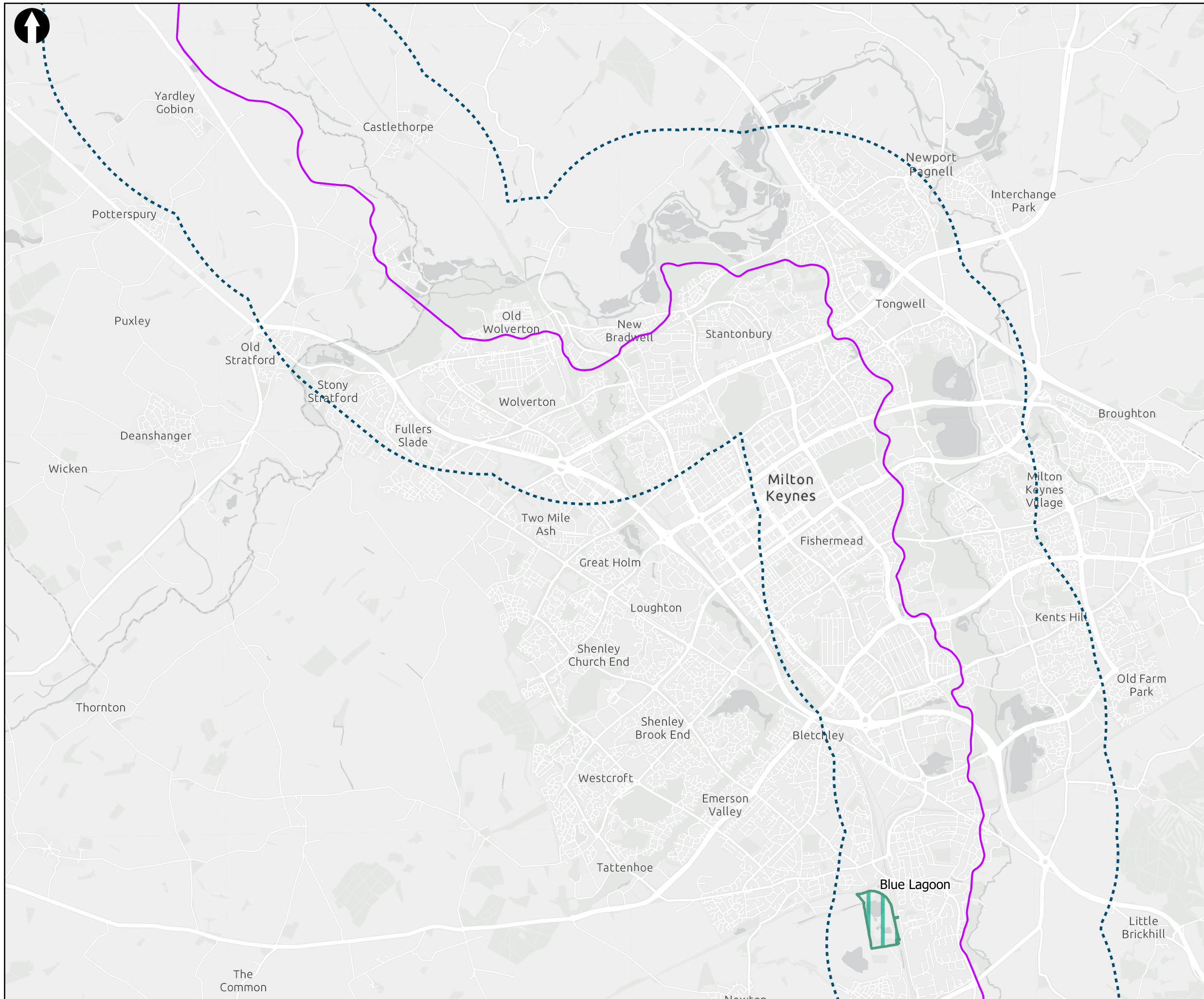
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**Title**  
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 NNR and LNR sites within 2km buffer from the pipeline and canal  
 Sheet 6 of 9

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GIS Check		Approved	
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**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 2km Study Area
- Local Nature Reserve (LNR)

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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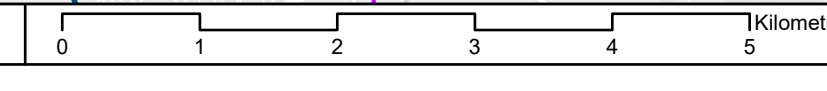
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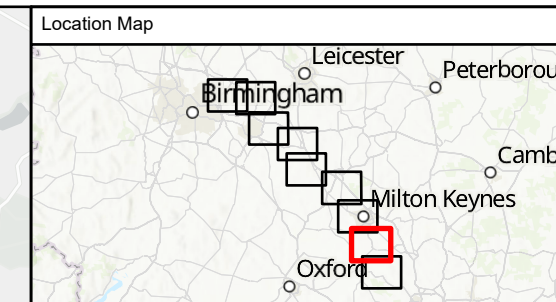
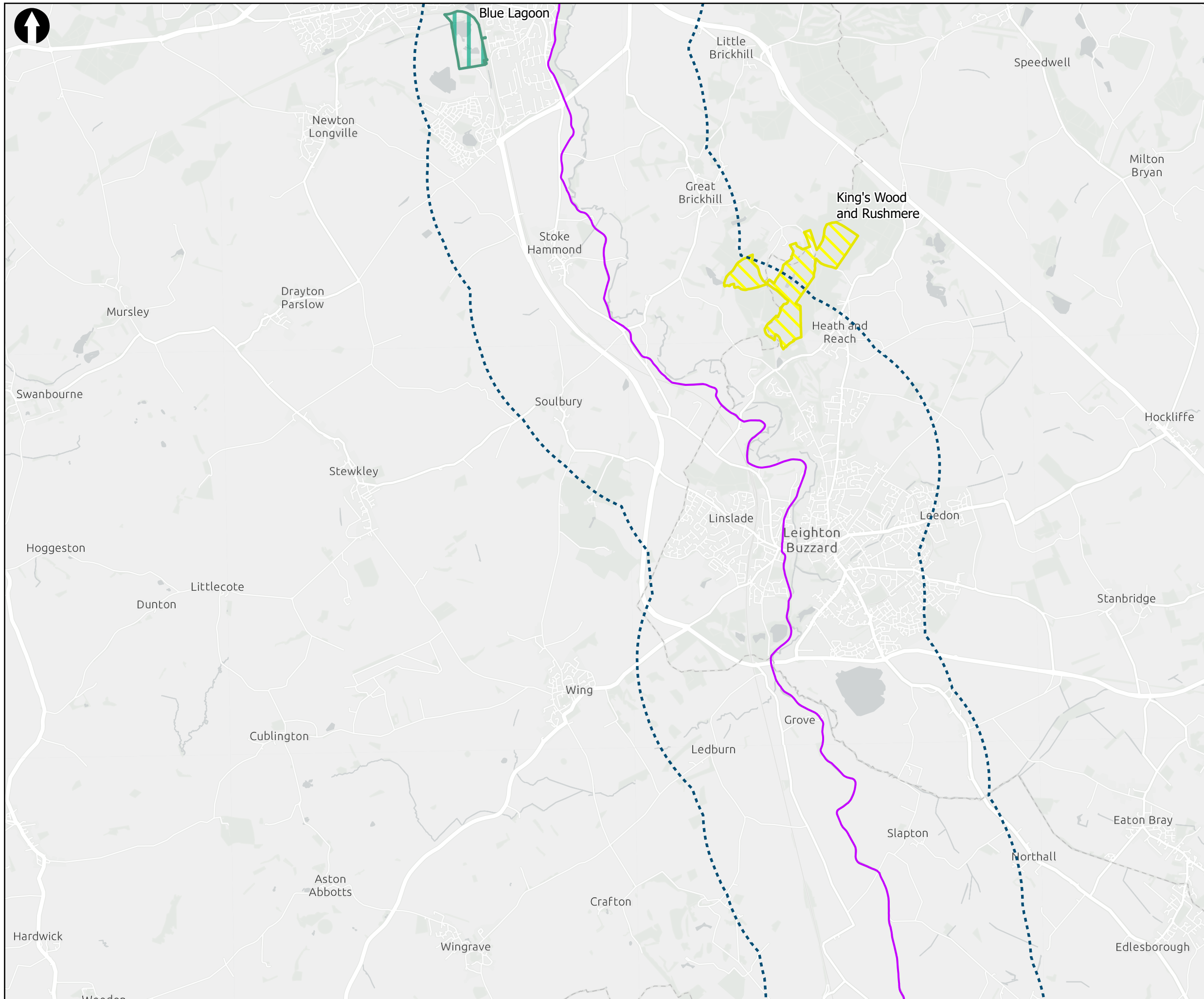
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 NNR and LNR sites within 2km buffer from the pipeline and canal  
 Sheet 7 of 9

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Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 2km Study Area
- Local Nature Reserve (LNR)
- National Nature Reserves (NNR)

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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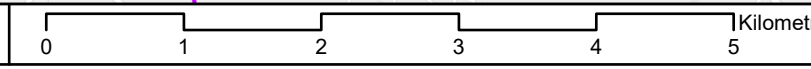
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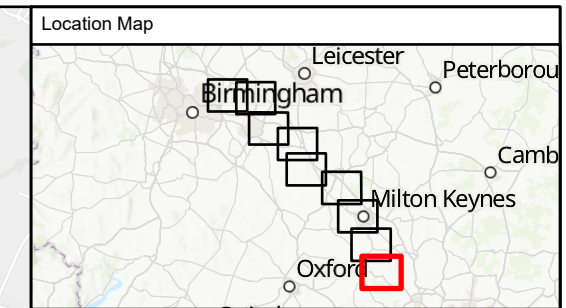
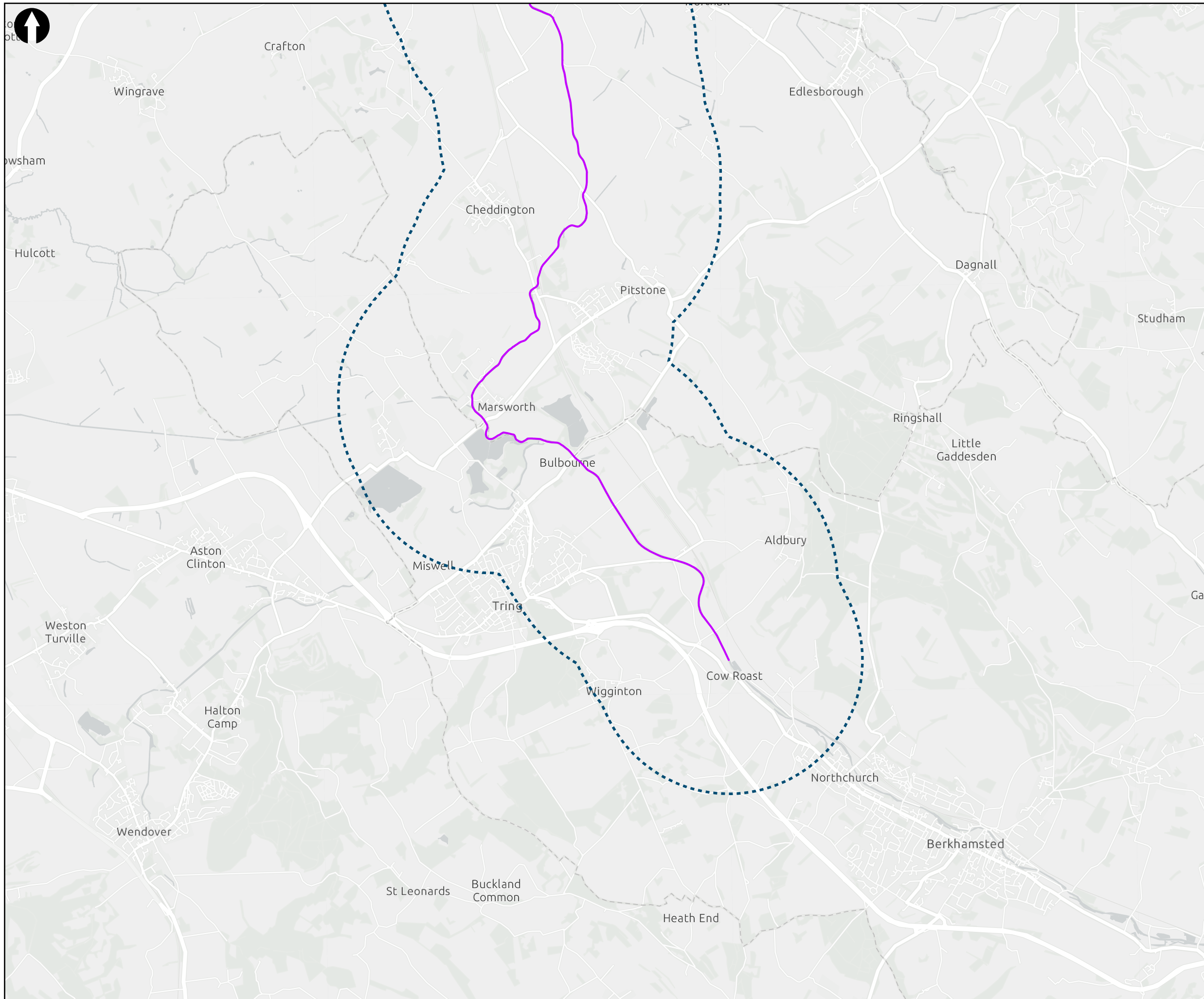
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 Sheet 8 of 9

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Drawing Number **GUC NNR and LNR**







**Key to Symbols**

— Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

  2km Study Area

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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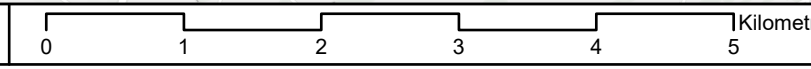
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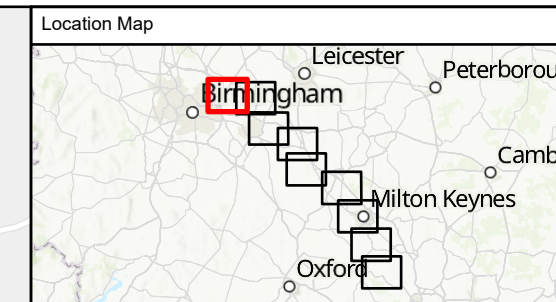
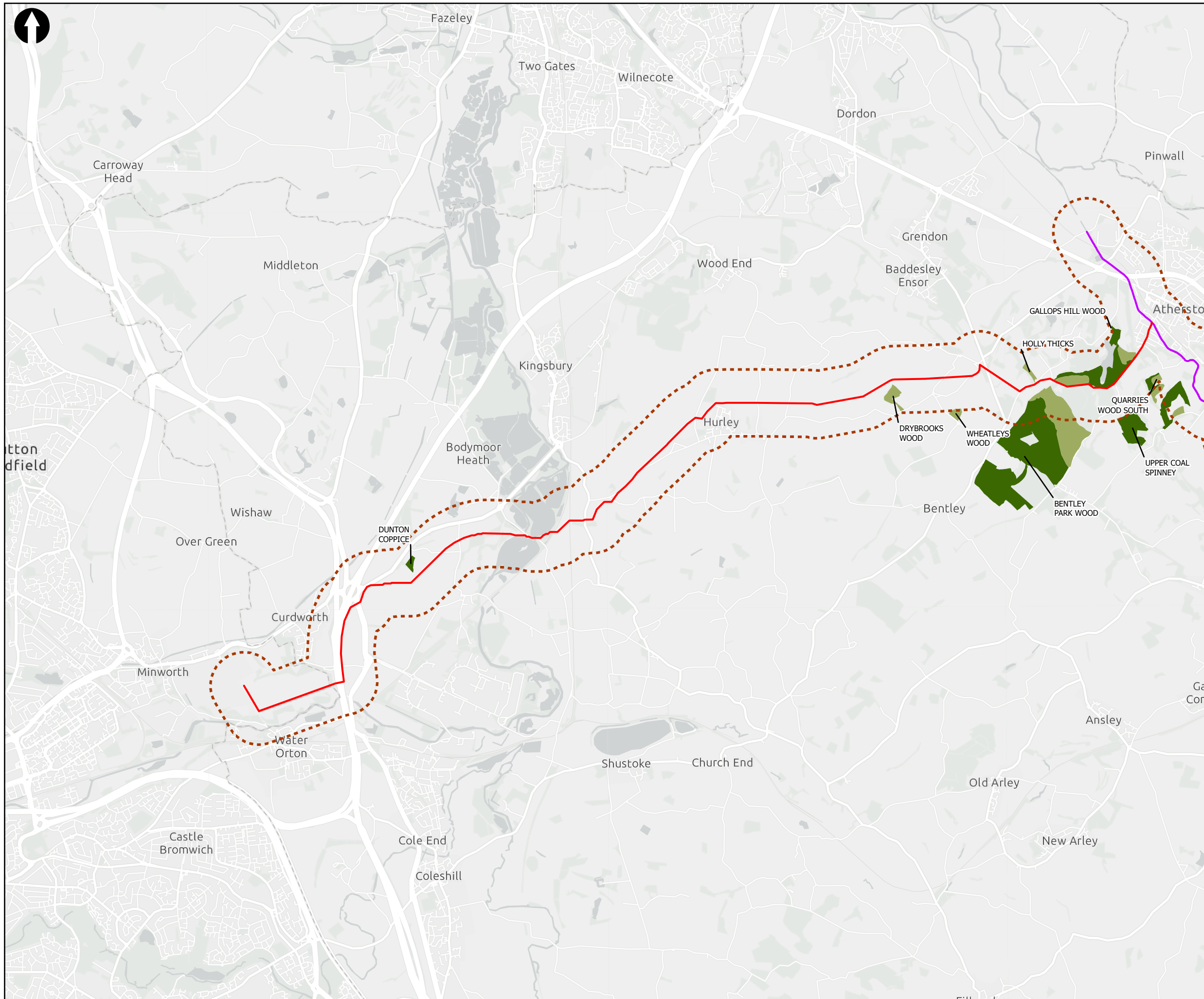
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 NNR and LNR sites within 2km buffer from the pipeline and canal  
 Sheet 9 of 9

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Scale at A3	Status	Rev	Security
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## A.2 Ancient Woodland Map





**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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Author names redacted

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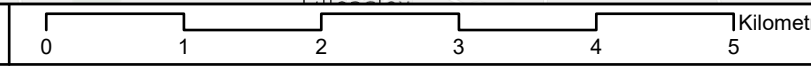
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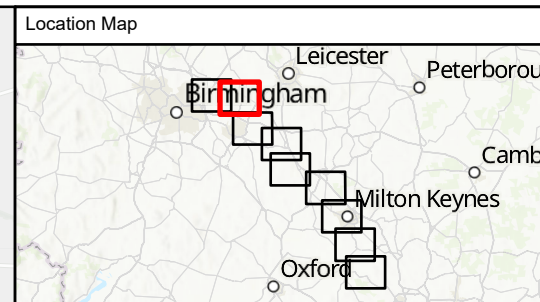
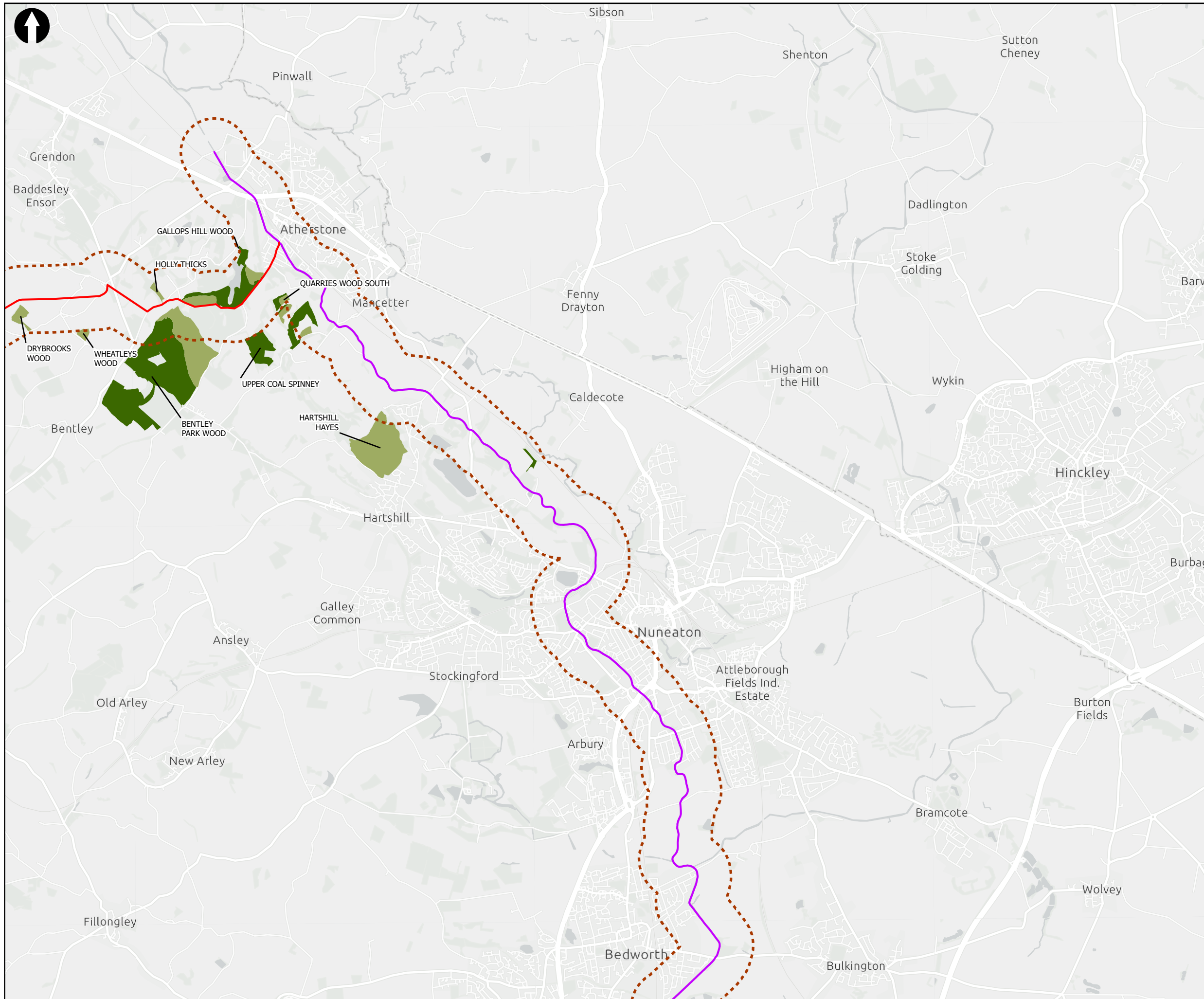
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**Title**  
 GUC  
 Ancient Woodland sites within 500m buffer from the pipeline and canal  
 Sheet 1 of 9

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Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Natural England, Open Government Licence

Author names redacted

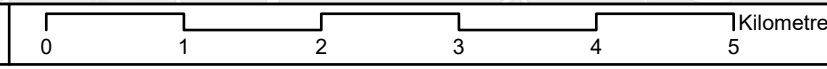
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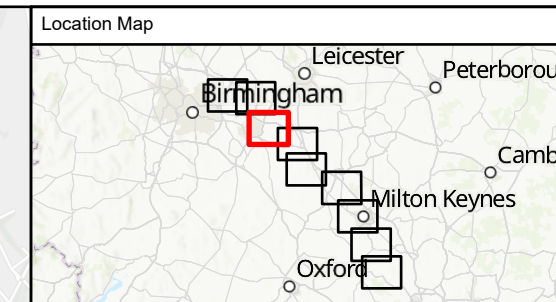
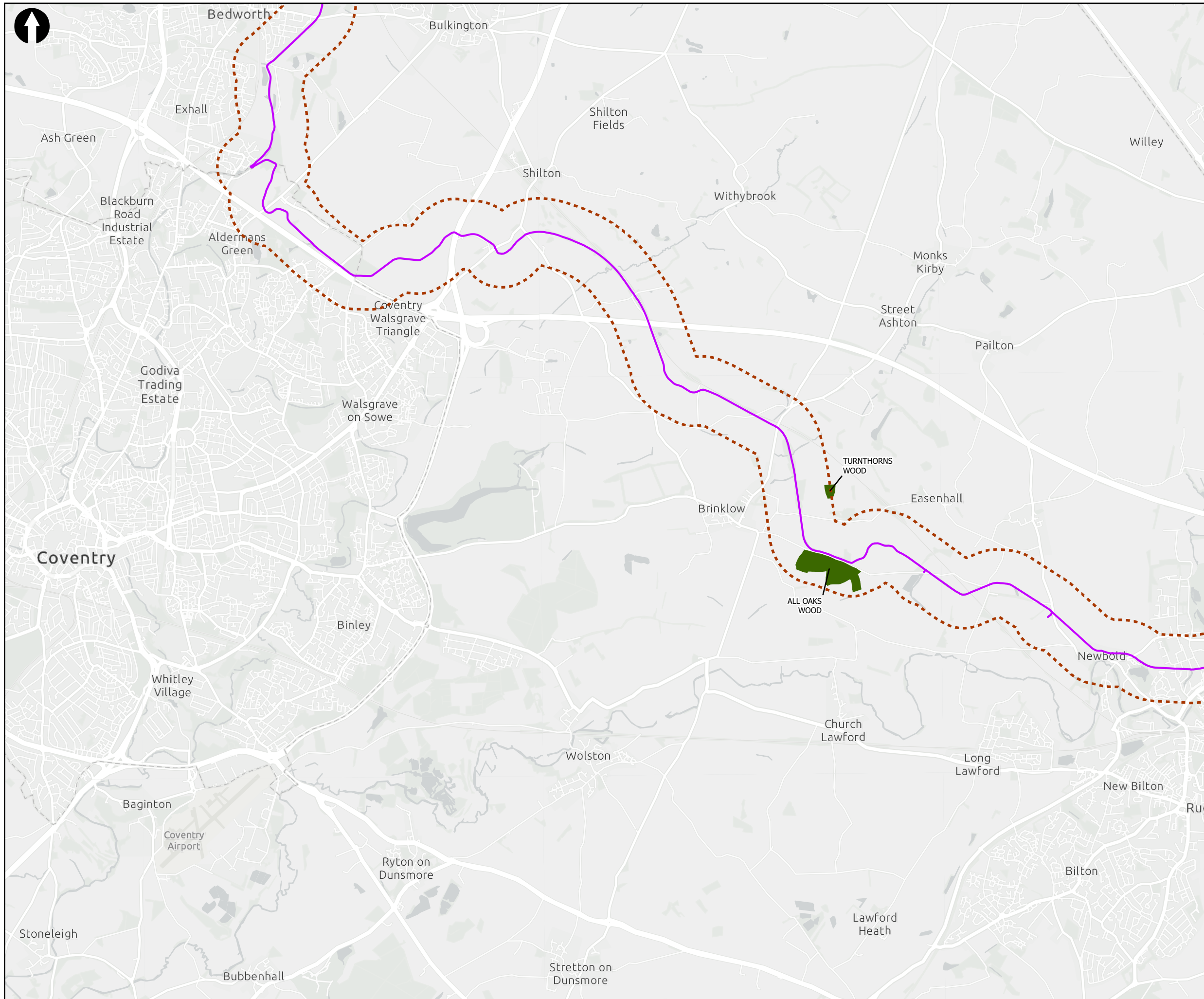


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 Sheet 2 of 9

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GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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Author names redacted

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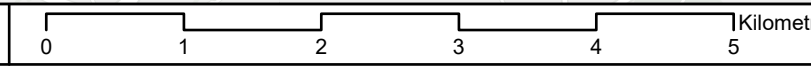
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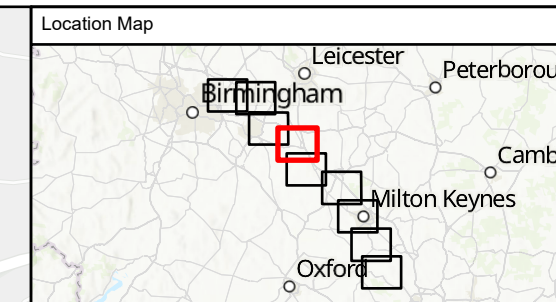
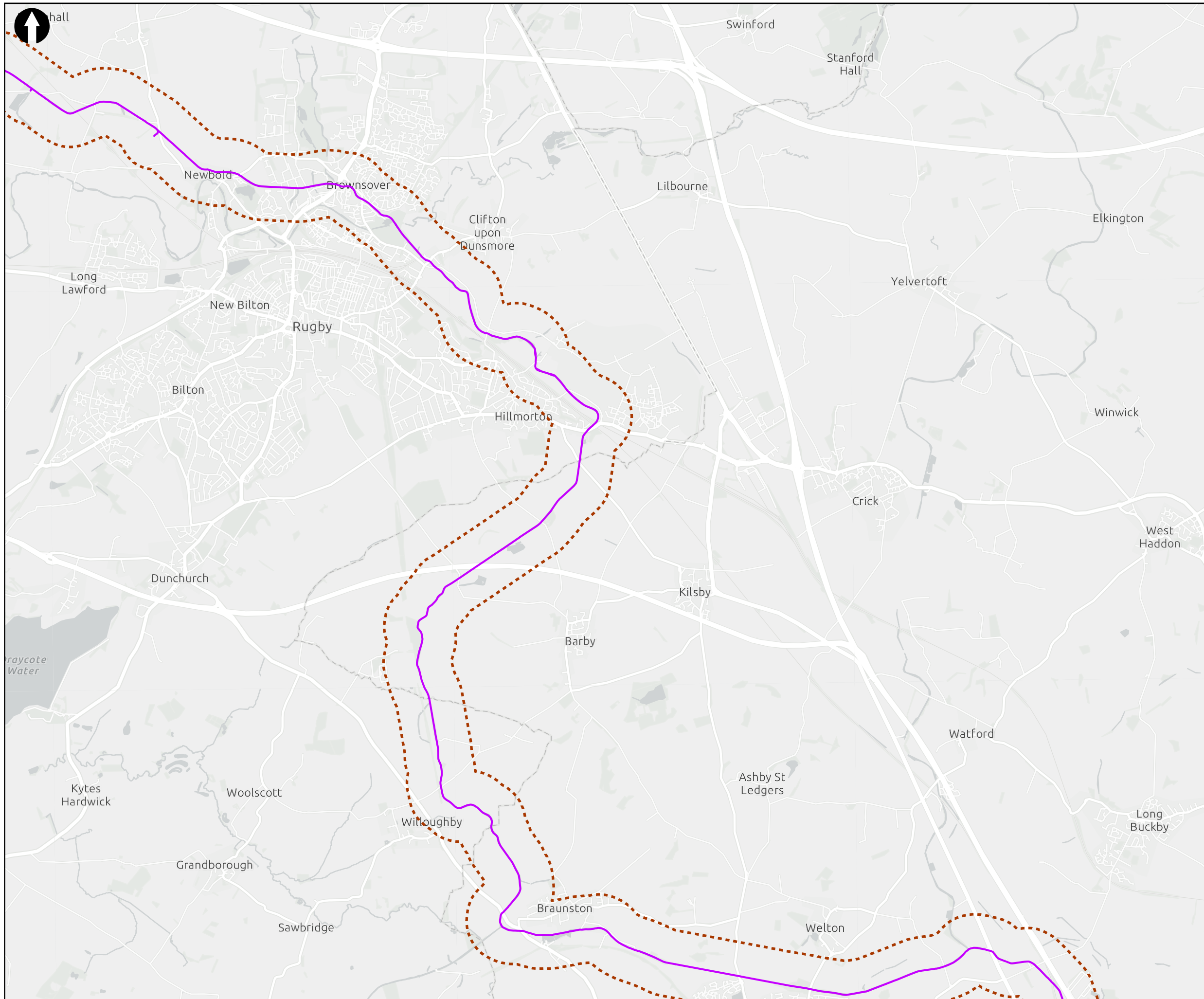
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**Title**  
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 Sheet 3 of 9

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Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Natural England, Open Government Licence

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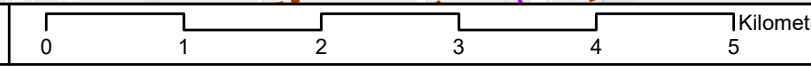
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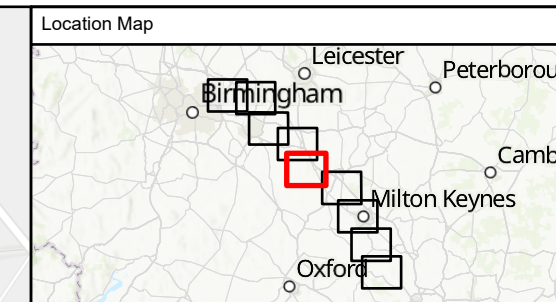
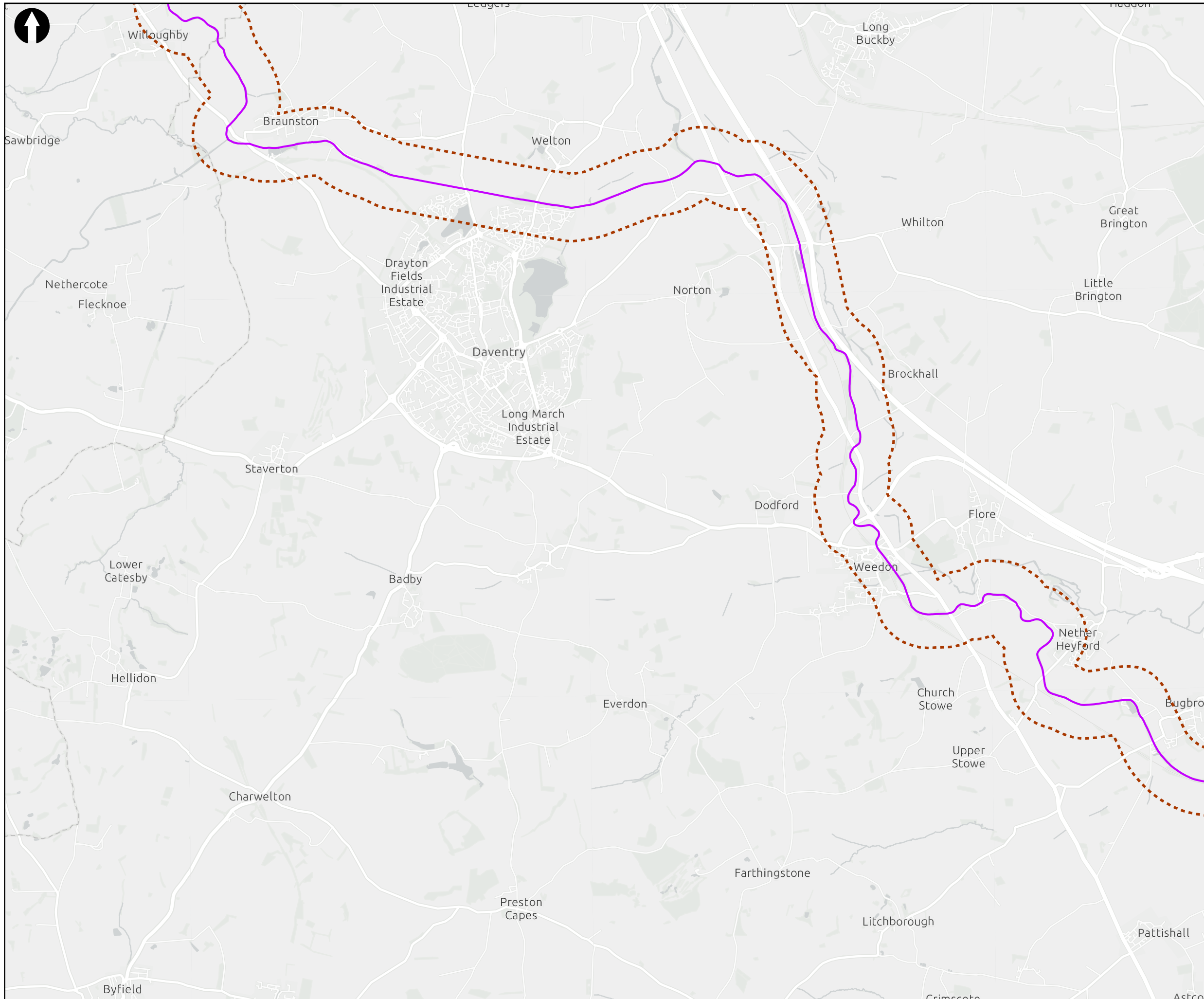
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**Title**  
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 Ancient Woodland sites within 500m buffer from the pipeline and canal  
 Sheet 4 of 9

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Scale at A3	Status	Rev	Security
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- Key to Symbols**
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
  - 500m Study Area
  - Ancient & Semi-Natural Woodland
  - Ancient Replanted Woodland

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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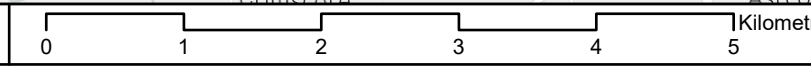
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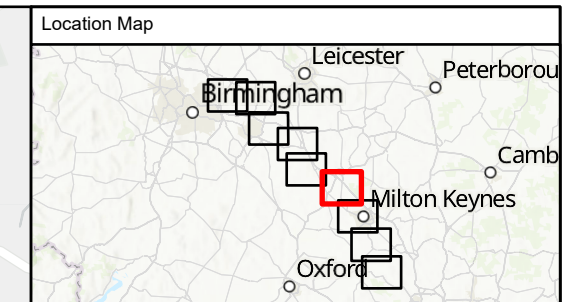
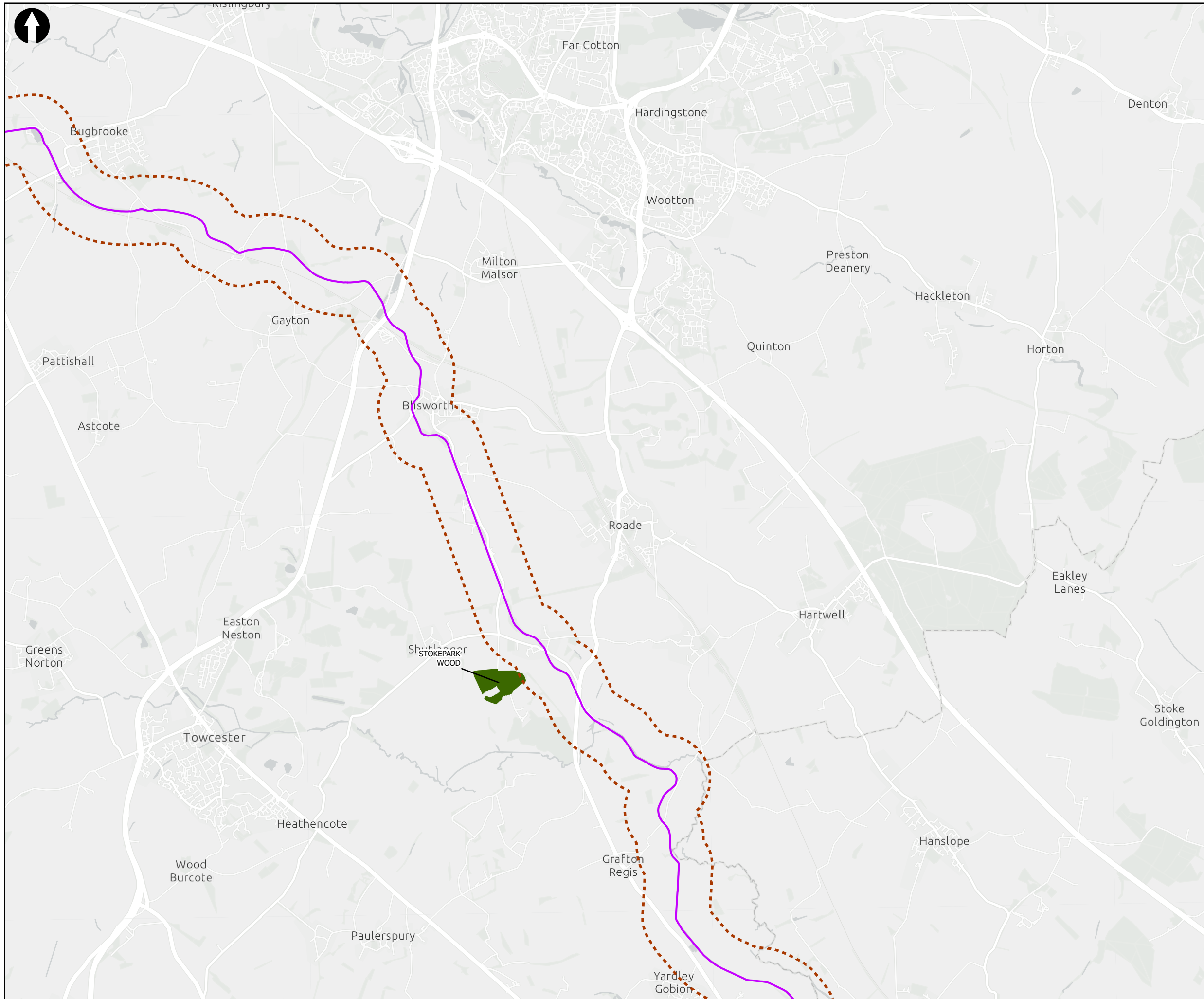
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**Title**  
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 Ancient Woodland sites within 500m buffer from the pipeline and canal  
 Sheet 5 of 9

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**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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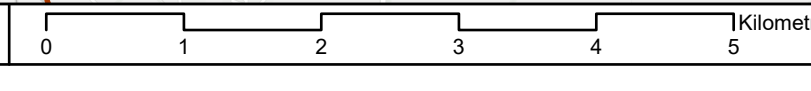
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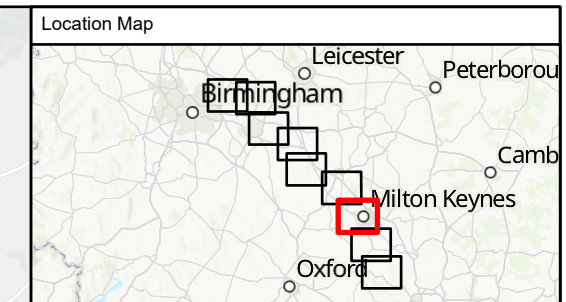
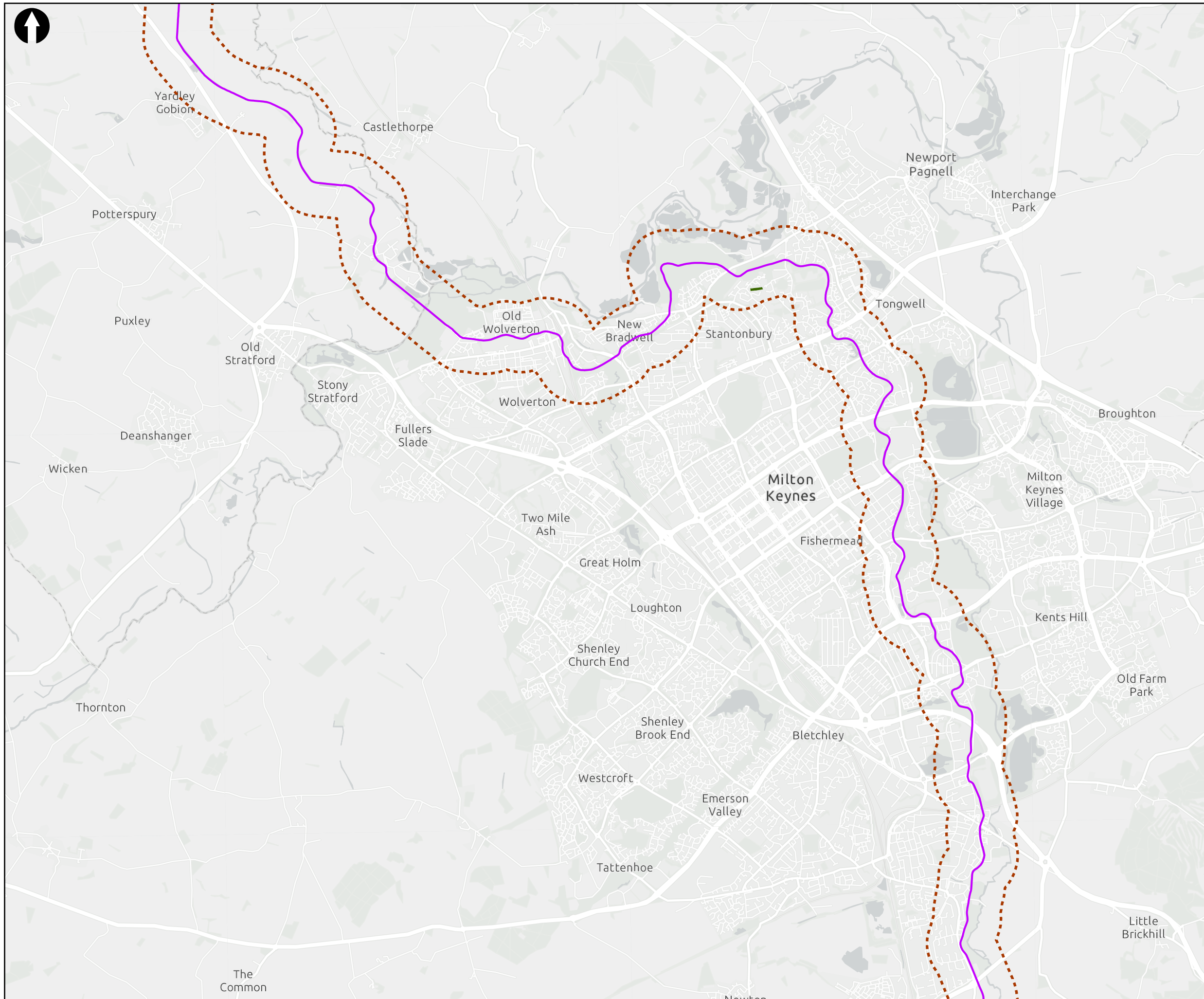
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**Title**  
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 Ancient Woodland sites within 500m buffer from the pipeline and canal  
 Sheet 6 of 9

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Scale at A3	Status	Rev	Security
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**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

**Notes**

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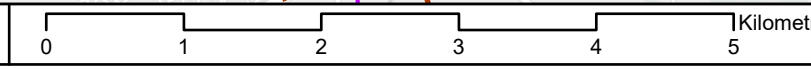
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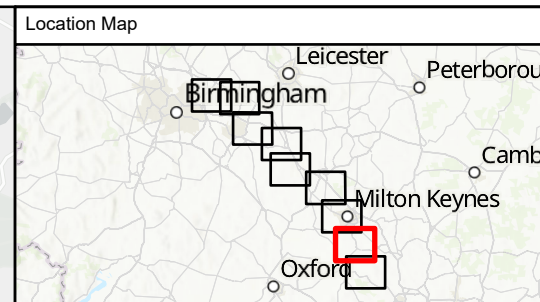
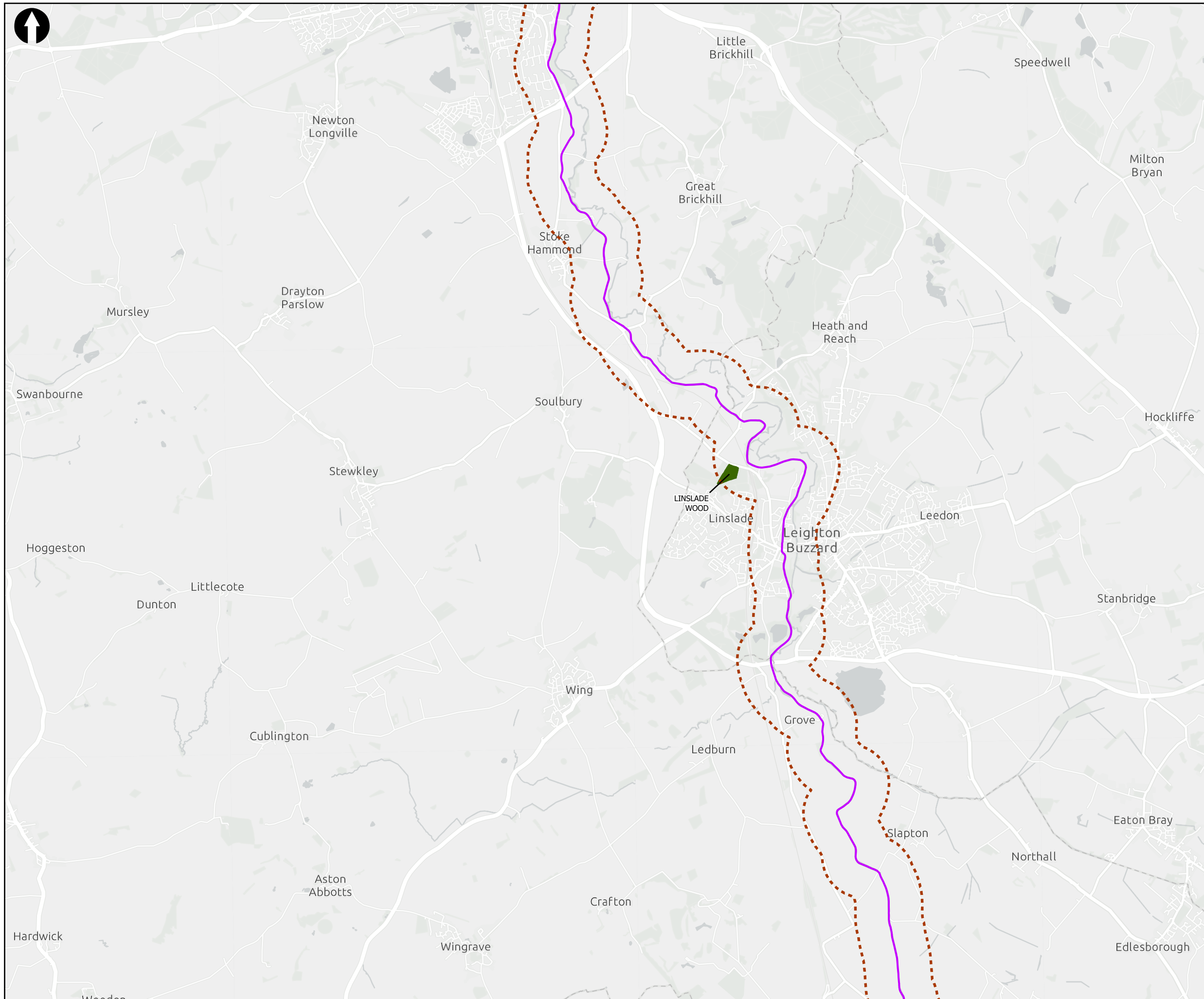
GUC  
 Ancient Woodland sites within 500m buffer from the pipeline and canal  
 Sheet 7 of 9

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Drawing Number **GUC Ancient Woodland**





- Key to Symbols**
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
  - 500m Study Area
  - Ancient & Semi-Natural Woodland
  - Ancient Replanted Woodland

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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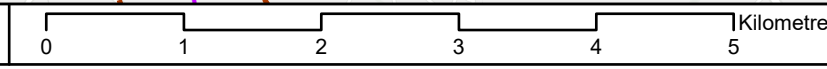
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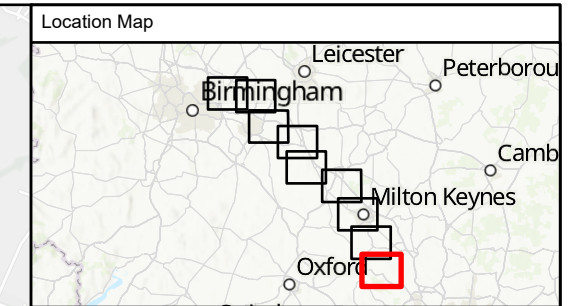
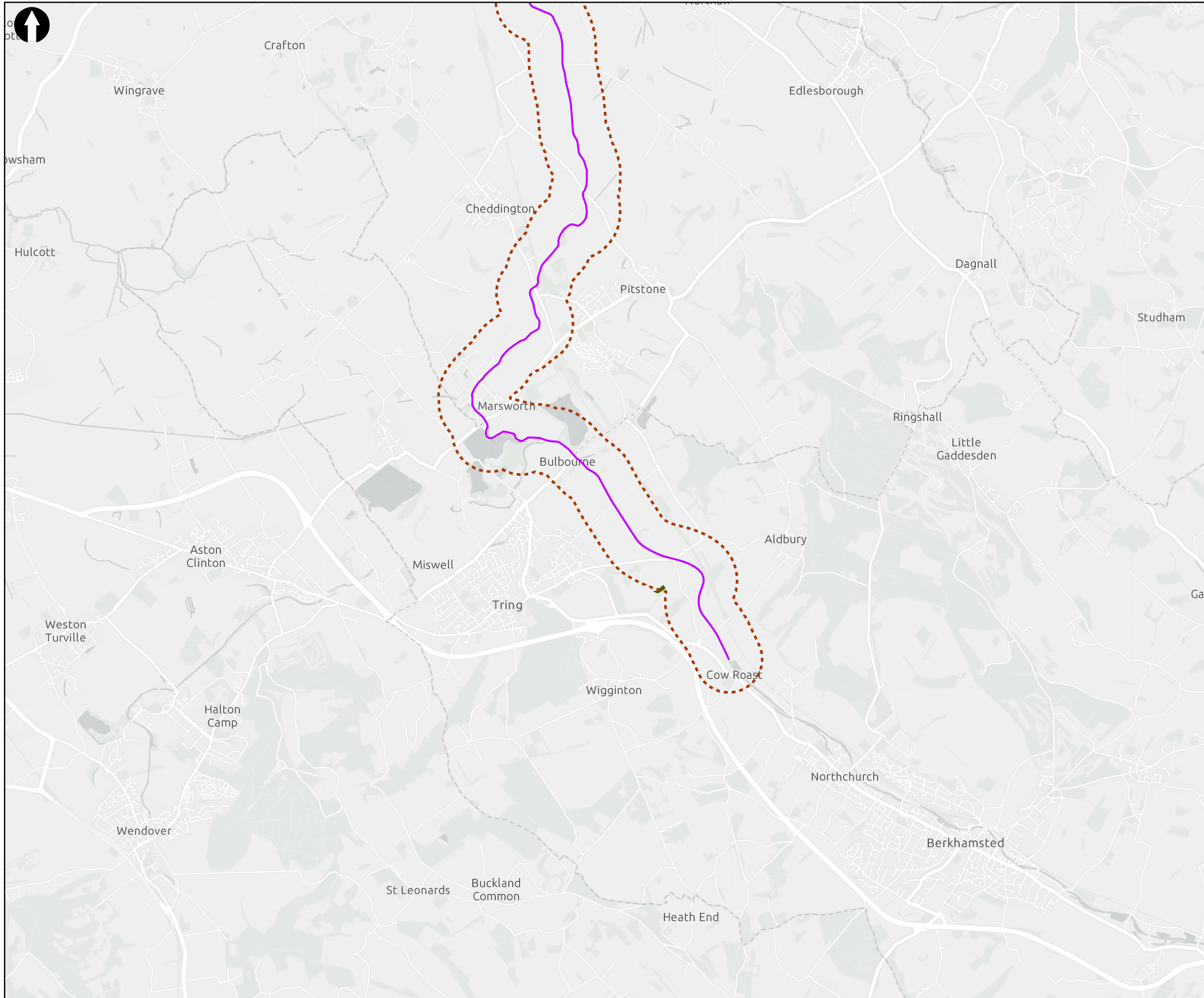


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 Ancient Woodland sites within 500m buffer from the pipeline and canal  
 Sheet 8 of 9

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GIS Check		Approved	
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**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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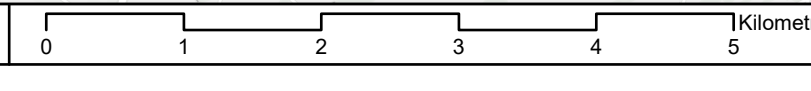
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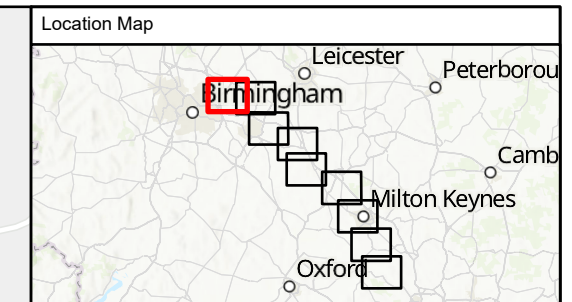
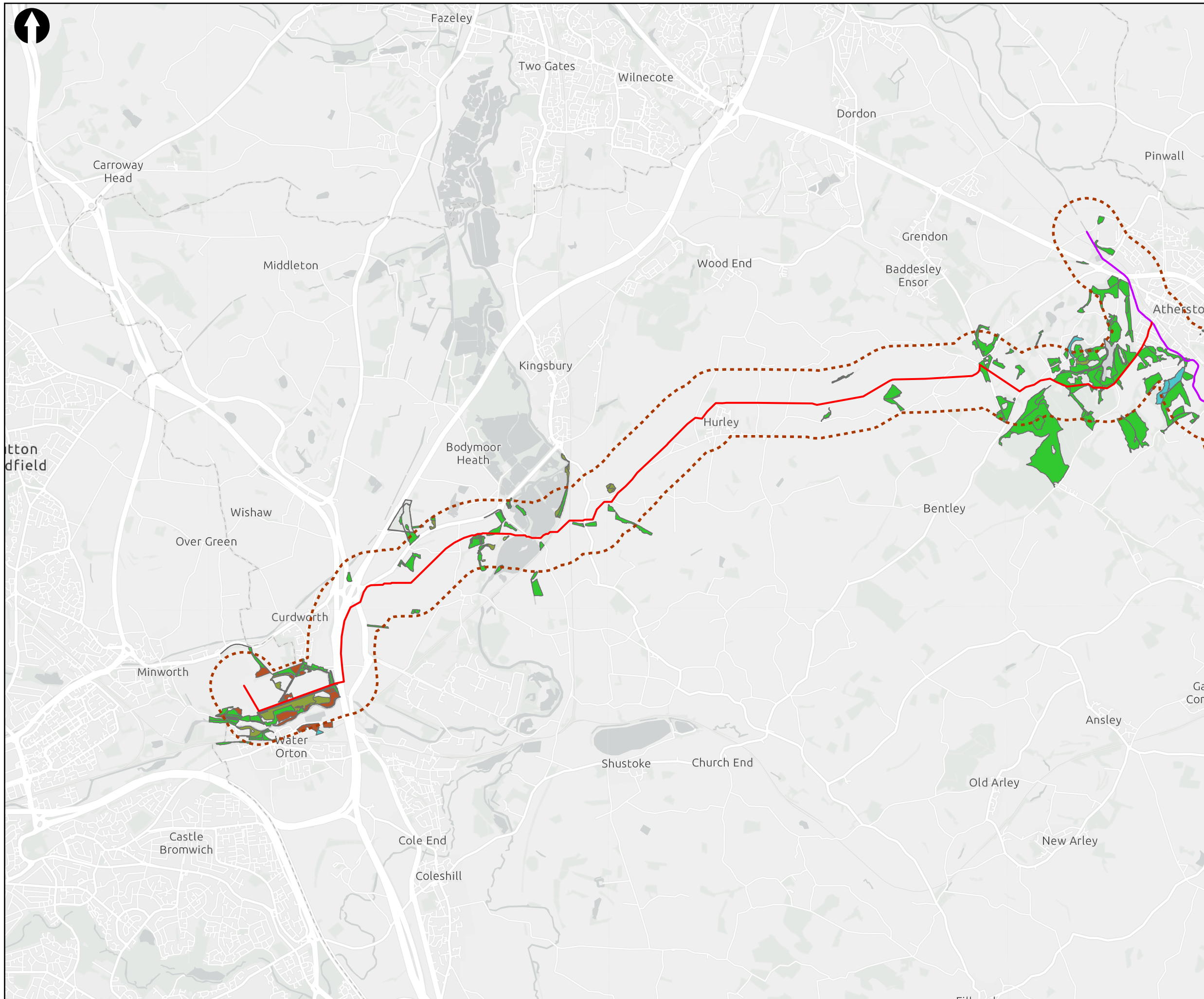
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 Ancient Woodland sites within 500m buffer from the pipeline and canal  
 Sheet 9 of 9

Designed		Check	
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GIS Check		Approved	
Scale at A3	Status	Rev	Security
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### A.3 Priority Habitat (Habitats of Principal Importance) Maps





**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- No main habitat but additional habitats present
- Traditional orchard

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Natural England, Open Government Licence

Author names redacted

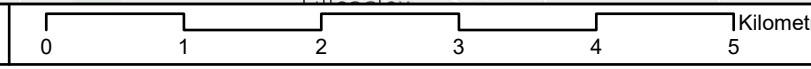
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<b>M</b> <b>MOTT</b> <b>MACDONALD</b>	<b>M</b>	22 Station Road Cambridge CB1 2JD  T +44 (0)1223 463500 W mottmac.com
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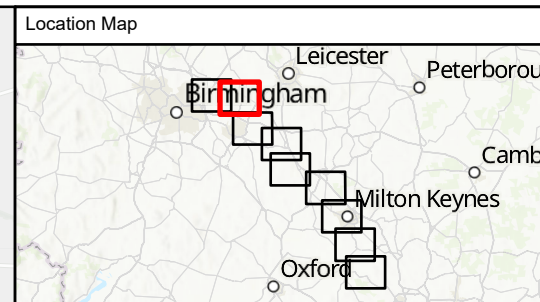
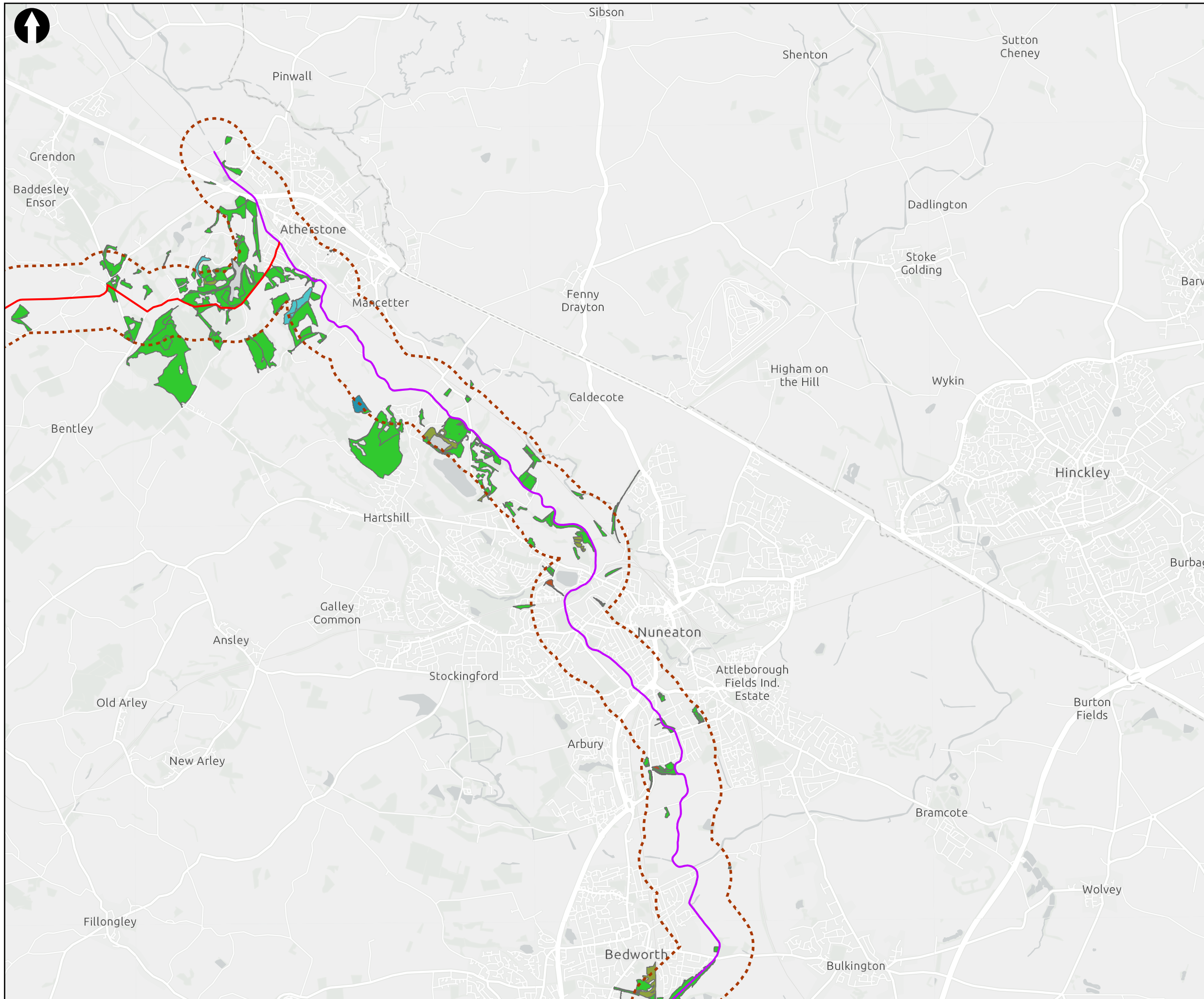
**Client**

**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 1 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
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- Good quality semi-improved grassland
- Lowland meadows
- No main habitat but additional habitats present

**Notes**  
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Author names redacted

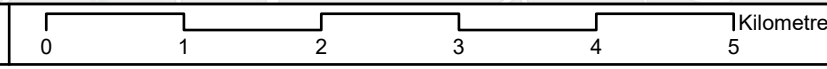
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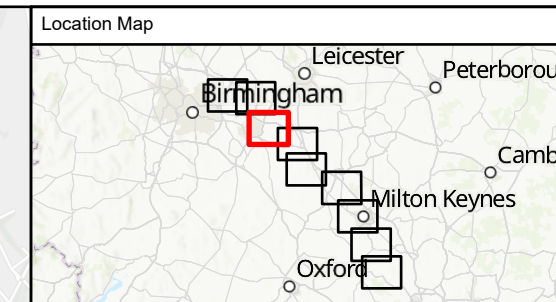
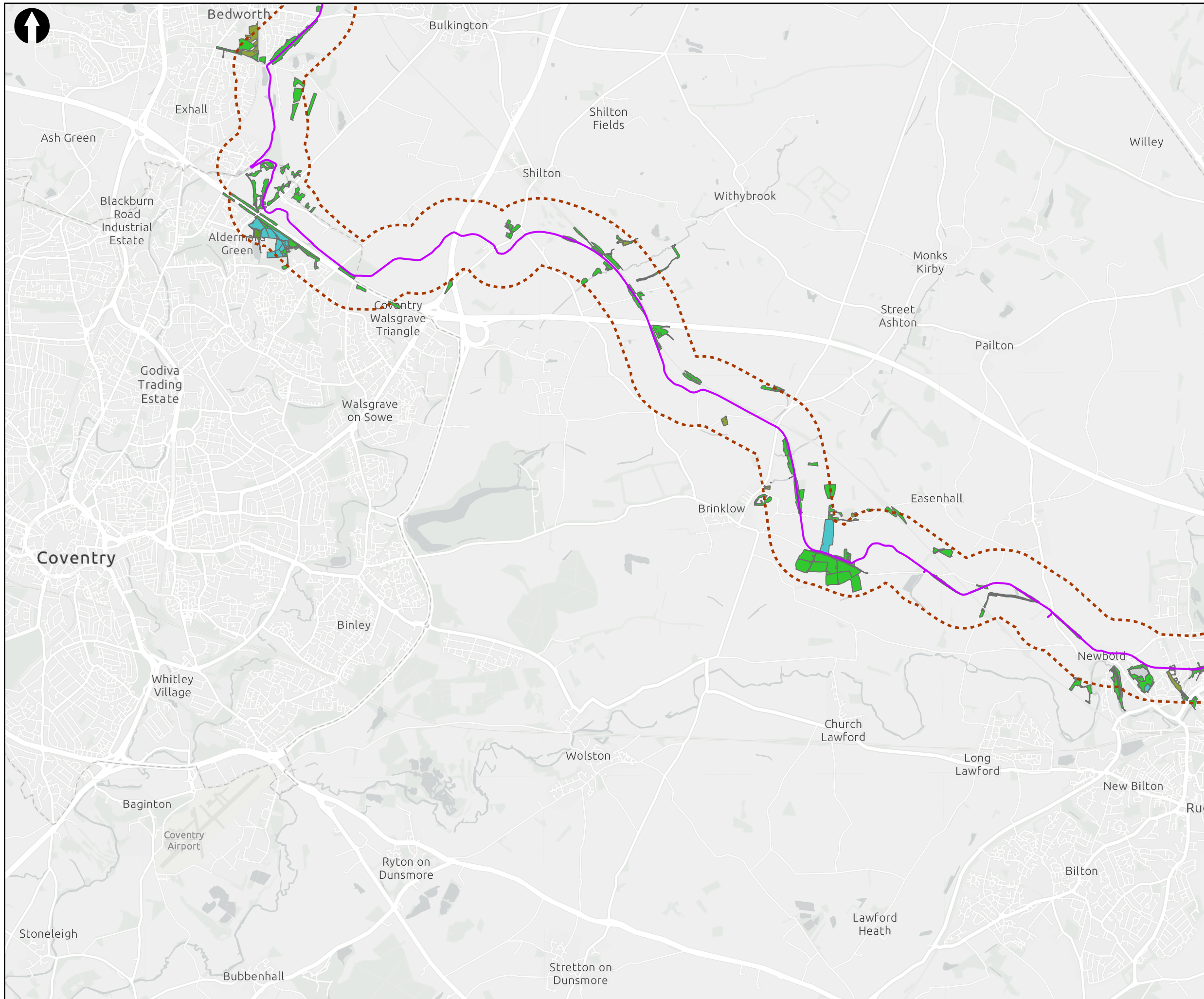


**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 2 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland fens
- No main habitat but additional habitats present

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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Author names redacted

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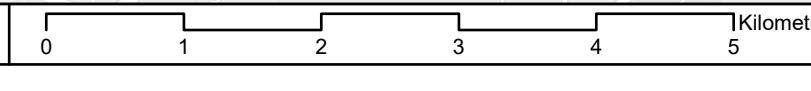
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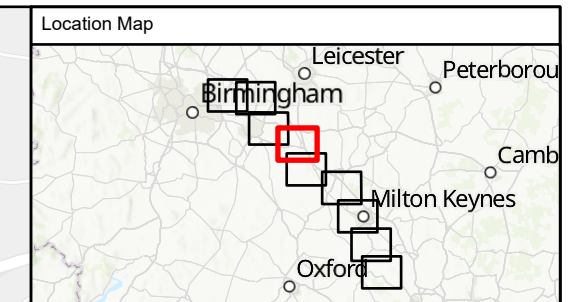
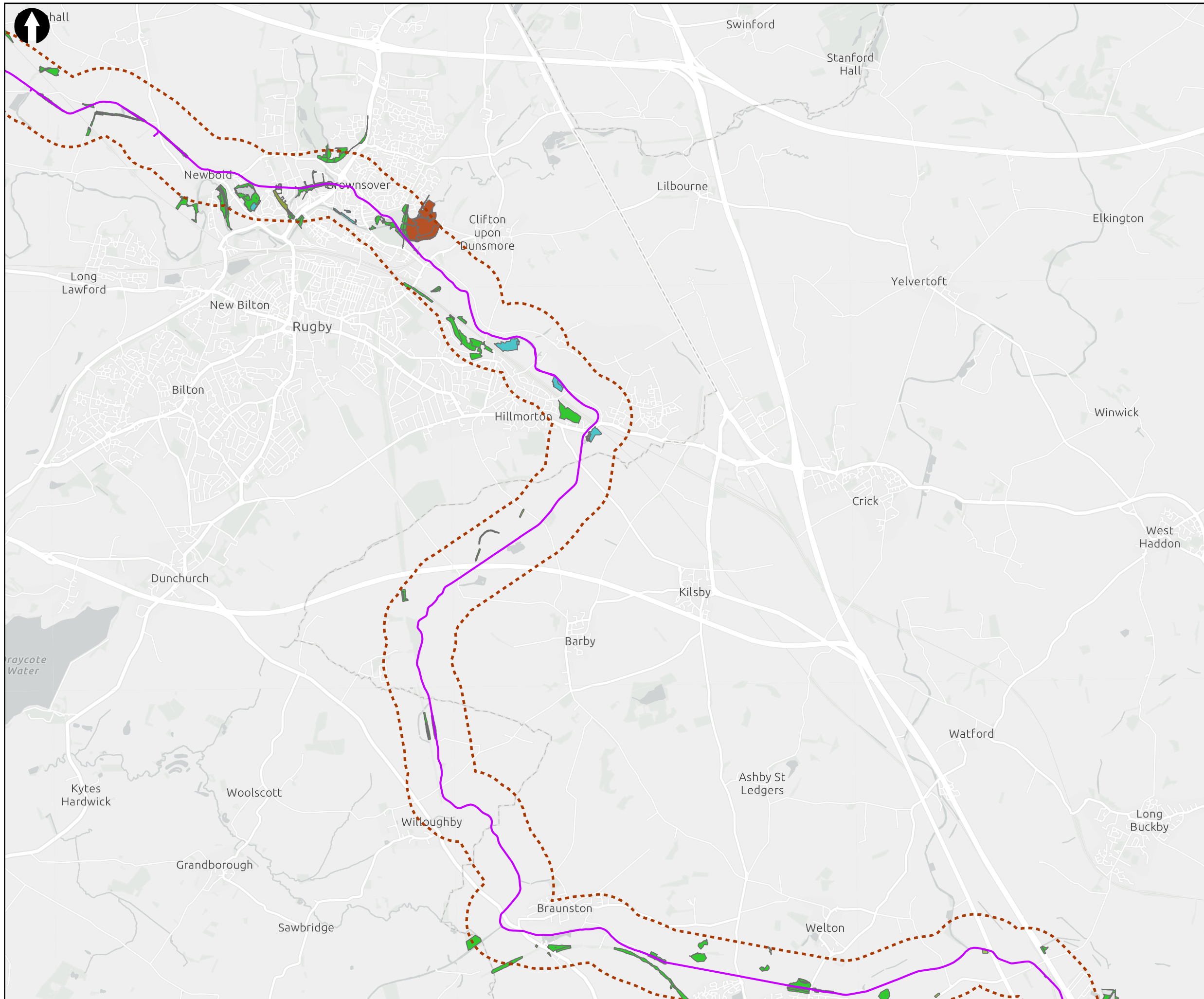
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**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 3 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland fens
- No main habitat but additional habitats present
- Traditional orchard

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Natural England, Open Government Licence

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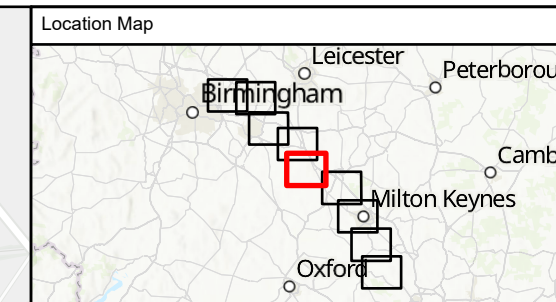
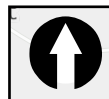
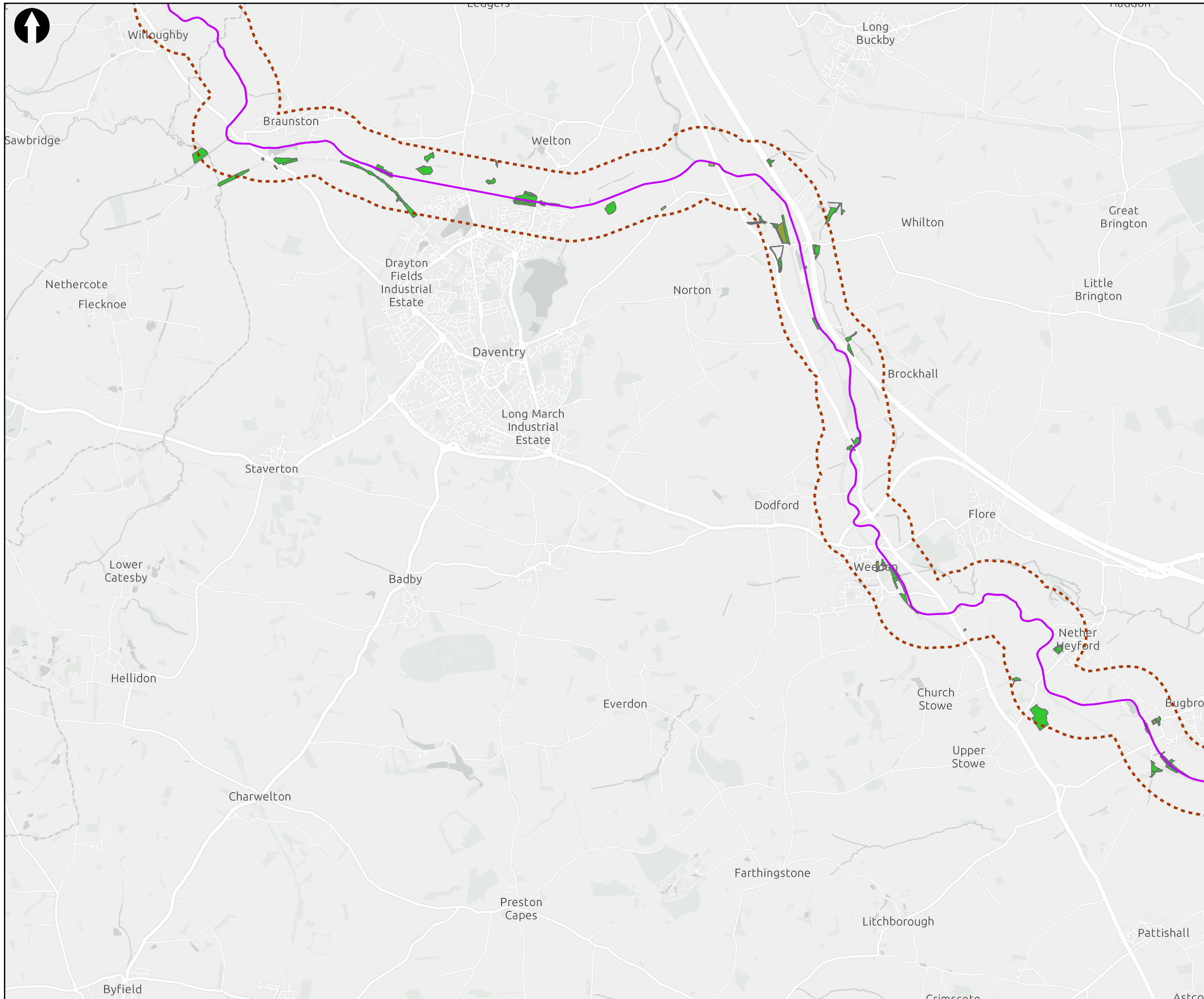
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**Client**

**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 4 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD





**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Deciduous woodland
- No main habitat but additional habitats present
- Traditional orchard

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Natural England, Open Government Licence

Author names redacted

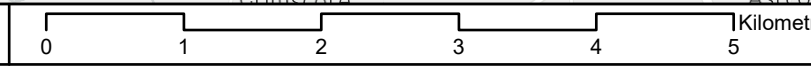
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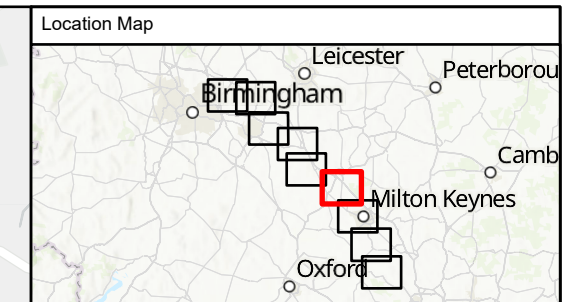
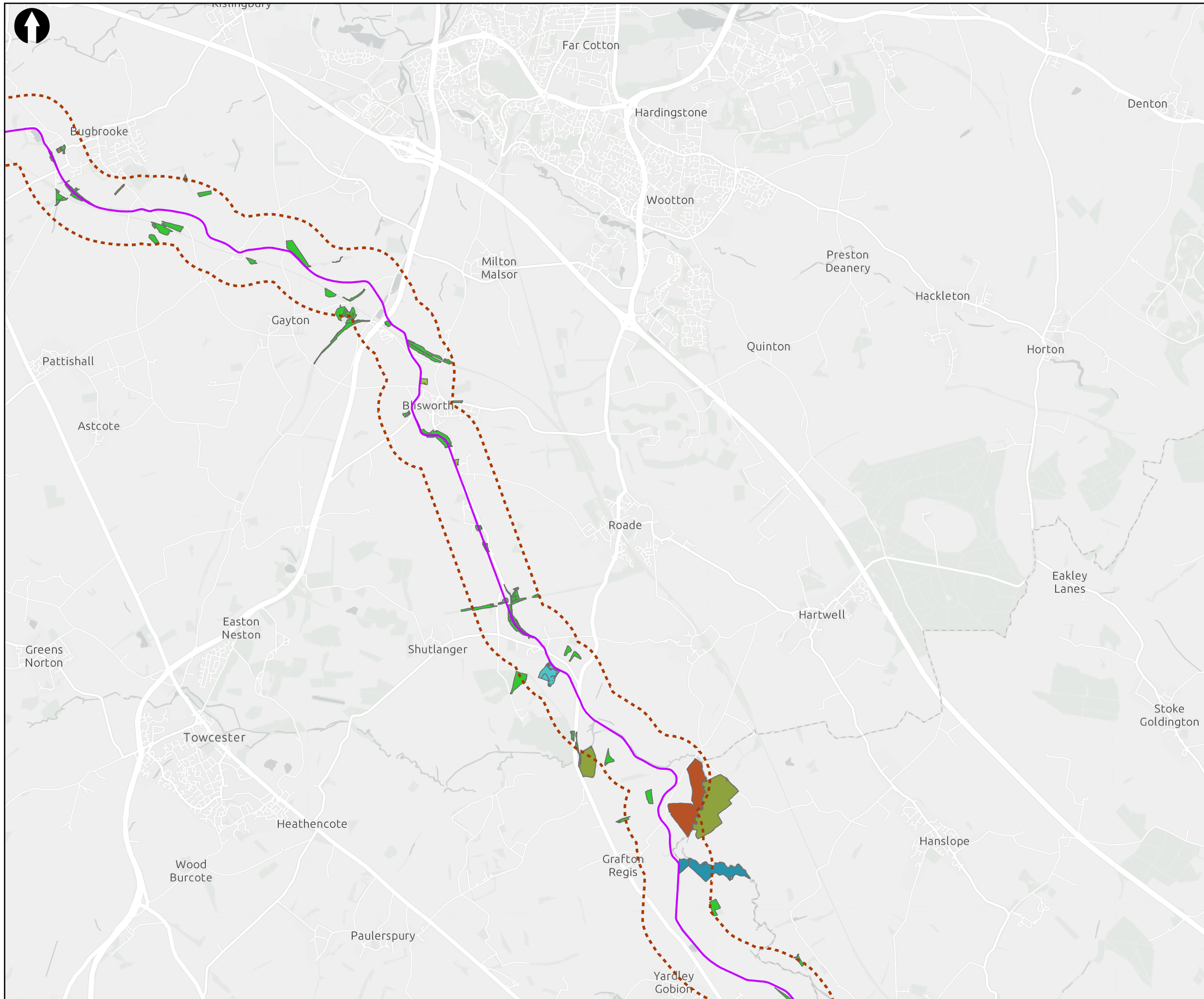
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**Client**

**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 5 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD





**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland meadows
- No main habitat but additional habitats present
- Traditional orchard

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Natural England, Open Government Licence

Author names redacted

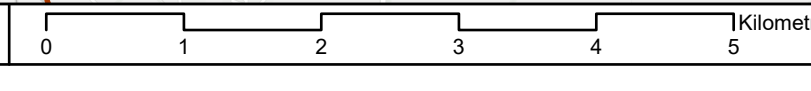
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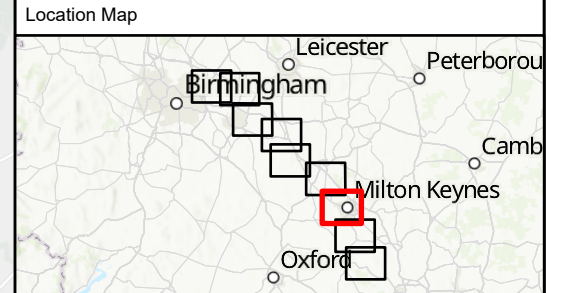
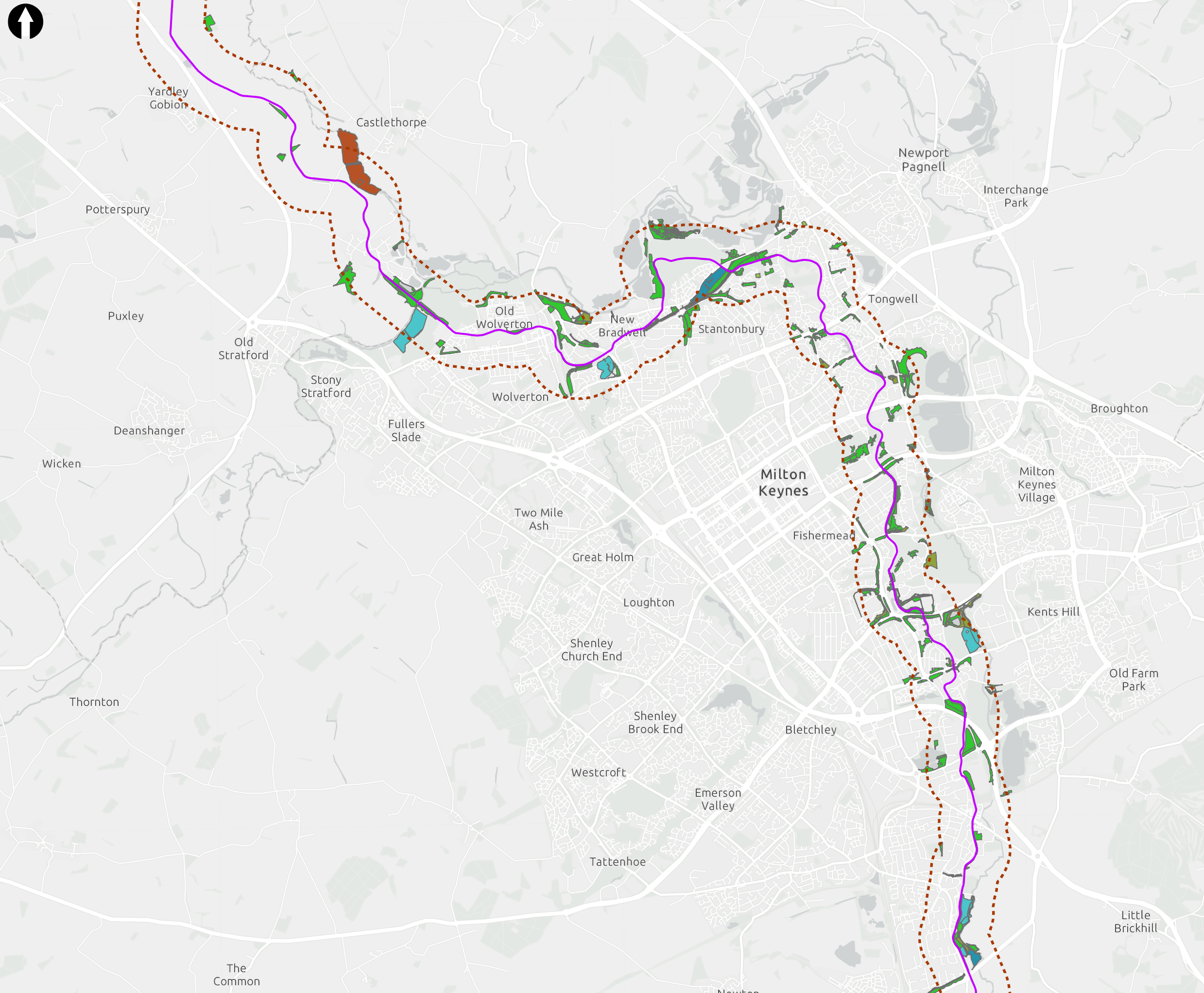


**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 6 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland meadows
- No main habitat but additional habitats present
- Traditional orchard

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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Author names redacted

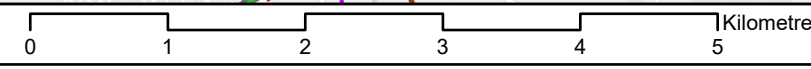
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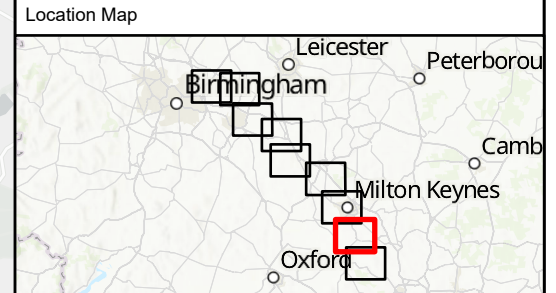
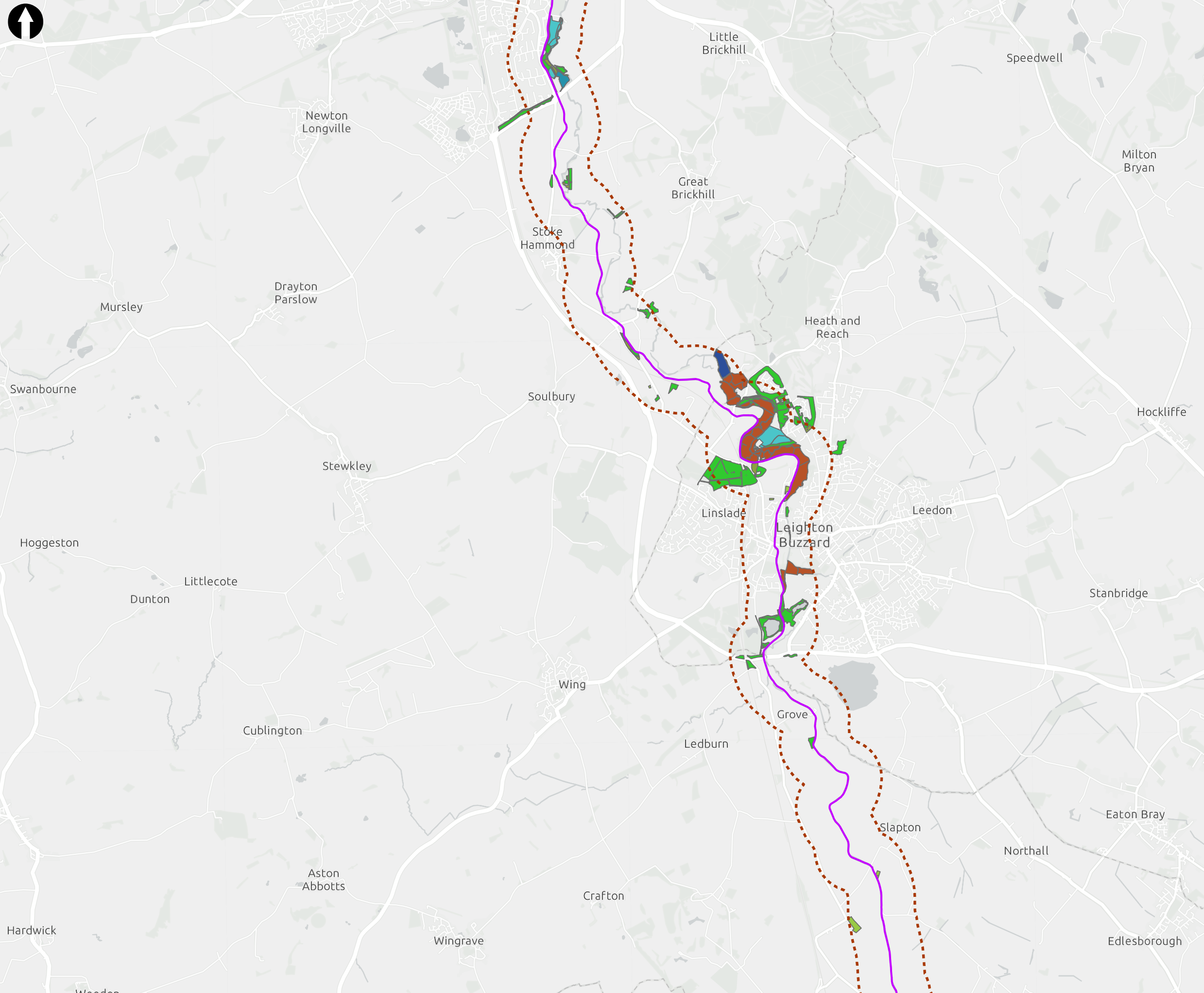


**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 7 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland fens
- Lowland meadows
- No main habitat but additional habitats present
- Purple moor grass and rush pastures
- Traditional orchard

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Natural England, Open Government Licence

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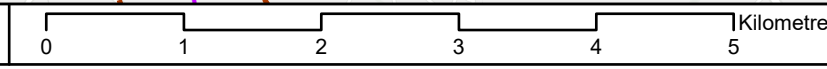
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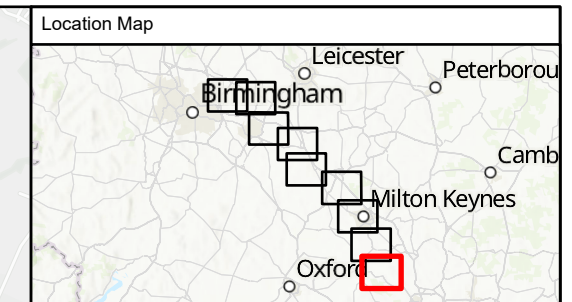
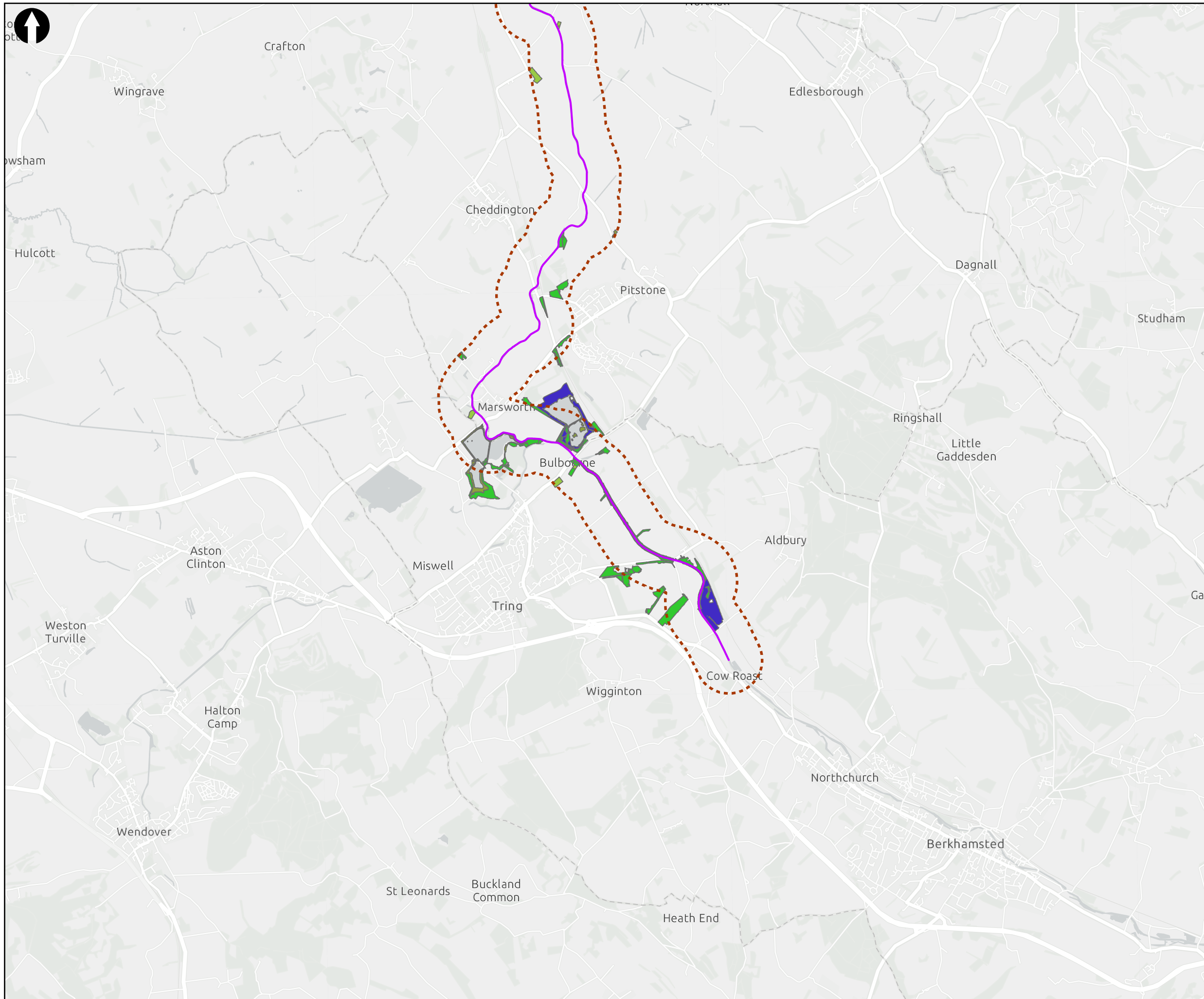
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**Title**  
 GUC  
 Priority Habitat Inventory within 500m  
 buffer from the pipeline and canal  
 Sheet 8 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- 500m Study Area
- Deciduous woodland
- Lowland calcareous grassland
- No main habitat but additional habitats present
- Traditional orchard

**Notes**  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
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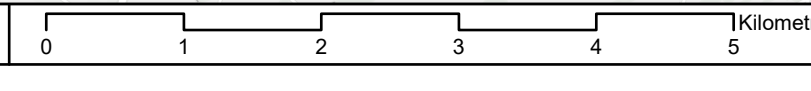
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**Client**

**Title**  
 GUC  
 Priority Habitat Inventory within 500m buffer from the pipeline and canal  
 Sheet 9 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
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## A.4 Designated Site Citations



## EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

### Citation for Special Area of Conservation (SAC)

**Name:** Chilterns Beechwoods

**Unitary Authority/County:** Buckinghamshire, Hertfordshire, Oxfordshire, Windsor and Maidenhead

**SAC status:** Designated on 1 April 2005

**Grid reference:** [REDACTED]

**SAC EU code:** UK0012724

**Area (ha):** 1276.48

**Component SSSI:** Ashridge Commons and Woods SSSI, Aston Rowant Woods SSSI, Bisham Woods SSSI, Bradenham Woods, Park Wood and The Coppice SSSI, Ellesborough and Kimble Warrens SSSI, Hollowhill and Pullingshill Woods SSSI, Naphill Common SSSI, Tring Woodlands SSSI, Windsor Hill SSSI

#### Site description:

The Chilterns Beechwoods represent a very extensive tract of ancient semi-natural beech *Fagus sylvatica* forests in the centre of the habitat's UK range. The woodland is an important part of a mosaic with species-rich chalk grassland and scrub. A distinctive feature in the woodland flora is the occurrence of the rare coralroot *Cardamine bulbifera*. Standing and fallen dead timber provide habitat for dead-wood (saproxylic) invertebrates, including stag beetle *Lucanus cervus*.

**Qualifying habitats:** The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- *Asperulo-Fagetum* beech forests. (Beech forests on neutral to rich soils)
- Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*). (Dry grasslands and scrublands on chalk or limestone)

**Qualifying species:** The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- Stag beetle *Lucanus cervus*

This citation relates to a site entered in the Register of European Sites for Great Britain.

Register reference number: UK0012724

Date of registration: 14 June 2005

Signed: *Trevor Salmon*

On behalf of the Secretary of State for Environment, Food and Rural Affairs

## EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

### Citation for Special Area of Conservation (SAC)

**Name:** Ensor's Pool  
**Unitary Authority/County:** Warwickshire  
**SAC status:** Designated on 1 April 2005  
**Grid reference:** [REDACTED]  
**SAC EU code:** UK0012646  
**Area (ha):** 3.80  
**Component SSSI:** Ensor's Pool SSSI

#### Site description:

Ensor's Pool lies on the western edge of Nuneaton and was formed in an abandoned clay pit. It has an average depth of 8 metres and is fed by groundwater. The pool overlies Etruria Marl which was extracted for brick-making early in the 20<sup>th</sup> Century. Ensor's Pool holds a very large and healthy population of native white-clawed crayfish *Austropotamobius pallipes*. It is of one of the best lake populations of crayfish in England. Although crayfish plague outbreaks have occurred in the Midlands, this water body is isolated from river systems and is a good example of a 'refuge' site in an important part of the species' former range.

The pool has some marginal vegetation of hard rush *Juncus inflexus*, common spike-rush *Eleocharis palustris*, water horsetail *Equisetum fluviatile* and lesser bulrush *Typha angustifolia*. Water plants include spiked water-milfoil *Myriophyllum spicatum* and broad-leaved pondweed *Potamogeton natans*. The pool is surrounded by areas of scrub and grassland.

**Qualifying species:** The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*.

This citation relates to a site entered in the Register of European Sites for Great Britain.

Register reference number: UK0012646

Date of registration: 14 June 2005

Signed: *Trevor Salmon*

On behalf of the Secretary of State for Environment, Food and Rural Affairs

COUNTY: HERTFORDSHIRE

SITE NAME: ALDBURY NOWERS

DISTRICT: DACORUM

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981.

Local Planning Authority: Dacorum Borough Council

National Grid Reference: [REDACTED] Area: 19.7 (ha.) 48.7 (ac.)

Ordnance Survey Sheet 1.50,000: 165 1:10,000: SP 91 SE, SW

Date Notified (Under 1949 Act): – Date of Last Revision: –

Date Notified (Under 1981 Act): 1990 Date of Last Revision: –

#### Other Information:

Aldbury Nowers is contiguous with the Pitstone Hill NCR site in Buckinghamshire, which it complements by providing additional diversity of wildlife habitats. The site is within the Chilterns AONB, it contains two sections of the archaeological feature Grim's Ditch and is crossed by the Ridgeway long distance footpath.

#### Reasons for Notification:

This site contains areas of unimproved calcareous grassland and ancient semi-natural woodland which have developed on the western slopes of a chalk scarp to the northeast of Tring. These habitats have declined dramatically in recent decades in the county through changes in agriculture and woodland management practices. Aldbury Nowers contains one of the best remaining areas of chalk downland in the county as well as one of the finest examples of ancient 'beech hanger' woodland in Hertfordshire.

Due to lack of grazing in recent years the calcareous grassland has been invaded by hawthorn *Crataegus monogyna*, buckthorn *Rhamnus catharticus*, dogwood *Cornus sanguinea* and spindle-tree *Euonymus europaeus* to produce a mosaic of scrub and grassland, which is important for some invertebrate species. In the more open areas the sward is dominated by red fescue *Festuca rubra* and sheep's fescue *F. ovina*, with upright brome *Bromus erectus*, crested hair-grass *Koeleria macrantha*, meadow oat-grass *Avenula pratensis* and downy oat-grass *A. pubescens* all common. There is a rich assemblage of herb species, including lady's bedstraw *Galium verum*, common milkwort *Polygala vulgaris*, salad burnet *Sanguisorba minor* and clustered bellflower *Campanula glomerata*. Two rare species, pasqueflower *Pulsatilla vulgaris* and field fleawort *Senecio integrifolius* have been noted recently. In the vicinity of scrub upright brome is dominant but wild carrot *Daucus carota*, burnet saxifrage *Pimpinella saxifraga* and hairy violet *Viola hirta* also thrive.

Characteristically for a mature beech wood, Turlhanger's Wood has a relatively poorly developed understorey. In places dog's mercury *Mercurialis perennis*, sanicle *Sanicula europaea* and false brome *Brachypodium sylvaticum* are frequent but on the lower slopes and to the east of Grim's Ditch a more open canopy has permitted oak *Quercus sp.*, ash *Fraxinus excelsior*, white-beam *Sorbus aria* and hazel *Corylus avellana* to grow. These areas support a richer ground flora, including yellow archangel *Lamium galeobdolon*, bluebell *Hyacinthoides non-scripta* and primrose *Primula vulgaris*. A number of locally and nationally rare plants are found within these woods, notably yellow bird's-nest *Monotropa hypopitys*, white helleborine *Cephalanthera damasonium*, and lesser hairy brome *Bromus benekenii*.

Thirty-four species of butterfly have been recorded from the site in recent times including the Essex skipper *Thymelicus lineola*, small blue *Cupido minimus*, a strong



colony of marbled white *Melanargia galathea* and the county's only colony of the duke of burgundy *Hamearis lucina*.

SITE NOTIFIED TO THE SECRETARY OF STATE ON THE 19TH NOVEMBER  
1990

**COUNTY:** HERTFORDSHIRE/BUCKINGHAMSHIRE      **SITE NAME:** ASHRIDGE COMMONS  
AND WOODS

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

**Local Planning Authorities:** Dacorum Borough Council, Aylesbury Vale District Council  
Hertfordshire County Council, Buckinghamshire County Council

**National Grid Reference:** [REDACTED]

**Ordnance Survey Sheet 1:50,000:** 165/166      **1:10,000:** SP90 NE, SP91 SE/NE,  
TL01 SW

**Date Notified (Under 1949 Act):** 1952      **Date of Last Revision:** 1972

**Date Notified (Under 1981 Act):** 1987      **Date of Last Revision:**

**Area:** 640.1 ha 1581.7 ac

**Other information:** This site is National Trust property within the Chilterns Area of Outstanding Natural Beauty

### **Description and Reasons for Notification**

Ashridge Commons and Woods is an extensive area of mainly semi-natural vegetation on the Hertfordshire/Buckinghamshire border. Situated towards the northern end of the Chiltern escarpment on wet, acidic Clay-with-Flints plateau soils and more base rich flinty chalks of the scarp slopes, the site comprises a mosaic of different habitats: a mixture of ancient semi-natural and secondary woodland, plantation, scrub, a more open component dominated by bracken, and grassland. The site supports an exceptionally rich breeding bird community including both county and national rarities.

A wide range of woodland bird species is known to breed, with raptors, woodpeckers, chats, warblers, tits and finches all well represented. Of particular importance within the community are species found rarely elsewhere in Hertfordshire, such as redstart, nightingale and wood warbler. The nationally rare firecrest is found here at one of its two known county localities. Other more widespread species are breeding in good numbers at this site, examples being sparrowhawk, tree pipit, lesser spotted woodpecker and hawfinch. The last species has a particularly strong population in the Ashridge woodlands.

The site is able to support the rich breeding bird community because of varied woodland stand types, an extensive range of trees giving structural variety and the diversity of shrub and plant communities. The ancient semi-natural stands on the scarp slopes are usually of beech and in places there is vigorous regeneration. Ancient large pollards are important nesting sites for redstart. The secondary woodland has developed over common land and is mainly self-sown birch interspersed with pedunculate oak and beech. Elsewhere, broadleaved woodland diversity is enhanced by storied hornbeam-sweet chestnut coppice and an area of ash-maple-hazel coppice with a varied shrub understorey. The tall ash poles are frequently the site for singing wood warbler. Mixed conifer-broadleaved plantations add structural diversity and provide necessary sites for goldcrest, firecrest and coal tit.

On the acidic plateau soils the woodland ground flora is generally sparse. Where a more basic influence is found the plant community is correspondingly richer with wood melick *Melica uniflora*, woodruff *Galium odoratum* and sanicle *Sanicula europaea* all abundant. Less frequent are fly orchid *Ophrys insectifera*, violet helleborine *Epipactis purpurata* and yellow bird's-nest *Monotropa hypopitys*, all of which are locally uncommon, while nationally rare are narrow-lipped helleborine *Epipactis leptochila*, green flowered helleborine *E. phyllanthes* and stinking helleborine *Helleborus foetidus*.

Other habitats which are important for the bird community, especially for warblers, tree pipit and nightingale, include scrub, adjacent open areas dominated by bracken and with scattered trees, and small areas of unimproved calcareous and acidic grassland. The calcareous grassland is characterised by locally uncommon yellow-wort *Blackstonia perfoliata* and autumn gentian *Gentianella amarella*, whilst of county importance in the acidic grassland is the presence of heath-grass *Danthonia decumbens* and trailing St John's wort *Hypericum humifusum*.

Additional interest is provided by small ponds scattered throughout the site which support amphibians and various invertebrates.



COUNTY: WARWICKSHIRE

SITE NAME: BENTLEY PARK WOOD

DISTRICT: North Warwickshire

SITE REF: 15WEK

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981.

Local Planning Authority: WARWICKSHIRE COUNTY COUNCIL, North Warwickshire Borough Council

National Grid Reference: [REDACTED]

Area: 103.43 (ha.) 255.6 (ac.)

Ordnance Survey Sheet 1:50,000: 140

1:10,000: SP 29 SE, NE

Date Notified (Under 1949 Act): 1955

Date of Last Revision: 1972

Date Notified (Under 1981 Act): 1986

Date of Last Revision: –

Other Information:

Boundary alteration (reduction &amp; extension).

Reasons for Notification:

This site is a large and important ancient woodland in north Warwickshire. It comprises Bentley Park Wood, sectors of the adjacent Monks Park Wood and a small detached area outwith the main wood known as the Birchleys. Bentley Park Wood lies mainly on Carboniferous sandstones, a substantial portion of which is overlain by boulder clay. In Monks Park Wood there are also areas of marl, sandstones and shales of the Coal Measures as well as earlier Cambrian shales with igneous intrusions. The majority of the wood lies on light, strongly acidic soils and is dominated by sessile oak, *Quercus petraea*. Alongside the deeply incised streams the soils are base rich and support alder *Alnus glutinosa*. The range of acid sessile oak on the better drained soils, and alder, on the wetter soils, found in Bentley Park Wood can be seen in only a limited number of other British Woods including Charnwood Forest, Chaddesley Woods and Wyre Forest. On this site there is an unusual and widespread juxtaposition of sessile oak and alder and there is a wider ecological range of alder woodland than possibly any other wood in Britain.

Most of the wood is dominated by sessile oak high forest with downy birch *Betula pubescens* thinly distributed throughout. The understorey consists of a scatter of holly *Ilex aquifolium*, rowan *Sorbus aucuparia* occasional alder buckthorn *Frangula alnus* and localised patches of hazel *Corylus avellana*. The ground flora is dominated by bracken *Pteridium aquilinum* and bramble *Rubus fruticosus* as well as honeysuckle *Lonicera periclymenum*, creeping soft-grass *Holcus mollis* and bluebell *Hyacinthoides non-scripta*. Parts of the oak wood have been felled and replanted with oak in a matrix of conifers. In these areas there has been considerable regrowth of native trees and shrubs which will facilitate the restoration of broadleaved woodland.

Alder occurs along the streams and on flushed sites together with ash *Fraxinus excelsior*, birch, sessile oak and usually in association with hazel. Here the ground vegetation consists of creeping soft-grass, bracken, broad buckler fern *Dryopteris dilatata* with limited patches of yellow archangel *Lamiastrum galeobdolon* and species such as wood-sorrel *Oxalis acetosella* and yellow pimpernel *Lysimachia nemorum*. In the wetter parts sessile oak is less common and tufted hair-grass *Deschampsia cespitosa*, pendulous sedge *Carex pendula* and wavy bitter-cress *Cardamine flexuosa* form distinct communities. Also along the stream sides are patches of lime *Tilia cordata* and *T. vulgaris* and wych elm *Ulmus glabra* and a damper area dominated by ash.

Noteworthy species include lily-of-the-valley *Convallaria majalis*, large bitter-cress *Cardamine amara*, wood horsetail *Equisetum sylvaticum* and wood fescue *Festuca altissima*

for which this is the only locality in the county. Small base-rich flushes are marked by additional species such as ramsons *Allium ursinum*, hard shield-fern *Polystichum aculeatum* and dog's mercury *Mercurialis perennis*.

The wood supports a sizeable bird community and is one of the three localities in the county for breeding redstart.

**COUNTY:** NORTHAMPTONSHIRE     **SITE NAME:** BUGBROOKE MEADOWS

**District:** South Northamptonshire

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

**Local Planning Authority:** South Northamptonshire District Council

**National Grid Reference:** [REDACTED]

**Ordnance Survey Sheet 1:50,000:** 152                      **1:10,000:** SP 65 NE

**Date Notified (Under 1949 Act):**                      **Date of Last Revision:**

**Date Notified (Under 1981 Act):** 1989                      **Date of Last Revision:**

**Area:** 9.8 ha 24.2 ac

**Other Information:** This is a new site.

### **Description and Reasons for Notification**

The site contains a group of low lying meadows alongside the River Nene which have escaped drainage and improvement. They tend to flood in winter and often remain wet well in to the growing season. As a result they support a range of damp grassland communities which are remarkably diverse and rich in species. Not only is this the only remaining example of its type in the Nene Valley but is probably unique in the county. The old hedgerows, drainage features and a short section of the River Nene form an integral part of the site which is managed as in the past by a combination of grazing and intermittent hay cutting.

The grassland of the crested dog's-tail-marsh marigold *Cynosurus cristatus*-*Caltha palustris* flood pasture type - grading through meadow foxtail-great burnet *Alopecurus pratensis*-*Sanguisorba officinalis* to crested dog's-tail-knapweed *Cynosurus cristatus*-*Centaurea nigra* on the drier areas. In some wetter places the creeping bent-marsh foxtail *Agrostis stolonifera*-*Alopecurus geniculatus* inundation community occurs.

Wetter areas, particularly along springlines and ditches, are dominated by hard rushes *Juncus inflexus*, jointed rush *J. articulatus* and greater pond sedge *Carex riparia*, with marsh marigold, common spike-rush *Eleocharis palustris*, great burnet *Sanguisorba officinalis* and ragged robin *Lychnis flos-cuculi*. The meadows are very species-rich and contain a number of species which are rare in the county, these include: sneezewort *Achillea ptarmica*, common cotton-grass *Eriophorum angustifolium*, adder's tongue *Ophioglossum vulgatum*, lesser spearwort *Ranunculus flammula*, marsh arrow-grass *Triglochin palustris* and marsh valerian *Valeriana dioica*.

The old hedges surrounding the meadow are important features in themselves both historically and as a wildlife habitat. Most of the common trees and shrubs are present including blackthorn *Prunus spinosa*, hazel *Corylus avellana*, crab apple *Malus sylvestris*, both species of hawthorn *Crataegus monogyna* and *C. laevigata*, spindle *Euonymus europaeus* and buckthorn *Rhamnus catharticus*.

Some of the adjoining fields are also very interesting botanically, but although still part of the same management unit are not as species-rich as the area selected.



**County:** Warwickshire **Site Name:** Ensor's Pool

**District:** Nuneaton and Bedworth **Site Ref:** 15W4T

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981 as amended

**Local Planning Authority:** Warwickshire County Council, Nuneaton and Bedworth Borough Council

**National Grid Reference:** [REDACTED] **Area:** 3.79 (ha.) 9.36 (ac.)

**Ordnance Survey Sheet 1:50,000:** 140 **1:10,000:** SP 39 SW, SP 39 SE

**Date Notified (Under 1949 Act):** - **Date of Last Revision:**

**Date Notified (Under 1981 Act):** 31/1/95 **Date of Last Revision:**

**Other Information:**

New site.

**Description and Reasons for Notification:**

Ensor's Pool lies on the western edge of Nuneaton in the north of Warwickshire and formed in an abandoned clay pit. It is about 220 metres long, 50 metres wide with an average depth of eight metres and is fed by groundwater. The pool overlies Etruria Marl which was extracted for brickmaking earlier this century. Ensor's Pool holds a very large and healthy population of native white-clawed crayfish *Austropotamobius pallipes* estimated at 50,000 individuals. It is of national importance as one of the best lake populations of crayfish in England.

The native crayfish population has declined in both Britain and elsewhere in Europe in recent years as a result of the commercial introduction of an American species the signal crayfish *Pacifastacus leniusculus*. This has escaped from fisheries and become established in the wild, but it carries a fungal disease to which the native crayfish has no immunity. The signal crayfish has been linked to the spread of the disease in many British rivers, but isolated water bodies like lakes and flooded quarries act as refuges for the native species. This makes the large population in Ensor's Pool particularly important in both regional and national contexts. Very much smaller populations occur elsewhere in Warwickshire such as the River Blythe, Newbold Quarry in Rugby and in several locations in the Coventry Canal, but the breeding colony in Ensor's Pool is the largest and most important.

The pool has some marginal vegetation of hard rush *Juncus inflexus*, common spike-rush *Eleocharis palustris*, water horsetail *Equisetum fluviatile* and lesser bulrush *Typha angustifolia*, which is rare in Warwickshire. Water plants include spiked water-milfoil *Myriophyllum spicatum* and broad-leaved pondweed *Potamogeton natans*. Ensor's Pool also supports a number of dragonflies and damselflies including the emperor dragonfly *Anax imperator*, the azure damselfly *Coenagrion puella* and the large red damselfly *Pyrrhosoma nymphula*. The pool is surrounded by areas of scrub and grassland.

**COUNTY:** BEDFORDSHIRE

**SITE NAME:** KINGS AND BAKERS WOODS AND HEATHS

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

**Local Planning Authorities:** South Bedfordshire District Council  
Bedfordshire County Council

**National Grid Reference:** [REDACTED]

Grid references for continued monitoring locations redacted

**Ordnance Survey Sheet 1:50,000:** 166      **1:10,000:** SP 92 NW, SP 92 SW

**Date Notified (Under 1949 Act):** 1953      **Date of Last Revision:** 1970

**Date Notified (Under 1981 Act):** 1984      **Date of Last Revision:**

**Area:** 212.8 ha 525 ac

**Other information:** Part of Kings Wood is a National Nature Reserve and includes areas owned by the WildlifeTrust. The site is listed in 'A Nature Conservation Review' (Cambridge University Press, 1977).

### **Description and Reasons for Notification**

The site represents the largest area of woodland in Bedfordshire as well as remnants of lowland heath and acidic grassland. It lies on the Boulder Clay passing to Lower Greensand, producing an outstanding series of soil types ranging from slightly calcareous to acid and from wet to well drained. This exceptional range is reflected in the rich variety of species and habitats.

Most of the wood is ancient and the diverse tree and shrub layer shows wide structural variety derived from centuries of coppice and high forest management.

The ground flora includes a large number of species which are uncommon or rare in the county, and the wide system of rides supports rich grassland that is an important element of the woodland. The lowland heath and acidic grassland represents a habitat that now has a very limited distribution, both in Bedfordshire and over its natural range in southern Britain.

The woodland types represented are as follows:

- Birch-sessile oak; occurring mainly on the sandy acidic soils and including areas of sessile oak *Quercus petraea* coppice, a type rare in eastern England.
- Small-leaved lime *Tilia cordata* coppice found on the boundary of the clay areas and forming a mosaic with the first type-a species rare in the county and associated with ancient woodland sites.
- Mixed woodland with pedunculate oak *Quercus robur*, hazel *Corylus avellana*, birch *Betula* spp., aspen *Populus tremula*, sallow *Salix caprea*, ash *Fraxinus excelsior* and hornbeam *Carpinus betulus* both as high forest and coppice. This type shows much variation associated with differing drainage characteristics.
- Mixed woodland mostly as high forest with pedunculate oak dominating the canopy and small amounts of ash, field maple *Acer campestre* and hazel coppice.

The ground flora in the dry sandy areas and on the remnants of open heath is largely dominated by bracken *Pteridium aquilinum* which has invaded the site together with birch scrub, but species characteristic of the former heath vegetation have survived, including heather *Calluna vulgaris* and bilberry *Vaccinium myrtillus*, a county rarity.

On the wetter clay the ground flora is predominantly primrose *Primula vulgaris*, dog's mercury *Mercurialis perennis*, yellow archangel *Lamium galeobdolon*, wood spurge *Euphorbia amygdaloides* (species associated with ancient woodland sites), honeysuckle *Lonicera periclymenum* and tufted hair-grass *Deschampsia cespitosa*.

Species present that are rare in the county include great woodrush *Luzula sylvatica*, wood vetch *Vicia sylvatica*, climbing corydalis *Corydalis claviculata*, saw-wort *Serratula tinctoria* and lily-of-the-valley *Convallaria majalis*. The acidic grassland has a characteristic flora including wavy hair-grass *Deschampsia flexuosa*, tormentil *Potentilla erecta*, heath speedwell *Veronica officinalis* and heath bedstraw *Galium saxatile*.

Many other groups of plants and animals are well represented and include national and regional rarities among the fungi and insects. Additional habitats are provided by several small ponds.

Re-presentation of details approved by Council. Re-typed September 1998.

Site Area calculated by GIS 19 April 1998.

File Ref: W/S/22

COUNTY: WARWICKSHIRE

SITE NAME: KINGSBURY WOOD

DISTRICT: North Warwickshire

SITE REF: 15WFC

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981 as amended

Local Planning Authority: WARWICKSHIRE COUNTY COUNCIL  
North Warwickshire Borough Council

National Grid Reference: [REDACTED] Area: 62.4 (ha.) 154.2 (ac.)

Ordnance Survey Sheet: 1:50,000: 139 1:10,000 SP 29 NW

Date Notified (Under 1949 Act): 1973 Date of Last Revision: 1973

Date Notified (Under 1981 Act): 1986 Date of Last Revision: 29 OCTOBER 1986

Other Information:

Site boundary alteration (reduction).

#### Description and Reasons for Notification

Kingsbury Wood lies to the south of Tamworth on clay soils over glacial drift with small areas of calcareous clays that have developed over 'Spirorbis' limestone. The limestone was once worked for marling the nearby fields and the wood contains old workings on its western side. Kingsbury Wood is an ancient woodland, which is recorded in the Domesday Book and this together with its diverse bird breeding community accounts for its interest.

Two types of woodland are represented at Kingsbury. The majority of the wood is oak (Quercus robur) with silver birch (Betula pendula) over a hazel (Corylus avellana) understorey, with hawthorn (Crataegus monogyna), dogwood (Cornus sanguinea) birch and the occasional crab apple (Malus sylvestris). There is a smaller area dominated by ash (Fraxinus excelsior) with oak over hazel understorey with hawthorn, dogwood, elder (Sambucus nigra), and maple (Acer campstre). The areas of ash woodland are associated with limestone working's, and the ground flora is distinctive, dominated by dog's mercury (Mercurialis perennis) with hedge woundwort (Stachys sylvatica) which is locally abundant. Under the oak-birch woodland, bracken (Pteridium aquilinum) and bramble (Rubus fruticosus) are locally dominant and creeping soft-grass (Holcus mollis) is abundant. The limestone workings have allowed a few calcicoles otherwise restricted to the south of the county to take hold. These include fairy flax (Linum catharticum), common twayblade (Listera ovata) and spindle, (Euonymus europaeus).

Forty-nine species of bird breed in Kingsbury Wood including kestrel (Falco tinnunculus), all three species of woodpecker (Picus viridis, Dendrocopos major and D. minor), treecreeper (Certhia familiaris), tawny owl (Strix aluco) and woodcock (Scolopax rusticola). Tits are well represented with six species breeding, including willow tit (Parus montanus). Six, species of warblers also breed regularly, including lesser



whitethroat (Sylvia curruca). In winter Kingsbury Wood is used as a roost for finches, thrushes and starlings (Sturnus vulgaris).

**COUNTY:** NORTHAMPTONSHIRE

**SITE NAME:** MILL CROOK

**District:** South Northamptonshire

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

**Local Planning Authority:** South Northamptonshire District Council

**National Grid Reference:** [REDACTED]

**Ordnance Survey Sheet 1:50,000:** 152

**1:10,000:** SP 74 NE

**Date Notified (Under 1949 Act):**

**Date of Last Revision:**

**Date Notified (Under 1981 Act):** 1989

**Date of Last Revision:**

**Area:** 5.7 ha 14.1 ac

**Other Information:** This is a new site.

### **Description and Reasons for Notification**

Mill Crook is a traditionally managed hay meadow situated on alluvial soils in the valley of the River Tove. The grassland is floristically diverse and an outstanding example of the meadow foxtail *Alopecurus pratensis*-great burnet *Sanguisorba officinalis* flood-meadow community type. Such neutral grassland is declining rapidly as a result of both agricultural changes and the extraction of river gravels present beneath alluvium, and is now very rare at both a national and county level. This site is the best of the few remaining species-rich hay meadows recorded from the Tove Valley.

The sward comprises a good range of grasses and forbs, the central 'core' of the meadow being particularly rich in this respect. Grasses such as meadow foxtail, sweet vernal-grass *Anthoxanthum odoratum*, false oat-grass *Arrhenatherum elatius* and Yorkshire fog *Holcus lanatus* occur in abundance, accompanied by a number of less abundant species including quaking-grass *Briza media*. The herb flora is dominated by great burnet, meadow buttercup *Ranunculus acris* and ribwort plantain *Plantago lanceolata* with associated species such as yellow rattle *Rhinanthus minor*, meadowsweet *Filipendula ulmaria*, pepper saxifrage *Silaum silaus*, common knapweed *Centaurea nigra* and cowslip *Primula veris*.

Damper parts of the meadow support sedges, such as spiked sedge *Carex spicata* and provide conditions for the growth of mosses, typically including *Calliargon cuspidatum*.

A well developed boundary hedgerow containing buckthorn *Rhamnus catharticus* and a mature pedunculate oak *Quercus robur* tree situated within the meadow add additional interest to the site.

**COUNTY:** BEDFORDSHIRE **SITE NAME:** NARES GLADLEY MARSH

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

**Local Planning Authorities:** South Bedfordshire District Council  
Bedfordshire County Council

**National Grid Reference:** [REDACTED]

**Ordnance Survey Sheet 1:50,000:** 165 **1:10,000:** SP 92 NW

**Date Notified (Under 1949 Act):** **Date of Last Revision:**

**Date Notified (Under 1981 Act):** **Date of Last Revision:**

**Area:** 5.12 ha 12.65 ac

### **Description and Reasons for Notification**

Nares Gladley Marsh is situated on the alluvial deposits which overlie the Lower Greensand in the valley of the River Ouzel in Bedfordshire, about 3 km north west of Leighton Buzzard. A series of springs emerging from the Greensand form a complex of wet flushes surrounded by marshy grassland which have developed rich plant communities. These grade into unimproved acidic grassland on the drier slopes. The site represents one of the best remaining river valley and hillside marsh systems in the county and is typical of wetland habitat now seriously reduced in extent nationally.

Several distinct plant communities occur on the site. *Juncus subnodulosus-Cirsium palustre* fen-meadow, *Juncus effusus/acutiflorus-Galium palustre* rush-pasture and *Glyceria maxima* swamp are associated with the wettest areas of the site. These grade into *Holcus lanatus-Juncus effusus* rush-pasture as conditions become less wet. The driest areas support acidic and mesotrophic grasslands.

The waterlogged spring flushes support a range of plants typical of such features but now uncommon in the county. These include marsh ragwort *Senecio aquaticus*, ivy-leaved crowfoot *Ranunculus hederaceus*, blinks *Montia fontana*, marsh valerian *Valeriana dioica*, marsh willowherb *Epilobium palustre* and whorl-grass *Catabrosa aquatica*. The surrounding marshes vary in character but constant species which are often dominant include soft rush *Juncus effusus*, hard rush *J. inflexus*, sharp-flowered rush *J. acutiflorus*, reed sweet-grass *Glyceria maxima* and floating sweet-grass *G. fluitans*. Water pepper *Polygonum hydropiper*, lesser spearwort *Ranunculus flammula*, water figwort *Scrophularia auriculata*, gypsywort *Lycopus europaeus*, brooklime *Veronica beccabunga*, fen bedstraw *Galium uliginosum* and ragged robin *Lychnis flos-cuculi* are characteristic herbs found throughout, while less frequent are fool's water-cress *Apium nodiflorum*, lesser water-parsnip *Berula erecta*, meadowsweet *Filipendula ulmaria* and marsh marigold *Caltha palustris*. Particularly notable species are greater tussock sedge *Carex paniculata*, common sedge *C. nigra* and bristle club-rush *Isolepis setacea*.

The adjacent River Ouzel supports in places a marginal and bankside vegetation of species such as branched bur-reed *Sparganium erectum*, common club-rush *Schoenoplectus lacustris*, bulrush *Typha latifolia*, great yellow-cress *Rorippa amphibia*, skullcap *Scutellaria galericulata* and trifid bur-marigold *Bidens tripartita*.

On the higher slopes and on drier patches within the wetland are acidic grassland communities, supporting a characteristic flora including common bent *Agrostis capillaris*, sweet vernal-grass *Anthoxanthum odoratum*, tormentil *Potentilla erecta*, sheep's sorrel *Rumex acetosella*, sneeze-wort *Achillea ptarmica* and hare-bell *Campanula rotundifolia*.



Scattered trees and scrub, including gorse *Ulex europaeus*, are found around the edges of the site and provide further habitat features.

COUNTY: HERTFORDSHIRE      SITE NAME: ODDY HILL AND TRING PARK

DISTRICT: DACORUM

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981.

Local Planning Authority: DACORUM BOROUGH COUNCIL

National Grid Reference  Area: 35.6 (ha.) 87.8 (ac.)

Ordnance Survey Sheet: 1:50,000: 165      1:10,000: SP 90 NW, SP 91 SW

Date Notified (Under 1949 Act): 1968      Date of Last Revision: –

Date Notified (Under 1981 Act): 1986      Date of Last Revision: 1991

Other Information:

The boundary has been extended.

Description and Reasons for Notification:

This site consists of two areas of calcareous grassland situated on a chalk scarp to the south of Tring and further areas of calcareous grassland on undulating parkland at the foot of the scarp. These grasslands support a diverse range of grasses and flowering plants including locally uncommon and rare species. The combined area of calcareous grassland comprises one of the most extensive areas of unimproved chalk downland in Hertfordshire. Such downland habitat is now scarce having been reduced in extent nationally due to agricultural improvement or cessation of management.

A range of calcareous grassland types and habitats are to be found over the site, these have been influenced by both topography and management. Below the scarp the parkland has been managed by grazing resulting in a close cropped sward. Here the banks and slopes support unimproved species rich grassland, although there has been some agricultural improvement restricted to the flatter valley bottoms.

On the steeper scarp slopes where there has been a lack of recent management the sward is taller and ant-hills are present throughout. Cessation of grazing has permitted scattered scrub to develop over parts of these slopes providing additional habitats for invertebrates and breeding birds.

Within the grassland the dominant grass species are upright brome *Bromus erectus*, false brome *Brachypodium sylvaticum* and quaking grass *Briza media* with abundant fescues *Festuca* sp. Frequent herbs include salad burnet *Sanguisorba minor*, small scabious *Scabiosa columbaria*, rough hawkbit *Leontodon hispidus*, burnet-saxifrage *Pimpinella saxifrage*, dwarf thistle *Cirsium acaule*, cowslip *Primula veris*, glaucous sedge *Carex flacca* and common rock-rose *Helianthemum nummularium*. In places the sward is particularly species-rich with carline thistle *Carlina vulgaris*, squinancy-wort *Asperula cynanchica*, spring-sedge *Carex caryophylla*, large thyme *Thymus pulegioides* and autumn gentian *Gentianella amarella* adding to the diversity. Notable is the abundance of chiltern gentian *G. germanica* otherwise known from very few sites in the county. Where the sward is taller additional species such as common valerian *Valeriana officinalis* and yellow rattle *Rhinanthus minor* are present.

Orchids (Orchidaceae) are well represented with common spotted-orchid *Dactylorhiza fuchsii* and twayblade *Listera ovata* frequent, and greater butterfly-orchid *Plantanthera chlorantha* and southern marsh-orchid *Dactylorhiza praetermissa* occasional. The rare hybrid *D. fuchsii* x *praetermissa* is known to this site.

SITE NOTIFIED TO THE SECRETARY OF STATE ON THE 1ST FEBRUARY  
1991



COUNTY: BUCKINGHAMSHIRE

SITE NAME: POKERS POND MEADOW

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

Local Planning Authorities: Aylesbury Vale District Council, Buckinghamshire County Council

National Grid Reference:



Grid references for continued monitoring locations redacted

Ordnance Survey Sheet 1:50,000:

165

1:10,000: SP82 NE

Date Notified (Under 1981 Act):

6 Feb 1992

Date of Last Revision:

Area: 1.89 ha 4.67 ac

### **Description and Reasons for Notification:**

Pokers Pond Meadow is one of the last remaining fragments of ancient hay meadow to be found in the Vale of Aylesbury. The herb-rich dry grassland community which covers the majority of the field is of a type that is now rare in lowland Britain. It has only been maintained by continuous traditional management usually involving a late annual hay cut, followed by stock grazing, with no fertiliser or herbicide applications. Along the north-western edge of the meadow beside the stream there is a small area of marshy grassland that has evolved from the original site of the pond, in combination with impeded drainage.

The soils are derived from the glacial drift that covers a major part of the Ouse basin. These slowly permeable, calcareous clayey soils were once extensively cultivated during medieval times. This is demonstrated by the widespread occurrence of ridge and furrow upon these soils; the western-most corner of Pokers Pond Meadow displays this distinctive pattern, further confirming its long history as meadowland, free from the disturbance of ploughing or other cultivation in recent decades.

The dry grassland community is unusual for the large number of common species which occur, several of which are closely associated with unimproved meadows. Over 100 species of grasses, sedges, rushes and herbs have been recorded from this field. The dominant grass species include sweet vernal grass *Anthoxanthum odoratum* and Yorkshire-fog *Holcus lanatus*. Frequent throughout the meadow are crested dog's-tail *Cynosurus cristatus* and red fescue *Festuca rubra* with quaking grass *Briza media* on the drier areas. Meadow brome *Bromus commutatus* is found throughout this sward, a species uncommon elsewhere in Buckinghamshire. The herb species constitute a major part of this type of community and include several that are associated with ancient grasslands. These include locally uncommon species such as dropwort *Filipendula vulgaris*, green winged orchid *Orchis morio*, carnation sedge *Carex panicea* and adder's tongue fern *Ophioglossum vulgatum*. Devil's-bit scabious *Succisa pratensis*, cowslip *Primula veris* and hoary ragwort *Senecio erucifolius* are ancient indicators that occur here but are also more widespread in the rest of the County. Other meadow species that are found throughout the sward include bird's-foot trefoil *Lotus corniculatus*, rough and autumn hawkbits *Leontodon hispidus* and *L. autumnalis*, common knapweed *Centaurea nigra*, Oxeye daisy *Leucanthemum vulgare* and yellow rattle *Rhinanthus minor*.

Tufted hair-grass *Deschampsia cespitosa* dominates the marshy grassland in the wetter area along the stream edge where marsh thistle *Cirsium palustre*, plicate sweet-grass *Glyceria plicata*, great willow-herb *Epilobium hirsutum*, meadowsweet *Filipendula ulumaria*, soft and hard rushes *Juncus effusus* and *J. inflexus* and ragged-robin *Lychnis flos-cuculi* also occur.

Tall ancient boundary hedgerows contain a good mixture of species including field maple, hawthorn, pedunculate oak, ash, elder and blackthorn, together with field and dog roses.

**COUNTY:** HERTFORDSHIRE/BUCKINGHAMSHIRE

**SITE NAME:** TRING RESERVOIRS

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

**Local Planning Authorities:** Dacorum Borough Council, Aylesbury Vale District Council

**National Grid Reference:**



Grid references for continued monitoring locations redacted

**Ordnance Survey Sheet 1:50,000:** 165 **1:10,000:** SP91 SW

**Date Notified (Under 1949 Act):** 1953 **Date of Last Revision:** 1969

**Date Notified (Under 1981 Act):** 1987 **Date of Last Revision:**

**Area:** 106.5 ha 263.2 ac

### **Description and Reasons for Notification**

These four reservoirs are situated on the Lower Chalk at the foot of the Chilterns escarpment and, although artificial, are fed by natural springs. Water bodies on the chalk of south-east England are scarce, and these reservoirs shows typical characteristics of shallow marl lakes. The clear eutrophic waters support diverse communities of plants and animals and the reservoirs are located on sites of ancient marshes, still retaining elements of the original flora. The marginal vegetation is dominated by tall fen communities with some marshy grassland, both threatened and declining habitats in the county which support locally rare plant species. These habitats, together with the open water, represent an important area for breeding, passage and wintering birds, and for interesting invertebrate communities.

The tall fen associated with the shelving slopes of the reservoir edge is largely dominated by common reed *Phragmites australis* with some areas of reed sweet-grass *Glyceria maxima*. More species-rich areas contain frequent hard rush *Juncus inflexus*, celery-leaved buttercup *Ranunculus sceleratus*, bulrush *Typha latifolia* and the locally uncommon lesser bulrush *T. angustifolia*. An ancient meadow comprised of marshy grassland is particularly rich and represents an unusual community type in the county. It is dominated by blunt-flowered rush *Juncus subnodulosus* with frequent meadowsweet *Filipendula ulmaria* and common fleabane *Pulicaria dysenterica*. A variety of sedges *Carex* spp. is present including the locally rare long-stalked yellow-sedge *C. lepidocarpa*. Other plant species present here and rare elsewhere in the county include fen bedstraw *Galium uliginosum*, southern marsh-orchid *Dactylorhiza praetermissa*, early marsh-orchid *D. incarnata* and bog pimpernel *Anagallis tenella*.

The open water supports few plant species, although Canadian waterweed *Elodea canadensis*, rigid hornwort *Ceratophyllum demersum*, and spiked water-milfoil *Myriophyllum spicatum* are all abundant. The muddy margins of the reservoirs vary greatly in extent but do support orange foxtail *Alopecurus aequalis* and the nationally uncommon mudwort *Limosella aquatica*. A small area of marginal woodland dominated by osier *Salix viminalis* is one of the few county sites for green-flowered helleborine *Epipactis phyllanthes*.

Birds are well represented in all seasons. Nationally important numbers of shoveler are present during winter together with other wildfowl, and the site is of county importance for wintering gulls and passerines. A diverse breeding bird community includes locally important numbers of sedge and reed warblers and a heronry is known to use the reed beds in addition to the more usual tree nesting sites. Passage waders and hirundines are of additional interest.

The reservoirs are an important site for invertebrates, including locally uncommon species of water boatman *Corixidae*, and illustrated by the diverse assemblage of dragonfly species *Odonata* including the ruddy darter *Sympetrum sanguineum*.

COUNTY: WARWICKSHIRE

SITE NAME: WHITACRE HEATH

DISTRICT: NORTH WARWICKSHIRE

SITE REF: 15W9B

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981 as amended

Local Planning Authority: WARWICKSHIRE COUNTY COUNCIL, North Warwickshire Borough Council

National Grid Reference: [REDACTED]

Area: 44.1 (ha.) 109.0 (ac.)

Ordnance Survey Sheet 1:50,000: 139

1:10,000: SP 29 SW

Date Notified (Under 1949 Act): –

Date of Last Revision: –

Date Notified (Under 1981 Act): 1989

Date of Last Revision: –

Other Information:

New site. The site is owned and managed by the Warwickshire Nature Conservation Trust.

Description and Reasons for Notification:

Whitacre Heath is situated on the eastern fringe of Birmingham, 4 km to the north of Coleshill. It lies on alluvial soils and glacial gravels in the flood plain of the River Tame and is one of a chain of water bodies created by gravel extraction along the valley that are now important for their bird life. Whitacre Heath is notified for its wetland breeding birds.

The site includes disused gravel workings showing a succession of vegetation from open water, through sedges *Carex* spp., reedmace *Typha latifolia* and common reed *Phragmites communis* to willow carr *Salix* spp. and birch scrub *Betula* spp. Part of the site has been excavated as a wader scrape. Adjoining the old gravel workings are wet meadows which flood regularly and attract wintering and migrant birds.

The site is important for its community of breeding wetland birds among which the commoner species are all represented. The species which breed regularly include little grebe *Tachybaptus ruficollis*, mute swan *Cygnus olor* and tufted duck *Aythya fuligula*. Two species with more restricted national distributions, teal *Anas crecca* and ruddy duck *Oxyura jamaicensis*, have bred occasionally.

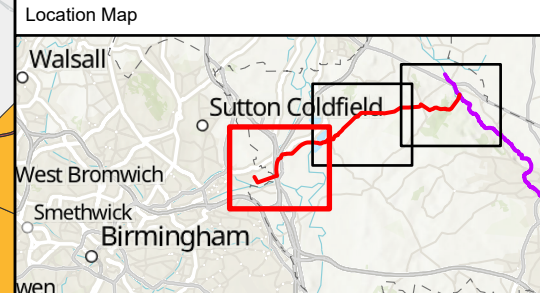
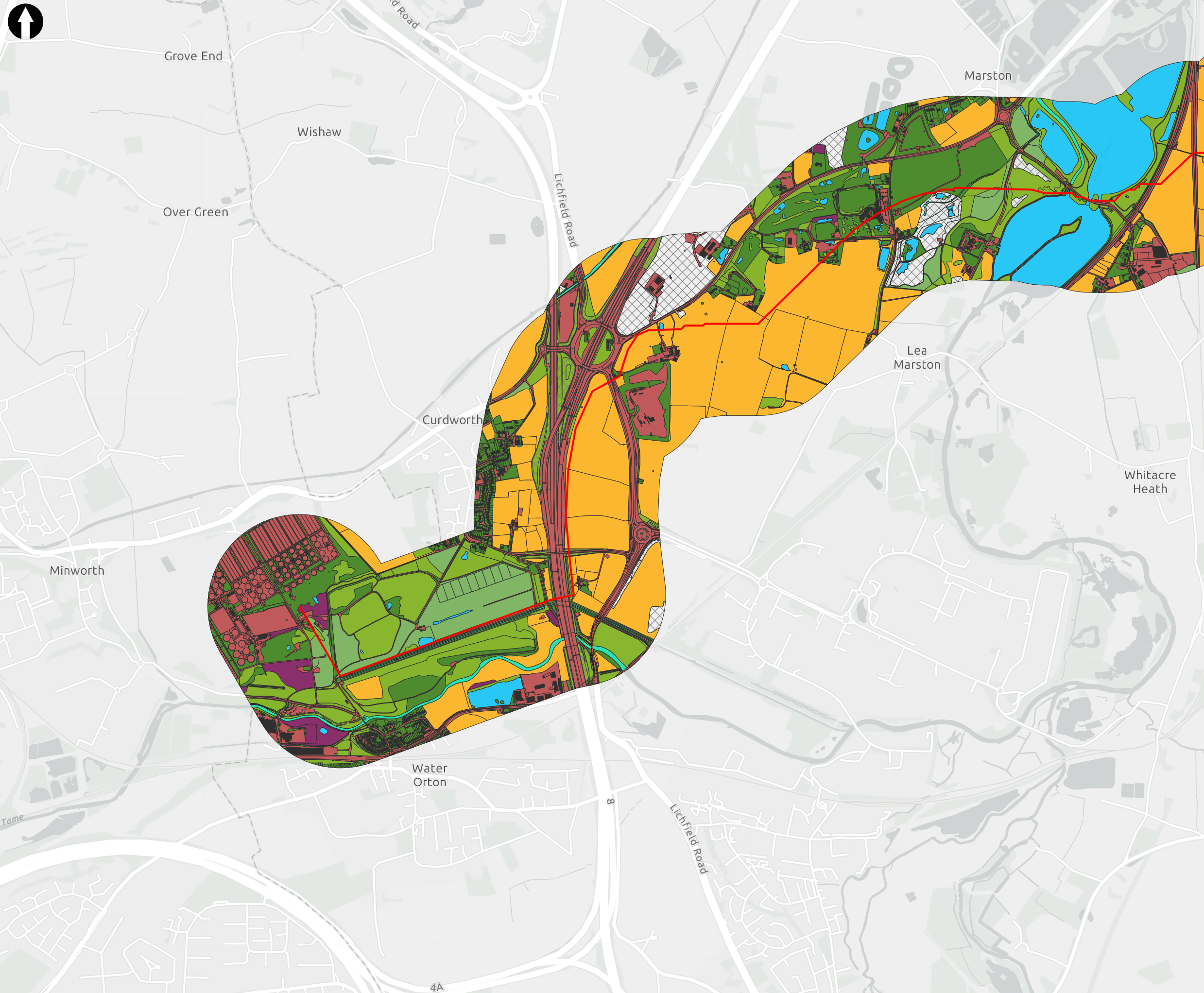
Two species of wader breed here regularly, snipe *Gallinago gallinago* and redshank *Tringa totanus*. Kingfisher *Alcedo atthis* nests in the river bank. Warblers are well represented by grasshopper warbler *Locustella naevia*, sedge warbler *Acrocephalus schoenobaenus*, reed warbler *A. scirpaceus* and whitethroat *Sylvia communis*. These all breed regularly with some acting as hosts to the cuckoo *Cuculus canorus*. In winter hen harrier *Circus cyaneus* and short-eared owl *Asio flammeus* hunt and roost at Whitacre Heath.

The grassland and scrub also hosts a mixed population of breeding crows, finches, tits, warblers and thrushes.



## B. Maps

### B.1 Pipeline Habitat Map



Key to Symbols

- Minworth WwTW to Atherstone via pipeline
- c1c - cereal crops
- g3c - other neutral grassland
- g4 - modified grassland
- h3 - dense scrub
- r1 - standing open water and canals
- r2 - rivers and lakes
- u1b5 - buildings
- u1b6 - other developed land
- w1 - broadleaved, mixed and yew woodland
- No JNCC Translation

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS  
 Data Sources: Mott MacDonald 2022  
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Author names redacted

Rev	Date	Drawn	Description	Ch'k'd	App'd
01	12/07/2022		For Information		

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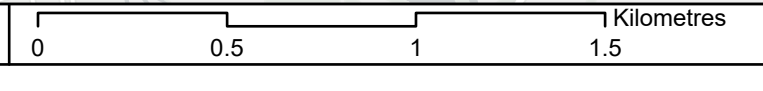
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 W mottmac.com

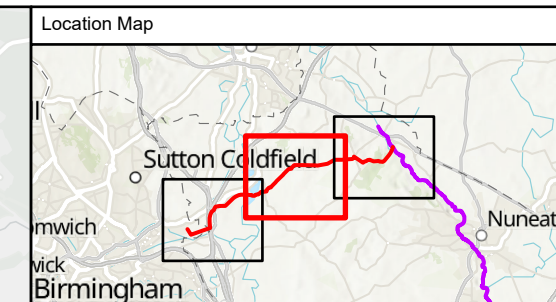
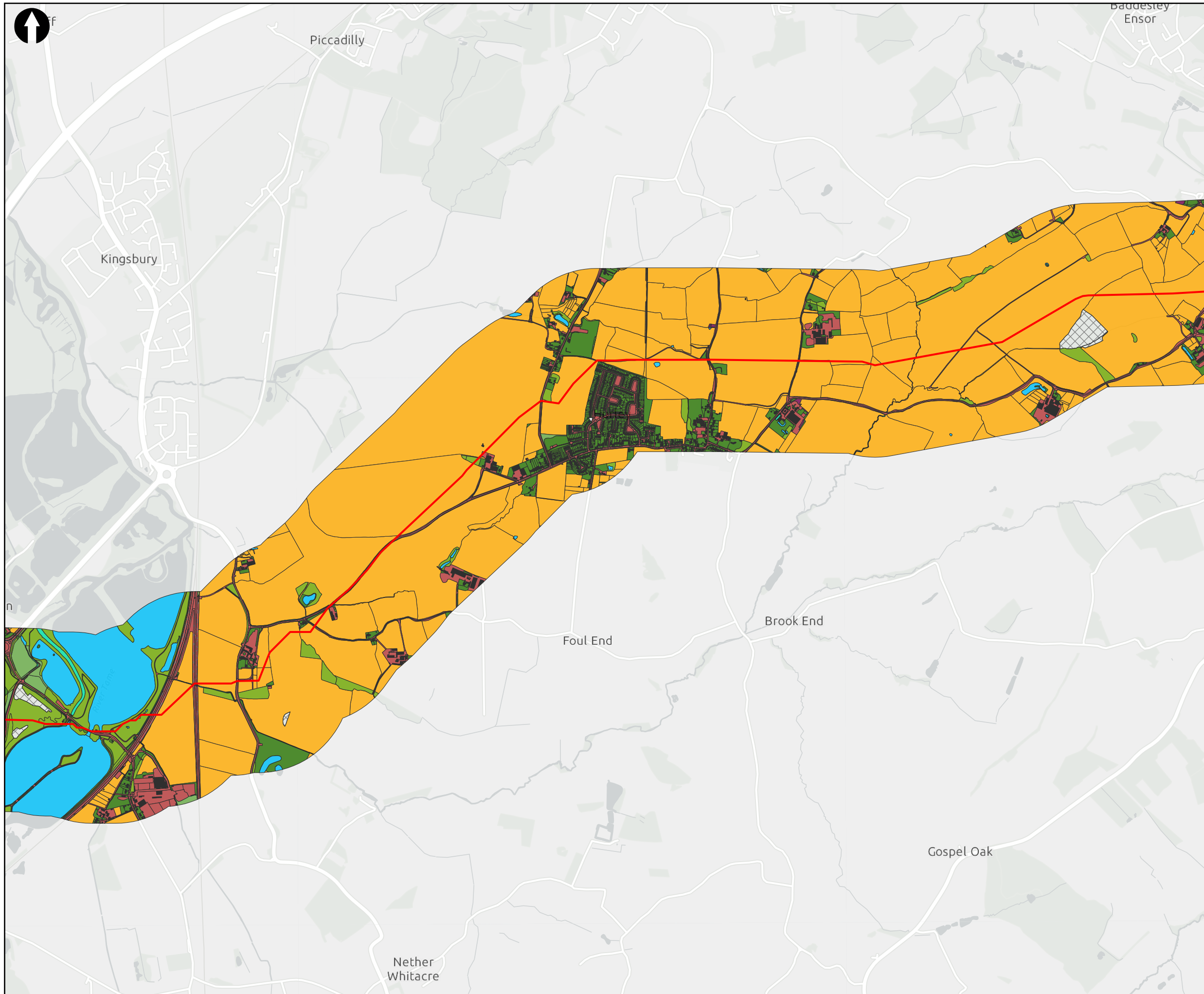
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Title  
 Grand Union Canal - Gate 2 Environmental Assessments  
 UKHabs Habitat mapping - Derived from OS Master Map Classifications  
 Pipeline Habitats - Map 1 of 3

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:20,000	INF	01	STD







Key to Symbols

- Minworth WwTW to Atherstone via pipeline
- c1c - cereal crops
- g3c - other neutral grassland
- g4 - modified grassland
- h3 - dense scrub
- r1 - standing open water and canals
- r2 - rivers and lakes
- u1b5 - buildings
- u1b6 - other developed land
- w1 - broadleaved, mixed and yew woodland
- No JNCC Translation

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS  
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Author names redacted

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**MOTT** **MACDONALD**

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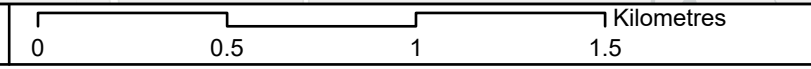
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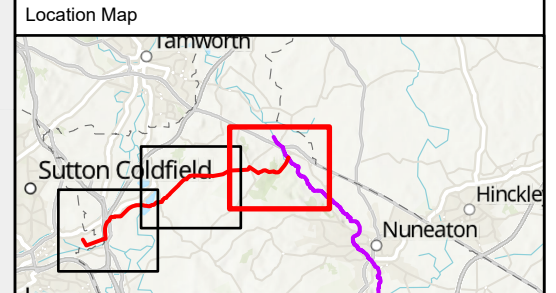
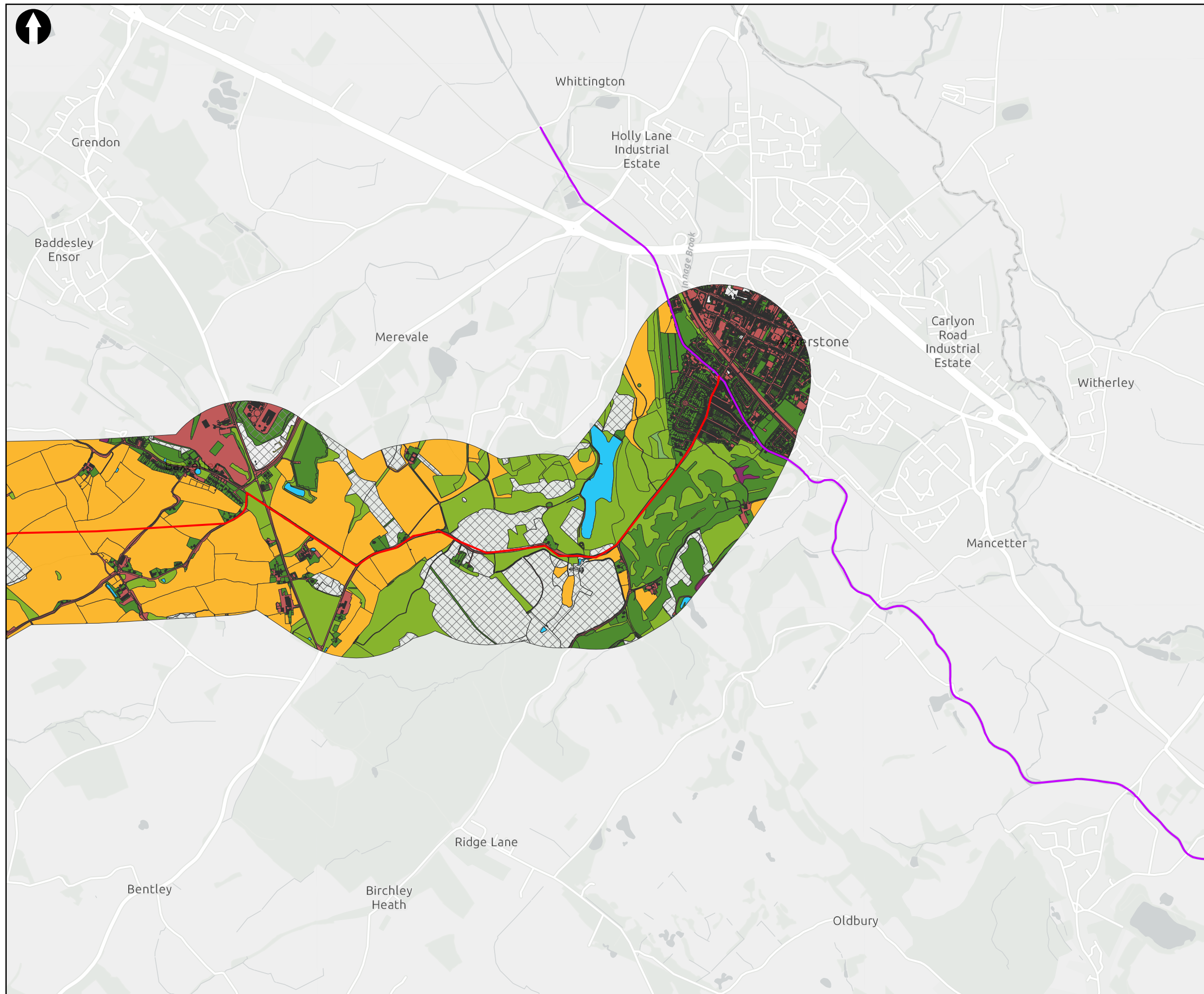
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 UKHabs Habitat mapping - Derived from OS Master Map Classifications  
 Pipeline Habitats - Map 2 of 3

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GIS Check		Approved	
Scale at A3 1:20,000	Status INF	Rev 01	Security STD

Drawing Number  
**GUC Pipeline Habitat**







Key to Symbols

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- c1c - cereal crops
- g3c - other neutral grassland
- g4 - modified grassland
- h3 - dense scrub
- r1 - standing open water and canals
- r2 - rivers and lakes
- s2 - supralittoral rock
- u1b5 - buildings
- u1b6 - other developed land
- w1 - broadleaved, mixed and yew woodland
- No JNCC Translation

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS  
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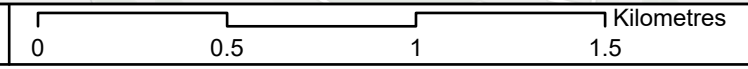
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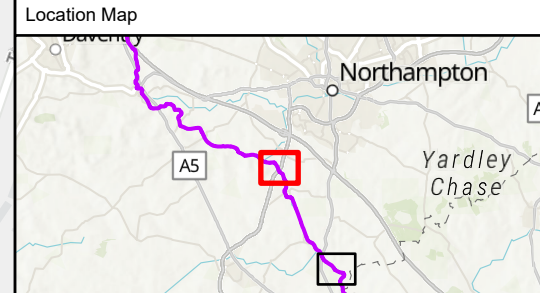
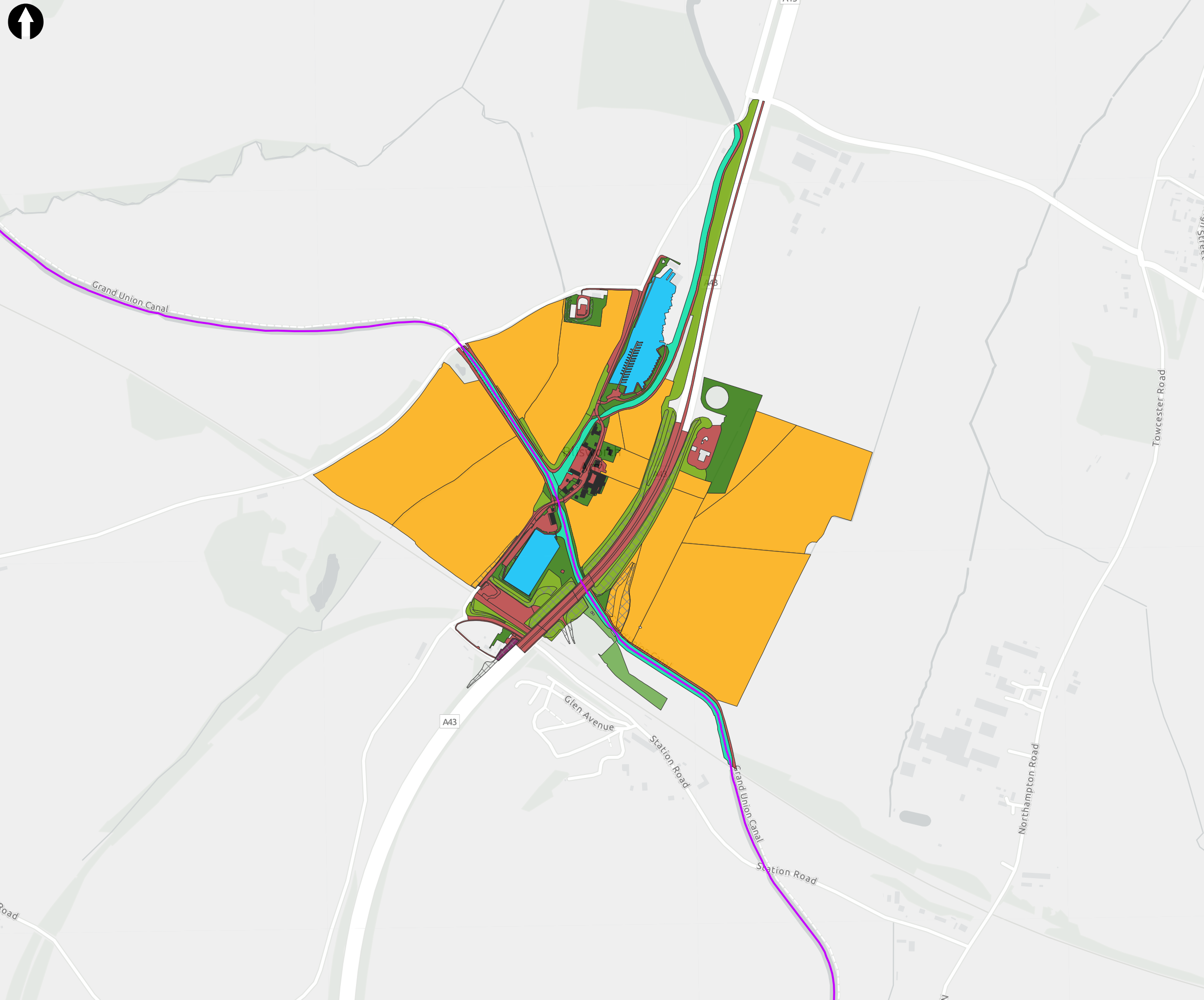
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 UKHabs Habitat mapping - Derived from OS Master Map Classifications  
 Pipeline Habitats - Map 3 of 3

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:20,000	INF	01	STD



## **B.2 Canal Network Habitat Maps**

### **B.2.1 GUC @ Northampton arm intersection (GUC only)**



**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

- c1c - cereal crops
- g3c - other neutral grassland
- g4 - modified grassland
- h3 - dense scrub
- r1 - standing open water and canals
- r2 - rivers and lakes
- u1b5 - buildings
- u1b6 - other developed land
- w1 - broadleaved, mixed and yew woodland
- No JNCC Translation

**Notes**

Service Layer Credits: Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS  
 Data Sources: Mott MacDonald 2022  
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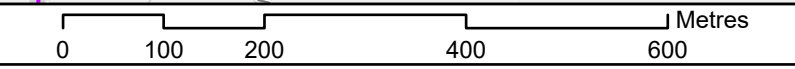
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 GUC @ Northampton arm intersection (GUC only)

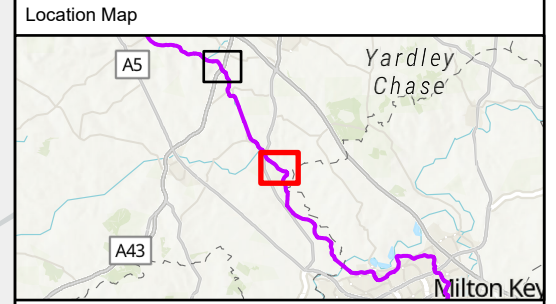
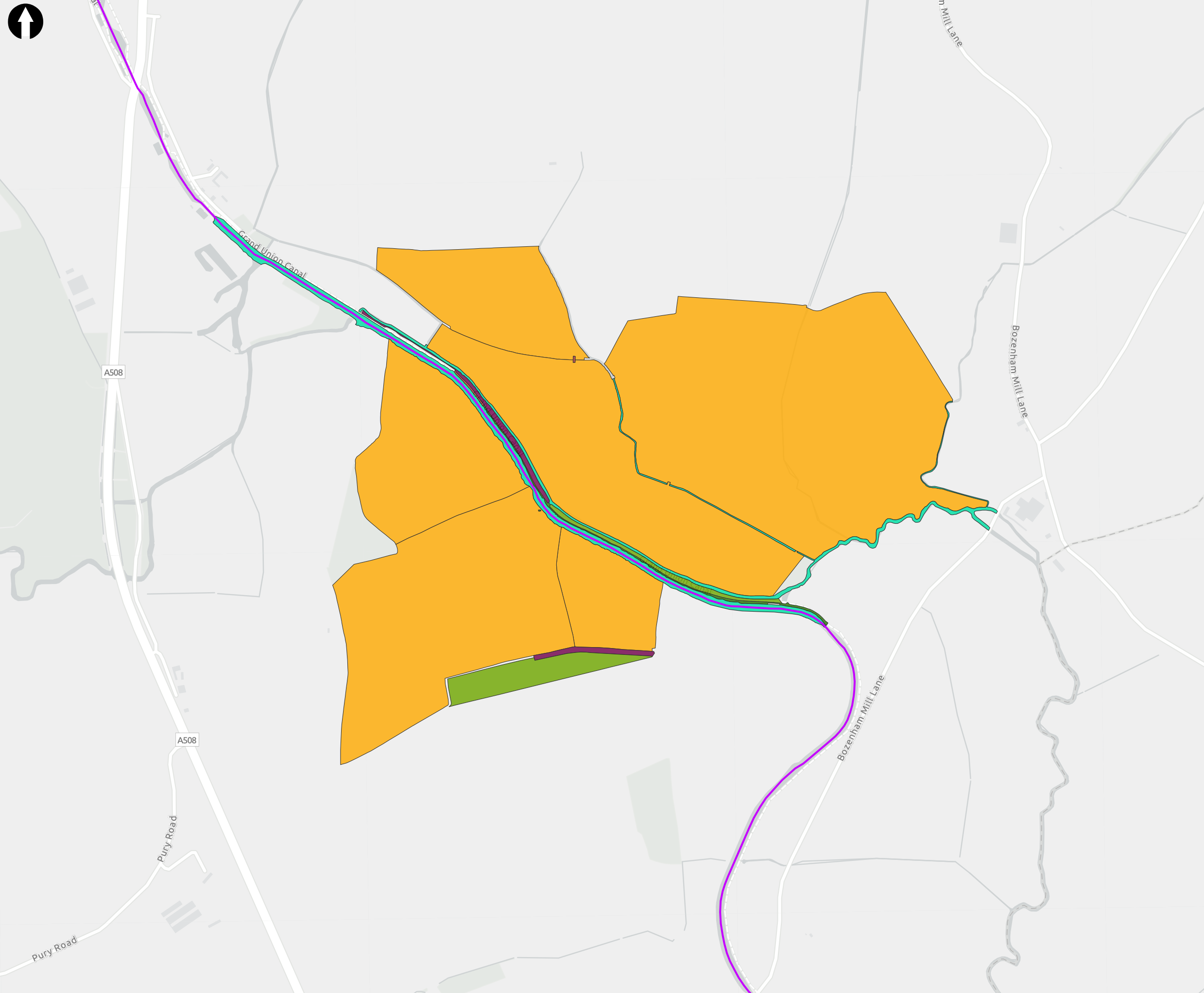
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Drawing Number **GUC Pipeline Habitat**





## **B.2.2 GUC and River Tove, Stoke Bruerne**



**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

- c1c - cereal crops
- g4 - modified grassland
- h3 - dense scrub
- r2 - rivers and lakes
- u1b6 - other developed land
- w1 - broadleaved, mixed and yew woodland

**Notes**

Service Layer Credits: Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS  
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Author names redacted

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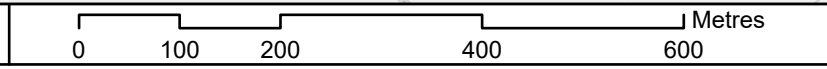
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 UKHabs Habitat mapping - Derived from OS Master Map Classifications  
 GUC and River Tove, Stoke Bruerne

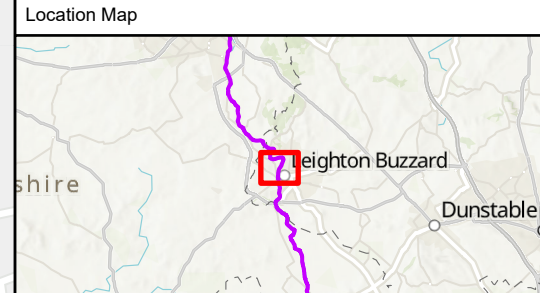
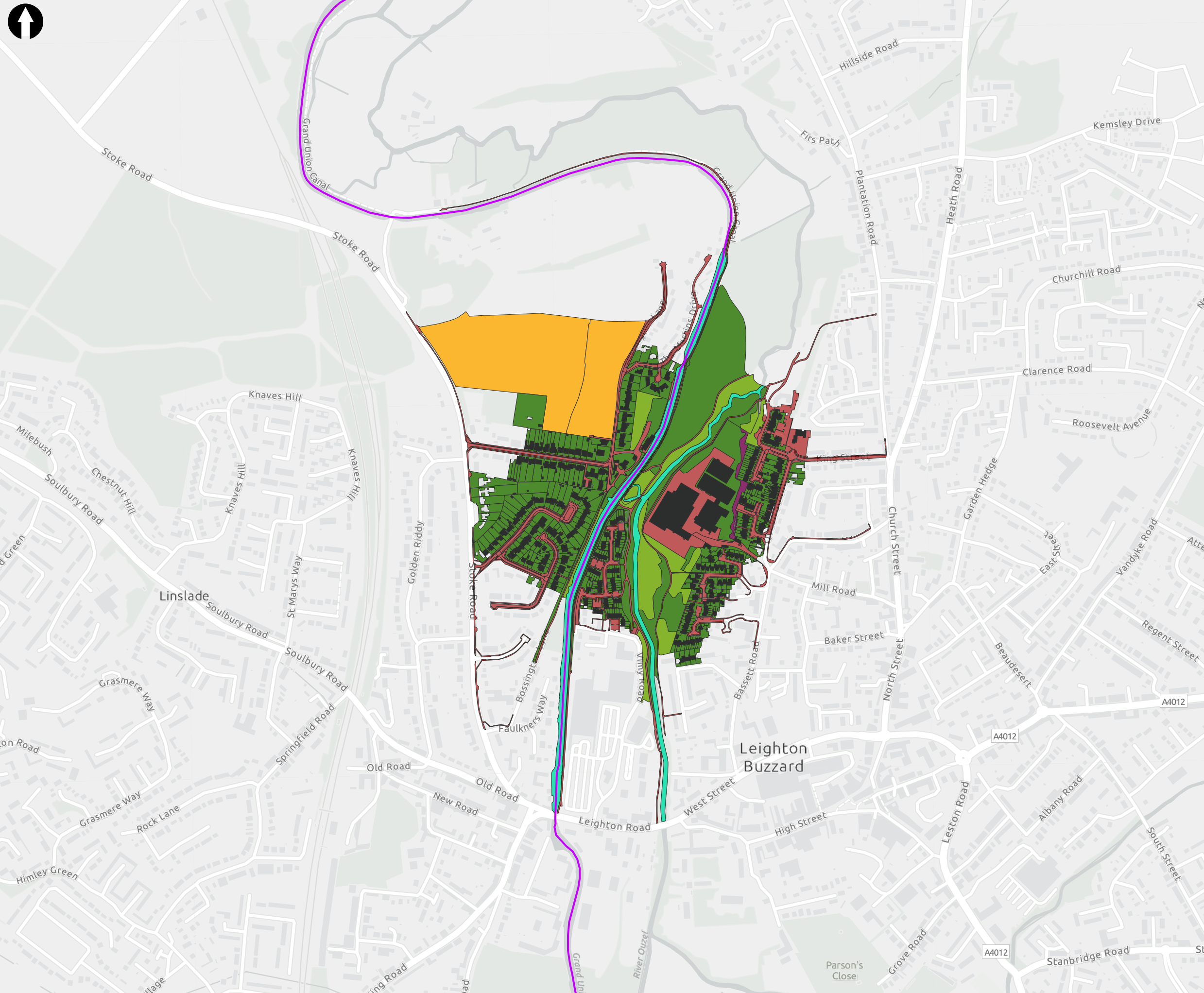
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Drawing Number **GUC Pipeline Habitat**



### **B.2.3 GUC and River Ouzel, Leighton Buzzard**





**Key to Symbols**

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- c1c - cereal crops
- g4 - modified grassland
- h3 - dense scrub
- r2 - rivers and lakes
- u1b5 - buildings
- u1b6 - other developed land
- w1 - broadleaved, mixed and yew woodland
- No JNCC Translation

**Notes**

Service Layer Credits: Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS  
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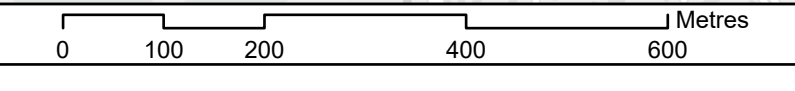
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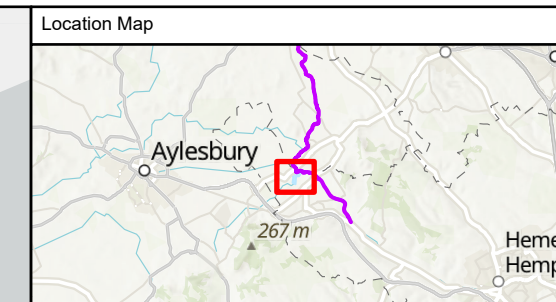
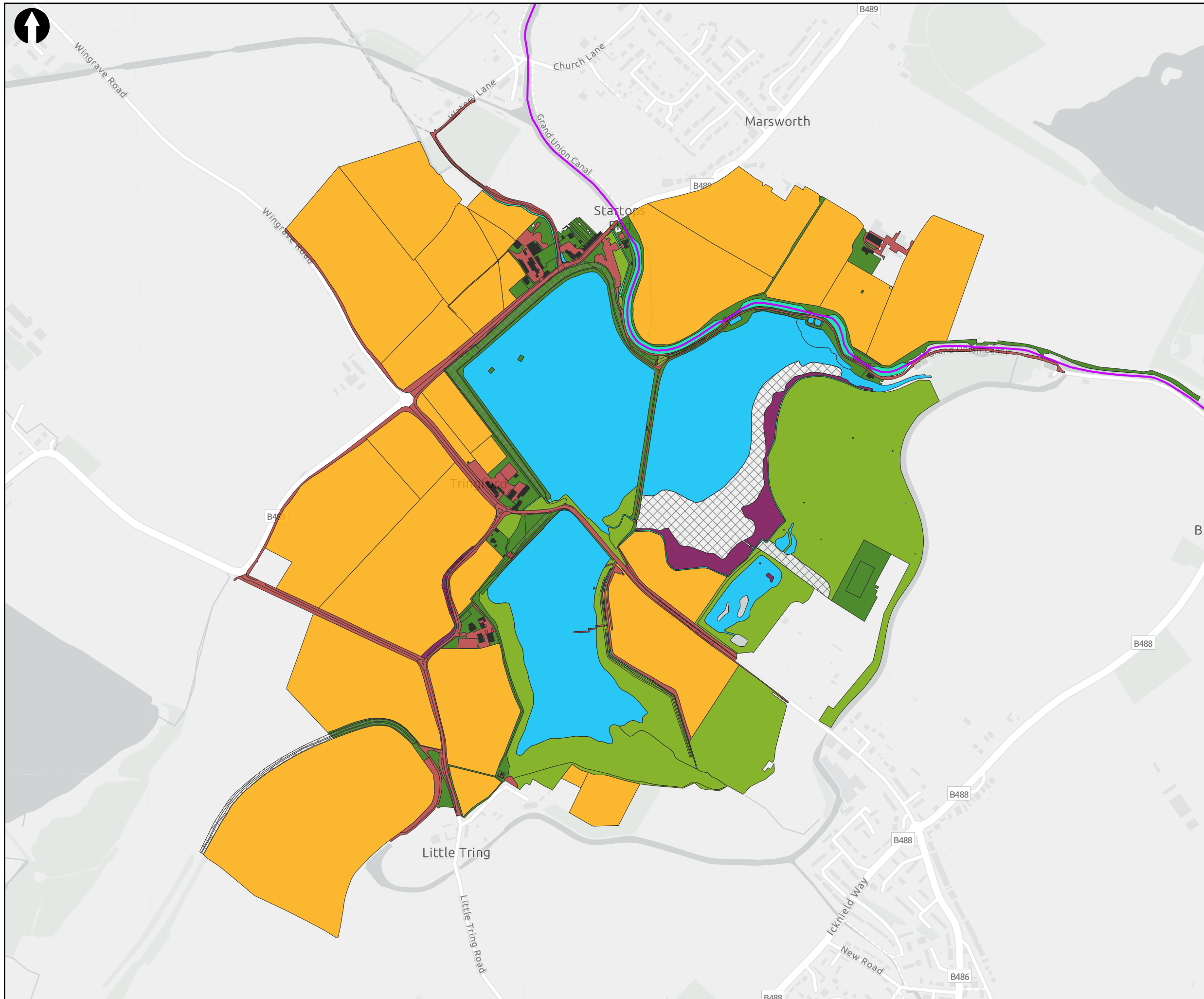
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 GUC and River Ouzel, Leighton Buzzard

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:7,500	INF	01	STD



## **B.2.4 GUC, Tringford, Startopend and Marsworth Reservoirs, Tring**





**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

- c1c - cereal crops
- g4 - modified grassland
- h3 - dense scrub
- r1 - standing open water and canals
- r2 - rivers and lakes
- u1b5 - buildings
- u1b6 - other developed land
- w1 - broadleaved, mixed and yew woodland
- No JNCC Translation

**Notes**

Service Layer Credits: Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS  
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Author names redacted

Rev	Date	Drawn	Description	Ch'k'd	App'd
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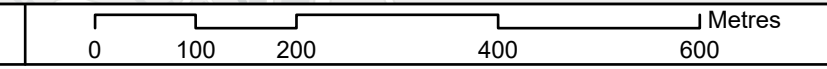
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**Client**

**Title**  
 Grand Union Canal - Gate 2 Environmental Assessments  
 UKHabs Habitat mapping - Derived from OS Master Map Classifications  
 GUC, Tringford, Startonsend and Marsworth Reservoirs, Tring

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Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
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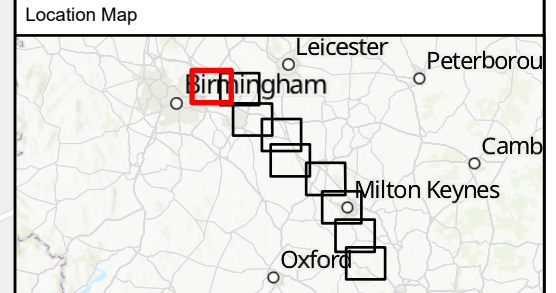
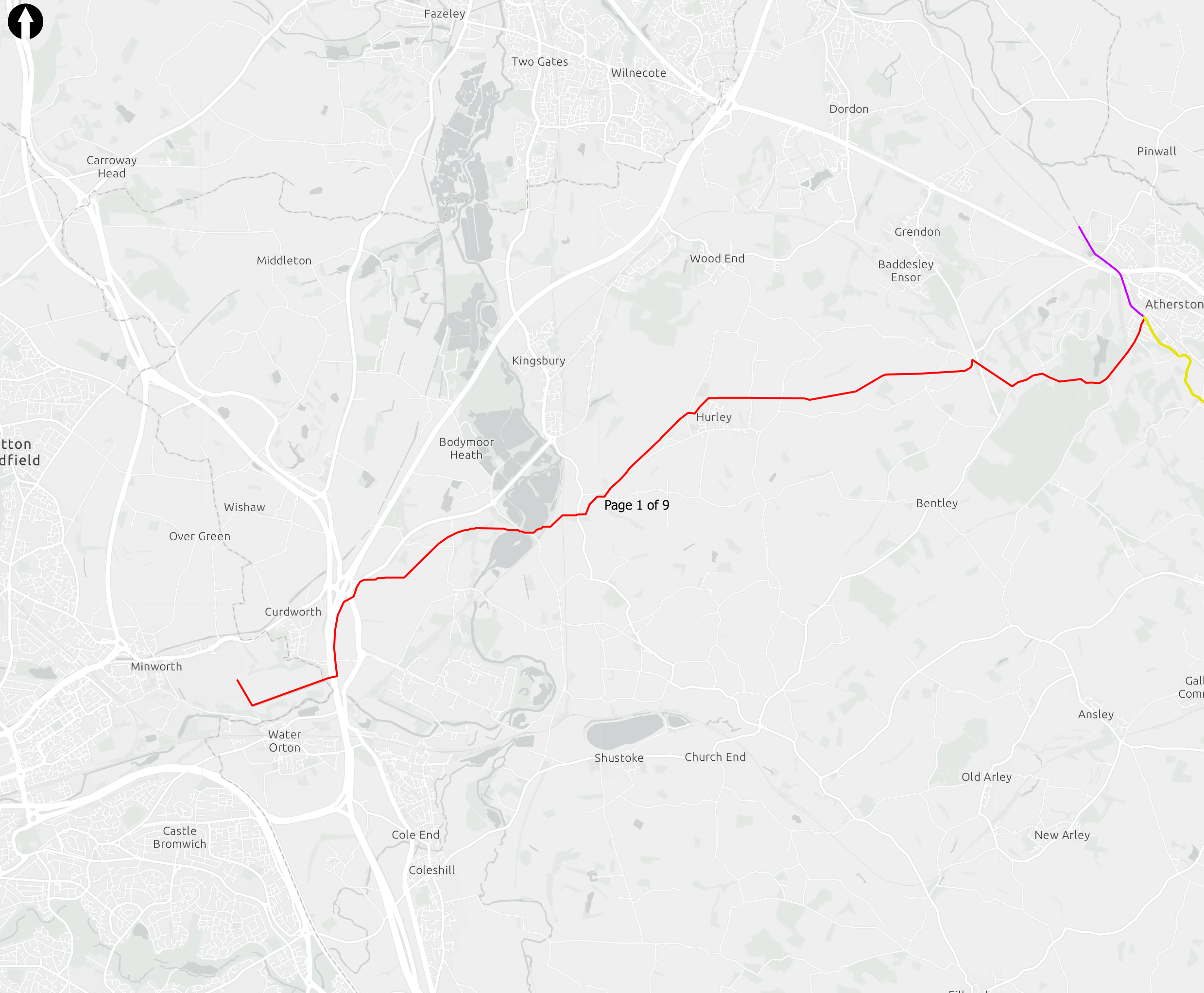
Drawing Number: **GUC Pipeline Habitat**





## C. Lengths of Canal to be Affected

### C.1 Map of predicted water levels increases



**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Bank Raise**

- Unknown
- >50mm
- >100mm
- >150mm
- >200mm
- <50mm

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Mott MacDonald 2022

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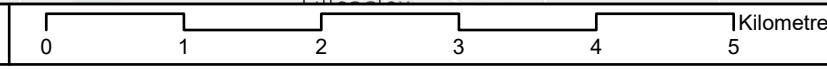
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**MOTT MACDONALD**

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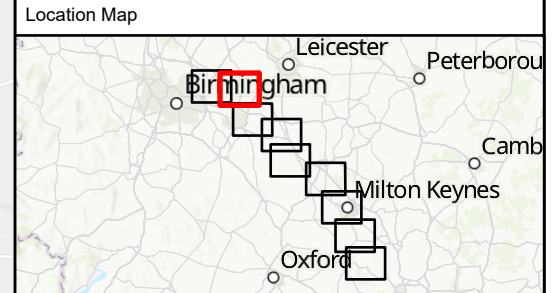
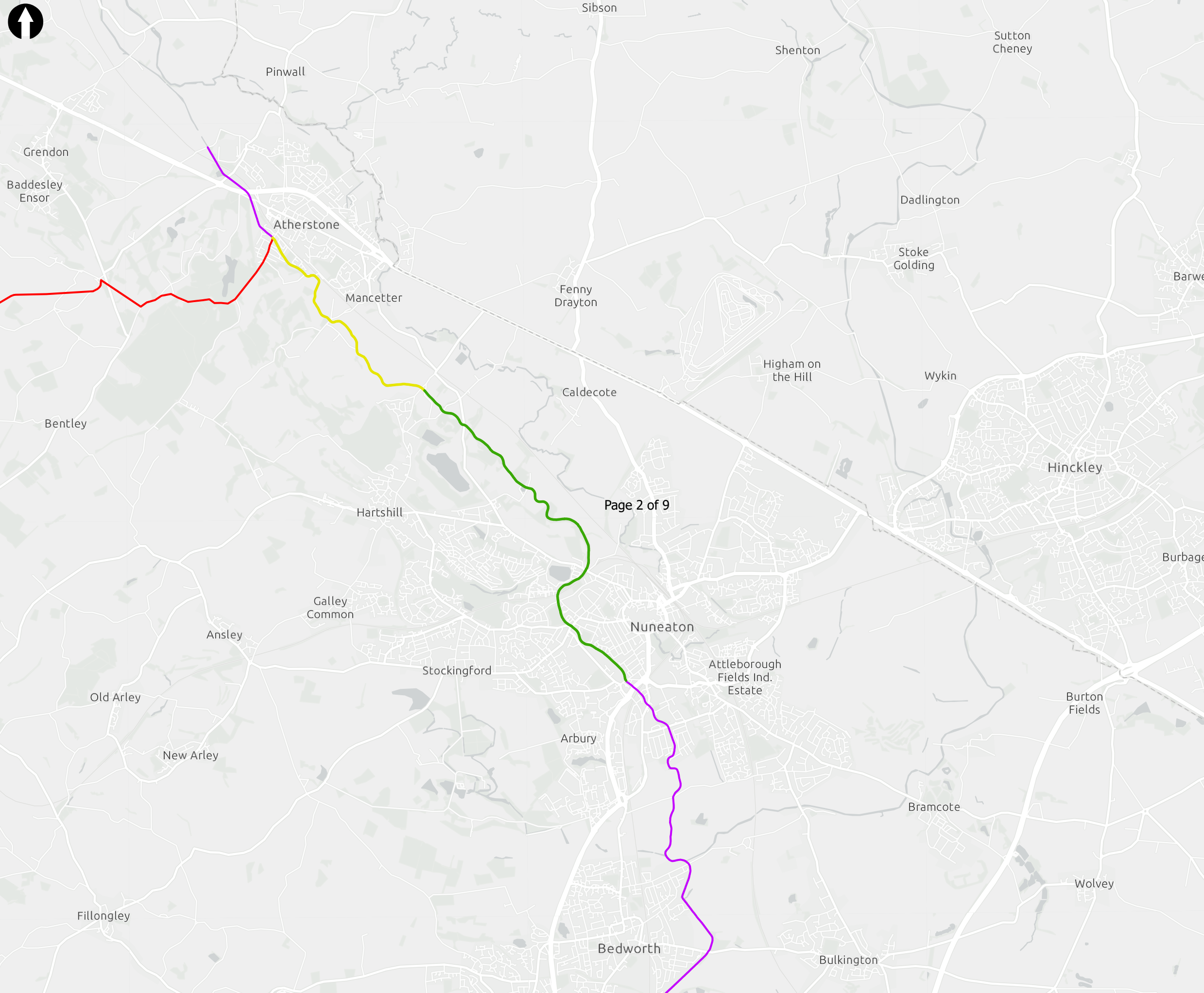
**Client**

**Title**  
 GUC  
 Map of the canal lengths  
 Sheet 1 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Bank Raise**

- Unknown
- >50mm
- >100mm
- >150mm
- >200mm
- <50mm

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Mott MacDonald 2022

Author names redacted

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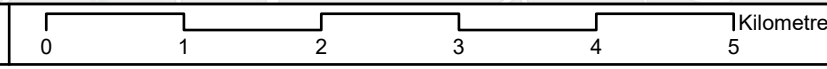
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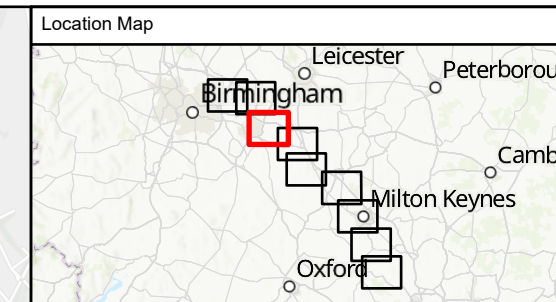
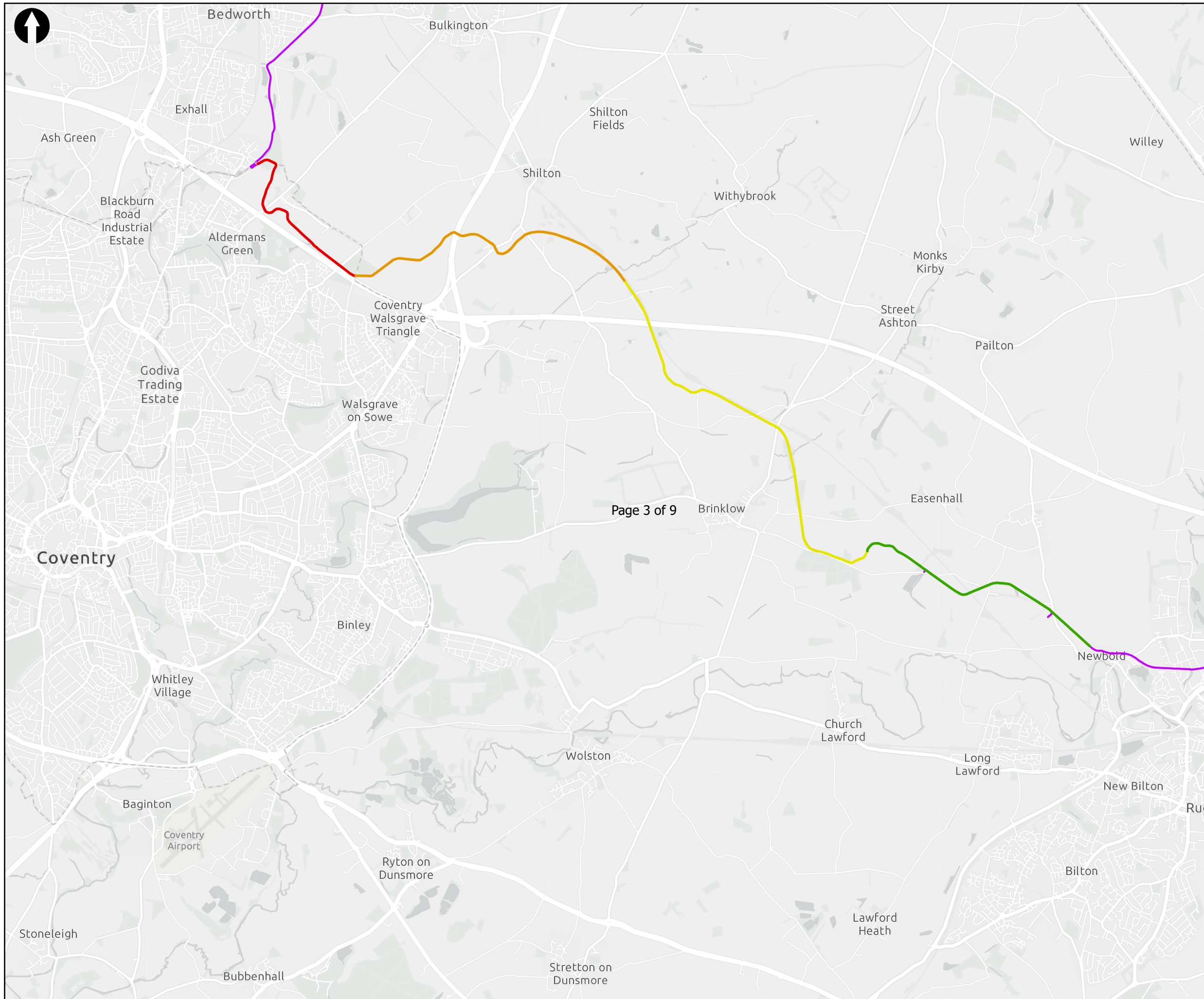
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**Title**  
 GUC  
 Map of the canal lengths  
 Sheet 2 of 9

Designed		Check	
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GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Bank Raise**

- Unknown
- >50mm
- >100mm
- >150mm
- >200mm
- <50mm

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Data Sources: Mott MacDonald 2022

Author names redacted

Rev	Date	Drawn	Description	Ch'kd	App'd
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**AffinityWater**

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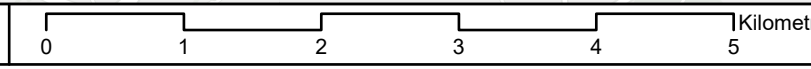
Canal & River Trust

**Title**

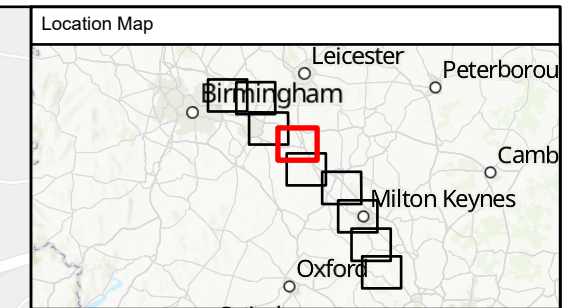
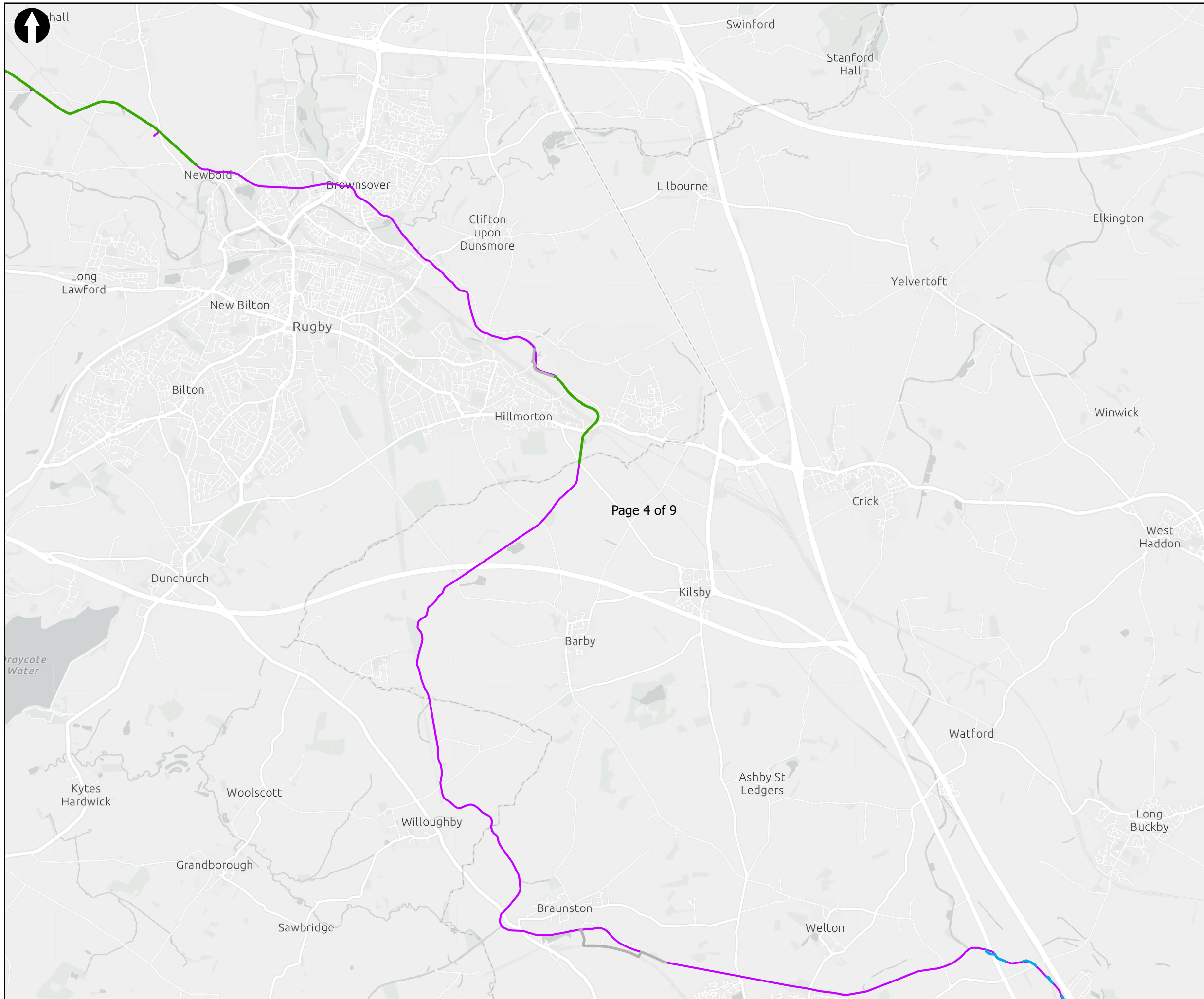
GUC  
 Map of the canal lengths  
 Sheet 3 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD

Drawing Number **GUC Embankments**







**Key to Symbols**

**Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC**

**Embankments**

**Bank Raise**

- Unknown
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Rev	Date	Drawn	Description	Ch'kd	App'd
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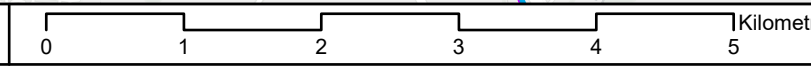
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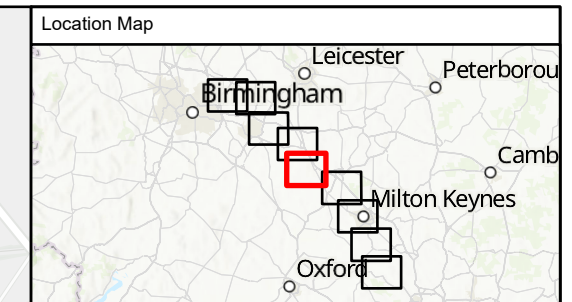
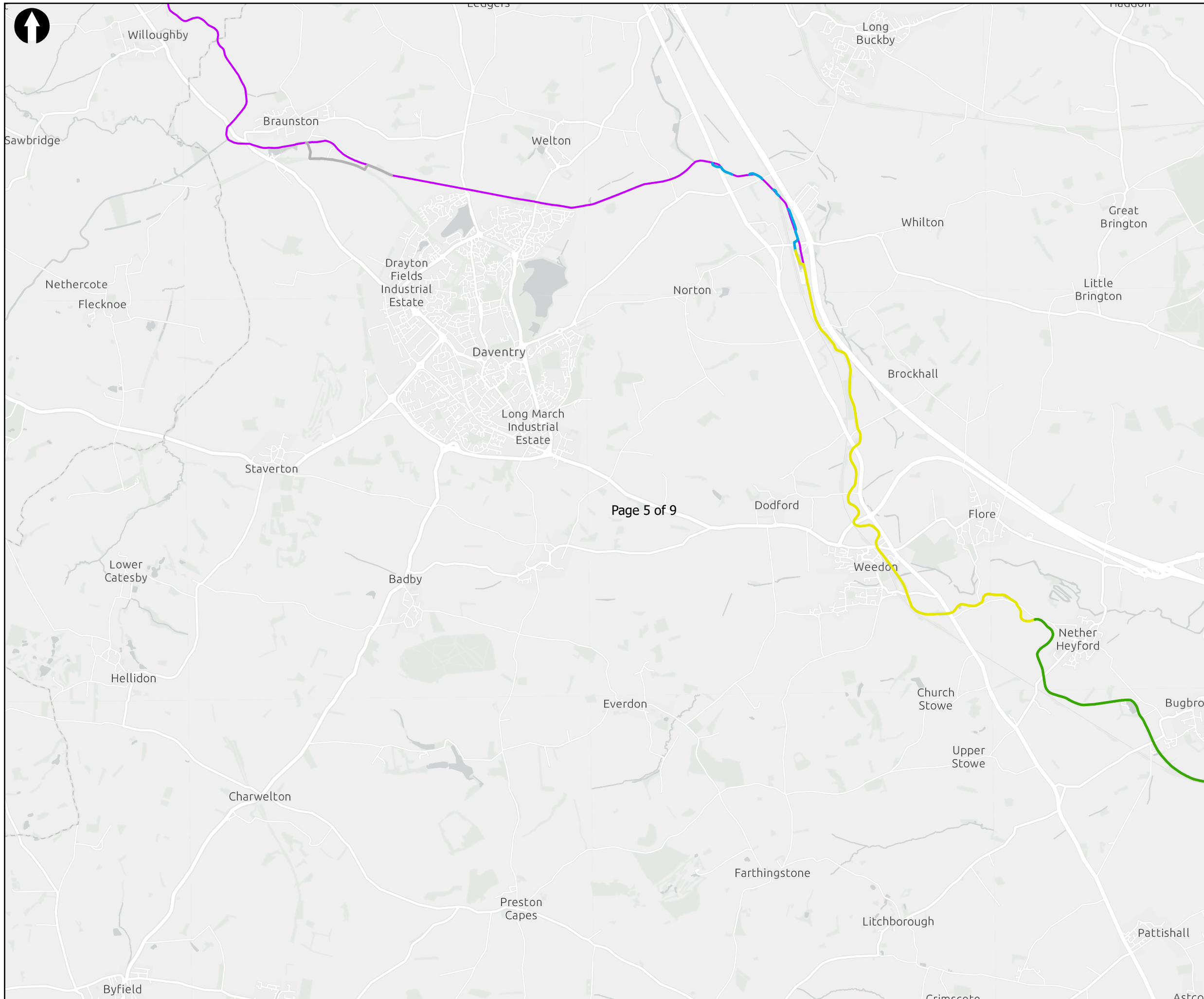
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**Title**

GUC  
 Map of the canal lengths  
 Sheet 4 of 9

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Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD





**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Bank Raise**

- Unknown
- >50mm
- >100mm
- >150mm
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**Notes**

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 Data Sources: Mott MacDonald 2022

Author names redacted

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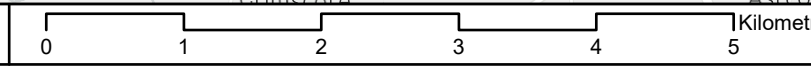
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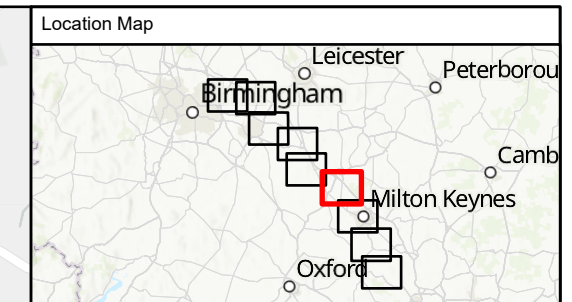
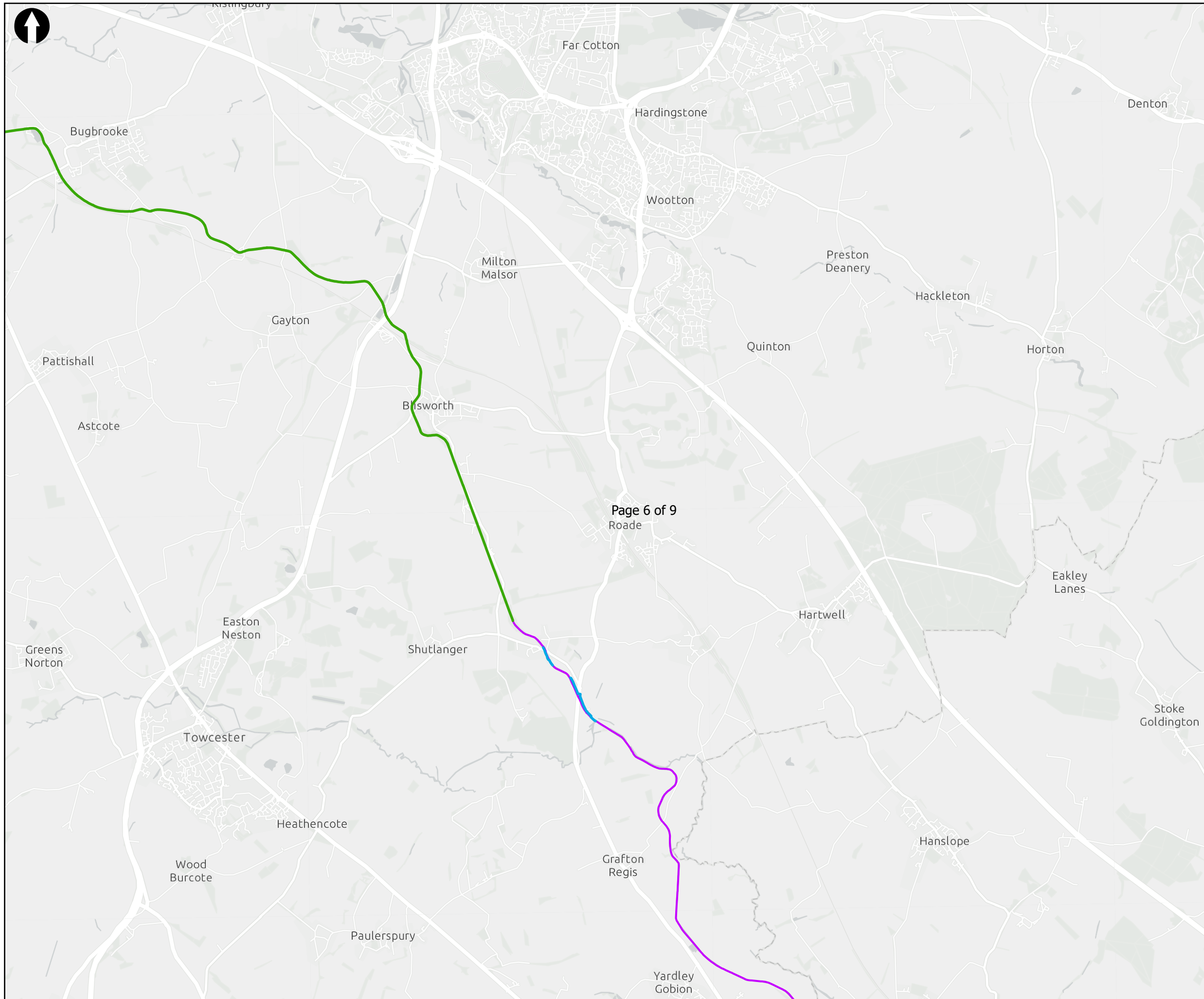
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 GUC  
 Map of the canal lengths  
 Sheet 5 of 9

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Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD

Drawing Number **GUC Embankments**







**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

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 Data Sources: Mott MacDonald 2022

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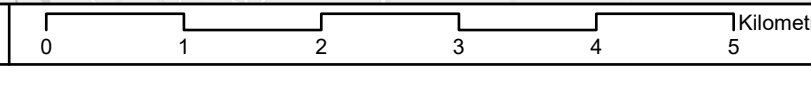
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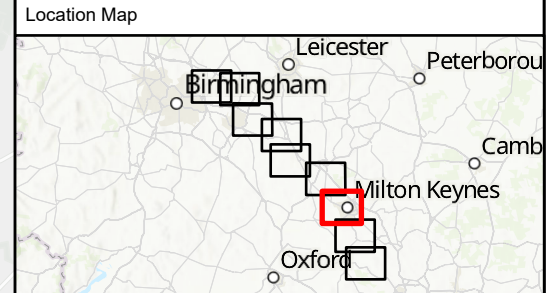
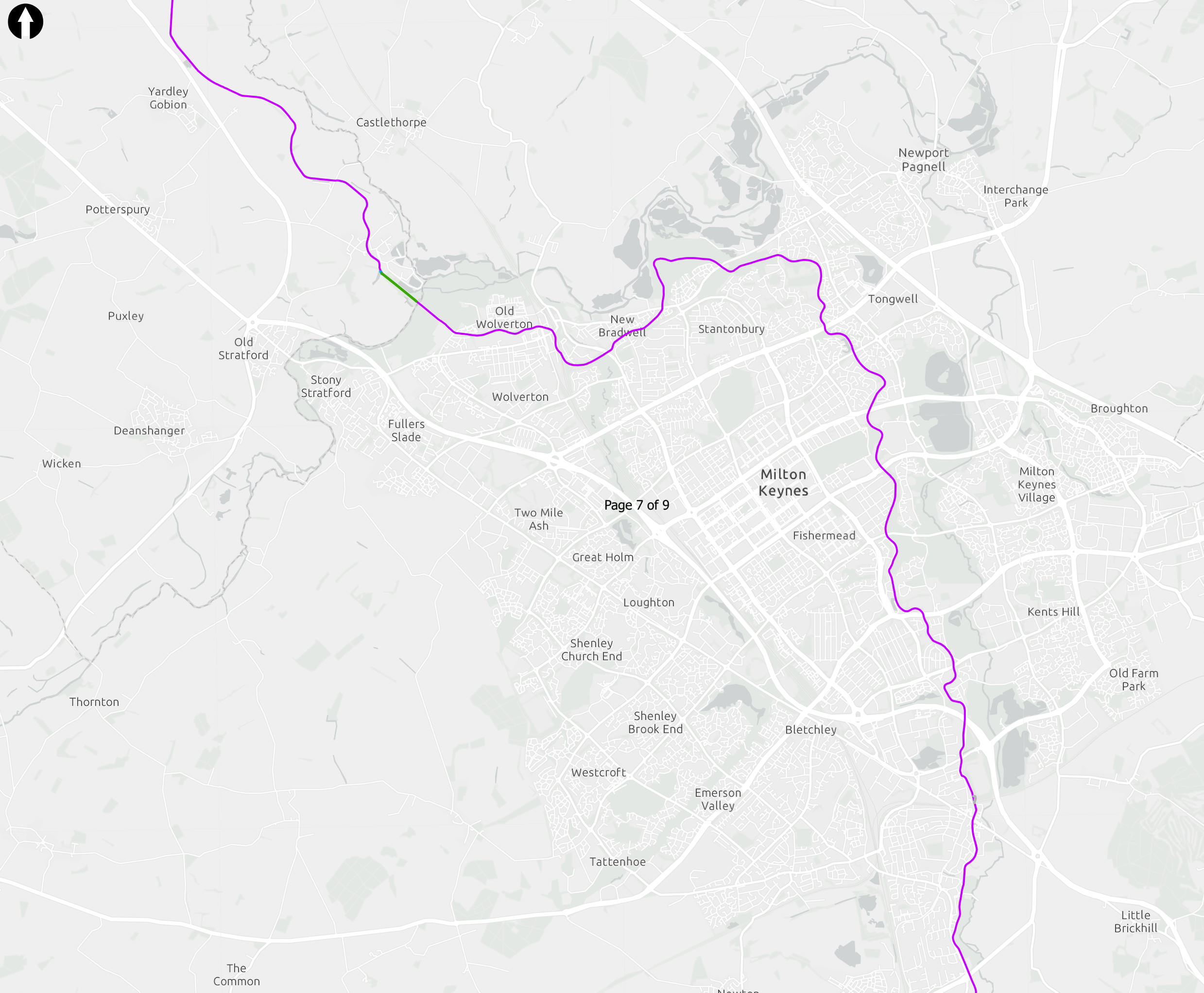
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**Title**  
 GUC  
 Map of the canal lengths  
 Sheet 6 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

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Rev	Date	Drawn	Description	Ch'k'd	App'd
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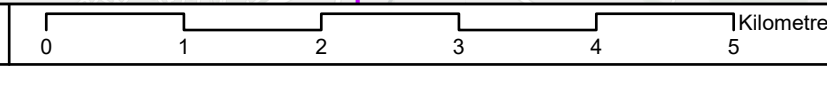
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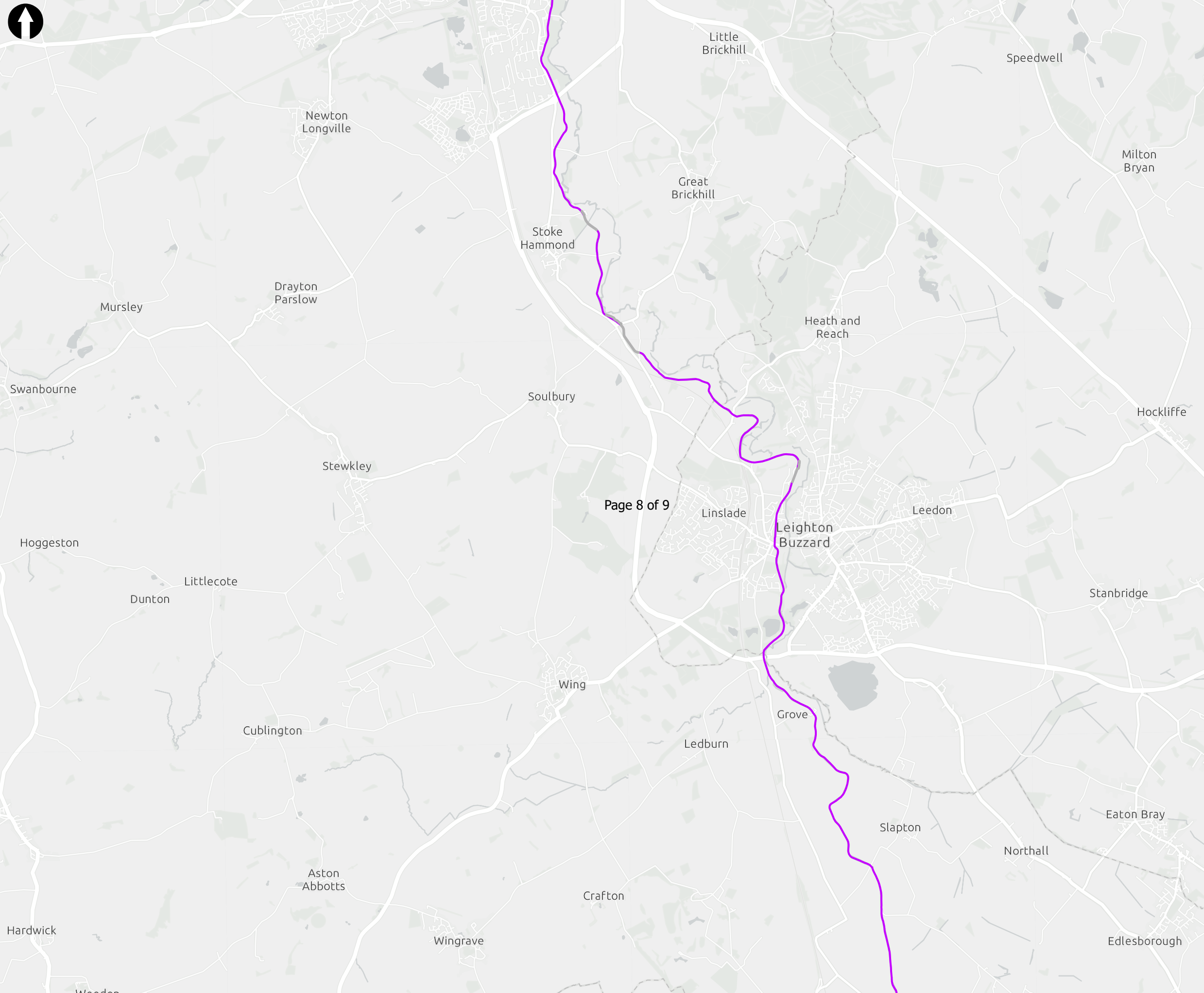
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**Title**  
 GUC  
 Map of the canal lengths  
 Sheet 7 of 9

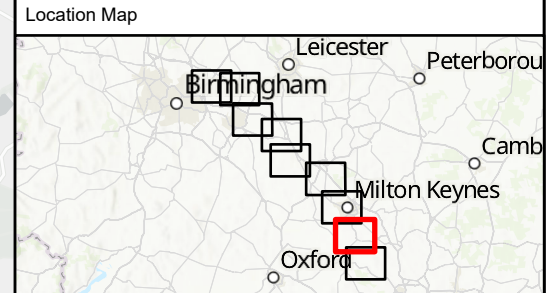
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GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD







Page 8 of 9



**Key to Symbols**

Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Bank Raise**

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 Data Sources: Mott MacDonald 2022

Author names redacted

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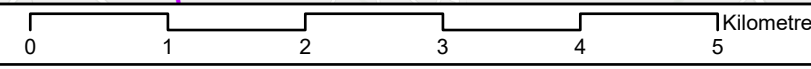
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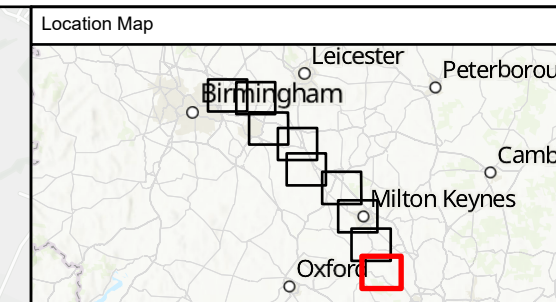
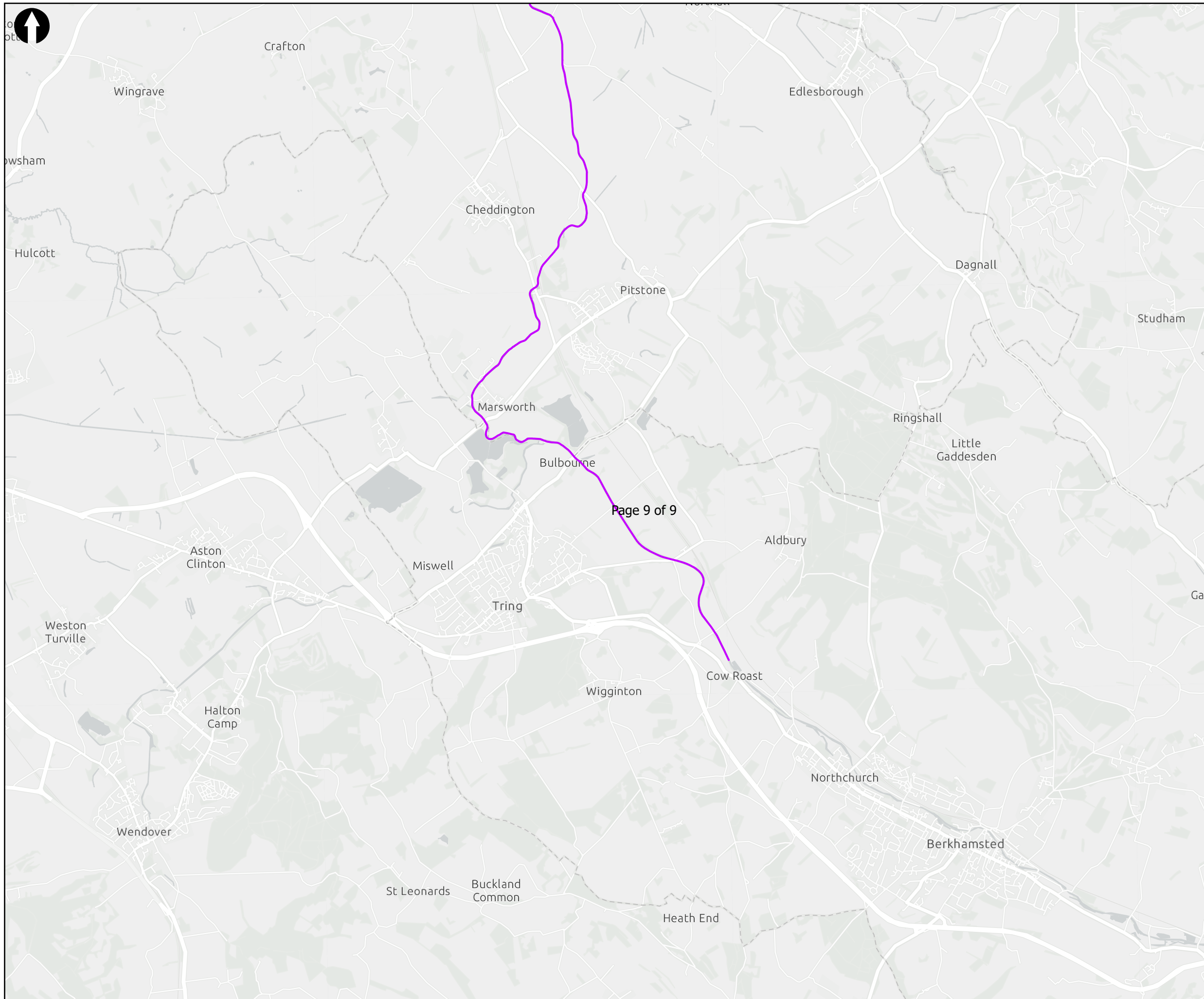
**Title**  
 GUC  
 Map of the canal lengths  
 Sheet 8 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD



Drawing Number **GUC Embankments**





**Key to Symbols**

— Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

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**Notes**

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 Data Sources: Mott MacDonald 2022

Author names redacted

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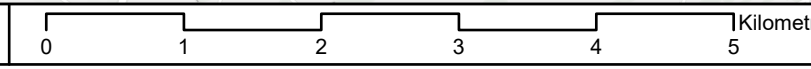
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 Sheet 9 of 9

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD



## C.2 Table of predicted water level increases

The table below shows predicted water level changes for the entire canal, broken down into short stretches as identified in the hydrological modelling. Key information is in the Total Head Loss column, which indicates the predicted increase in water level.

Those lengths predicted to rise by less than 50mm are in white. An increase of 50mm to 99mm is shown as green, of 100mm to 149mm as yellow, 150mm to 199mm as orange, and 200mm or more as red.

**Table 4.1: Water level modelling output<sup>13</sup>**

Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
536	538	305	bridge	0.0000	61.66	61.66
480	305	313	constriction	0.0004	548.24	609.90
479	313	314	bridge	0.0018	29.12	639.02
344	314	312	bridge	0.0021	521.44	1,160.45
255	312	311	bridge	0.0027	299.39	1,459.85
254	311	309	bridge	0.0034	461.08	1,920.92
256	309	310	bridge	0.0037	20.25	1,941.17
482	310	316	constriction	0.0044	988.20	2,929.37
481	316	318	pump outlet	0.0073	220.96	3,150.33
26	318	319	pumping station	0.0000	70.43	3,220.76
5	319	320	pump inlet	0.0011	53.37	3,274.13
346	320	317	bridge	0.0000	130.35	3,404.48
345	317	304	bridge	0.0011	633.38	4,037.86
315	304	303	bridge	0.0029	1,261.70	5,299.56
314	303	302	bridge	0.0035	801.82	6,101.38
313	302	301	bridge	0.0049	1,059.68	7,161.06
312	301	300	pump outlet	0.0063	517.77	7,678.83
38	300	299	pumping station	0.0000	249.83	7,928.66
6	299	298	pump inlet	0.0012	34.02	7,962.69
308	298	297	bridge	0.0000	944.89	8,907.57
484	297	296	constriction	0.0012	410.67	9,318.25
483	296	295	pump outlet	0.0037	299.66	9,617.91
27	295	294	pumping station	0.0000	13.30	9,631.20
18	294	293	pump inlet	0.0012	55.38	9,686.59
329	293	283	bridge	0.0000	1,125.70	10,812.29
328	283	285	bridge	0.0016	842.27	11,654.56
270	285	284	bridge	0.0017	43.06	11,697.62
337	284	275	bridge	0.0032	685.80	12,383.42
336	275	277	bridge	0.0035	563.76	12,947.18
327	277	292	bridge	0.0049	642.28	13,589.46
271	292	286	bridge	0.0063	482.61	14,072.07

<sup>13</sup> Source Scott Bringloe, WSP, personal communication, 9<sup>th</sup> February 2022.

Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
269	286	288	bridge	0.0071	69.97	14,142.04
268	288	291	bridge	0.0079	260.29	14,402.33
267	291	290	pump outlet	0.0084	27.67	14,430.00
39	290	289	pumping station	0.0001	28.66	14,458.66
4	289	287	pump inlet	0.0008	72.21	14,530.87
307	287	278	bridge	0.0000	347.84	14,878.71
306	278	276	bridge	0.0013	276.95	15,155.66
273	276	279	bridge	0.0017	380.19	15,535.84
272	279	280	bridge	0.0033	231.40	15,767.24
266	280	282	bridge	0.0035	92.04	15,859.28
275	282	281	bridge	0.0040	6.06	15,865.34
274	281	274	bridge	0.0057	890.66	16,756.00
265	274	273	bridge	0.0068	45.56	16,801.56
264	273	272	bridge	0.0071	640.17	17,441.73
263	272	271	bridge	0.0074	311.59	17,753.32
276	271	270	bridge	0.0075	51.09	17,804.41
277	270	269	bridge	0.0089	379.02	18,183.43
297	269	267	bridge	0.0096	125.23	18,308.66
296	267	265	bridge	0.0104	158.22	18,466.88
278	265	263	bridge	0.0117	331.89	18,798.76
303	263	268	bridge	0.0130	314.70	19,113.47
302	268	261	bridge	0.0140	268.56	19,382.02
301	261	262	bridge	0.0141	317.75	19,699.77
300	262	266	bridge	0.0157	206.84	19,906.61
280	266	264	bridge	0.0169	349.05	20,255.66
279	264	259	bridge	0.0182	205.81	20,461.47
262	259	257	bridge	0.0184	26.18	20,487.65
281	257	256	bridge	0.0188	374.81	20,862.46
335	256	258	bridge	0.0193	160.29	21,022.74
334	258	255	bridge	0.0197	476.78	21,499.52
283	255	260	bridge	0.0200	539.76	22,039.28
282	260	254	bridge	0.0215	257.79	22,297.07
261	254	253	bridge	0.0223	358.99	22,656.06
260	253	252	bridge	0.0226	293.04	22,949.09
259	252	251	bridge	0.0228	298.34	23,247.44
258	251	250	bridge	0.0230	63.02	23,310.46
257	250	249	bridge	0.0233	255.99	23,566.45
285	249	248	bridge	0.0247	241.11	23,807.55
299	248	247	bridge	0.0251	503.98	24,311.53
298	247	246	bridge	0.0264	654.64	24,966.17
240	246	245	bridge	0.0278	9.03	24,975.20



Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
239	245	244	bridge	0.0296	738.14	25,713.34
128	244	243	bridge	0.0299	191.31	25,904.66
127	243	242	bridge	0.0308	787.38	26,692.04
126	242	241	bridge	0.0324	983.08	27,675.12
125	241	240	bridge	0.0336	695.02	28,370.14
241	240	239	bridge	0.0349	304.31	28,674.45
530	239	527	aqueduct	0.0354	44.66	28,719.11
529	527	526	aqueduct	0.0365	130.99	28,850.11
486	526	238	constriction	0.0373	178.72	29,028.83
485	238	237	bridge	0.0400	581.36	29,610.19
124	237	236	bridge	0.0404	351.09	29,961.28
236	236	235	bridge	0.0406	54.77	30,016.06
235	235	234	bridge	0.0408	141.72	30,157.78
123	234	233	bridge	0.0412	44.23	30,202.01
488	233	232	constriction	0.0416	477.83	30,679.84
487	232	231	bridge	0.0426	600.71	31,280.55
122	231	230	bridge	0.0435	220.45	31,501.00
528	230	531	constriction	0.0443	297.54	31,798.54
527	531	525	aqueduct	0.0468	376.54	32,175.08
526	525	524	aqueduct	0.0498	74.50	32,249.58
121	524	229	bypass outlet	0.0509	665.65	32,915.23
3	229	227	bypass inlet	0.0000	16.44	32,931.67
113	227	226	bridge	0.0002	86.48	33,018.15
228	226	225	bridge	0.0016	468.34	33,486.49
227	225	224	bridge	0.0036	1,190.49	34,676.98
120	224	223	bridge	0.0046	1,398.06	36,075.04
179	223	222	bridge	0.0067	773.72	36,848.76
178	222	221	bridge	0.0086	490.54	37,339.31
177	221	220	bridge	0.0097	382.31	37,721.62
116	220	218	bridge	0.0114	607.99	38,329.61
117	218	219	bridge	0.0125	462.13	38,791.74
226	219	216	bridge	0.0149	1,108.44	39,900.18
225	216	217	bridge	0.0191	887.02	40,787.20
173	217	514	constriction	0.0206	732.75	41,519.95
513	514	215	bridge	0.0222	693.57	42,213.52
172	215	213	bypass outlet	0.0235	104.59	42,318.11
166	213	208	bypass inlet	0.0000	679.78	42,997.89
165	208	207	bridge	0.0002	335.54	43,333.43
224	207	205	bypass outlet	0.0016	97.24	43,430.67
509	205	204	bypass inlet	0.0000	79.70	43,510.37
525	204	530	constriction	0.0002	299.97	43,810.34

Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
508	530	203	tunnel	0.0016	325.09	44,135.43
511	203	202	tunnel	0.0707	2,815.29	46,950.72
510	202	200	bridge	0.0719	791.67	47,742.39
196	200	201	bridge	0.0729	410.47	48,152.87
195	201	199	bridge	0.0741	520.54	48,673.40
244	199	198	bridge	0.0750	219.11	48,892.51
490	198	197	constriction	0.0757	391.10	49,283.61
489	197	196	bridge	0.0769	105.78	49,389.39
194	196	195	bridge	0.0771	181.15	49,570.55
193	195	194	bridge	0.0786	376.67	49,947.22
192	194	193	bridge	0.0799	635.31	50,582.53
191	193	192	bridge	0.0814	801.15	51,383.68
190	192	191	bridge	0.0826	284.36	51,668.04
234	191	190	bridge	0.0838	346.18	52,014.21
233	190	189	bridge	0.0840	108.65	52,122.87
189	189	188	bridge	0.0856	666.06	52,788.92
188	188	187	bridge	0.0874	857.39	53,646.32
187	187	186	bridge	0.0883	342.39	53,988.71
186	186	185	bridge	0.0896	560.08	54,548.79
524	185	529	constriction	0.0920	540.34	55,089.13
119	529	184	bridge	0.0930	212.92	55,302.05
118	184	183	bridge	0.0941	402.12	55,704.17
136	183	182	bridge	0.0950	443.77	56,147.95
176	182	181	bridge	0.0964	816.07	56,964.02
185	181	180	bridge	0.0979	578.60	57,542.62
492	180	179	constriction	0.0997	1,113.40	58,656.02
491	179	178	bridge	0.1018	456.90	59,112.92
175	178	177	bridge	0.1023	319.40	59,432.32
184	177	176	bridge	0.1031	351.54	59,783.86
183	176	175	bridge	0.1045	525.23	60,309.09
158	175	174	bridge	0.1049	474.63	60,783.72
523	174	523	aqueduct	0.1070	807.26	61,590.98
522	523	522	aqueduct	0.1075	44.38	61,635.36
157	522	173	bridge	0.1081	320.96	61,956.32
250	173	170	bridge	0.1088	663.14	62,619.46
249	170	167	bridge	0.1092	540.11	63,159.57
197	167	169	bridge	0.1103	19.44	63,179.01
135	169	171	bridge	0.1118	736.20	63,915.21
203	171	172	bridge	0.1126	302.51	64,217.72
494	172	168	constriction	0.1139	569.21	64,786.94
493	168	166	bridge	0.1159	451.18	65,238.12

Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
159	166	165	bridge	0.1168	694.62	65,932.74
521	165	528	constriction	0.1174	174.09	66,106.83
174	528	164	bridge	0.1186	366.66	66,473.49
202	164	163	bridge	0.1198	474.08	66,947.57
201	163	162	bypass outlet	0.1212	249.12	67,196.69
200	162	161	bypass inlet	0.0000	187.84	67,384.53
199	161	160	bypass outlet	0.0001	145.34	67,529.87
198	160	158	bypass inlet	0.0000	348.48	67,878.35
160	158	157	bridge	0.0002	244.42	68,122.77
207	157	537	bypass outlet	0.0005	65.98	68,188.75
535	537	156	bypass inlet	0.0000	62.93	68,251.68
206	156	155	bridge	0.0002	234.21	68,485.89
205	155	536	bypass outlet	0.0012	145.05	68,630.94
534	536	154	bypass inlet	0.0000	73.30	68,704.24
204	154	153	bridge	0.0002	269.76	68,974.00
134	153	535	bypass outlet	0.0014	214.76	69,188.76
164	535	151	bypass inlet	0.0000	146.66	69,335.42
163	151	150	bridge	0.0002	273.50	69,608.92
162	150	149	bridge	0.0012	35.40	69,644.32
133	149	148	bridge	0.0024	415.17	70,059.48
132	148	147	bridge	0.0035	365.37	70,424.85
100	147	146	bridge	0.0047	451.48	70,876.33
131	146	145	bridge	0.0064	1,271.24	72,147.57
507	145	144	tunnel	0.0072	321.21	72,468.78
506	144	143	tunnel	0.0175	1,877.40	74,346.18
505	143	142	pump outlet	0.0178	398.08	74,744.26
36	142	129	pumping station	0.0000	1,166.84	75,911.10
16	129	128	pump inlet	0.0011	30.67	75,941.78
94	128	125	bridge	0.0000	259.39	76,201.17
115	125	122	bridge	0.0012	150.80	76,351.97
114	122	121	bridge	0.0025	148.28	76,500.25
519	121	521	aqueduct	0.0036	29.87	76,530.12
520	521	520	aqueduct	0.0038	64.98	76,595.10
130	520	117	bridge	0.0048	236.33	76,831.43
129	117	112	junction	0.0054	299.42	77,130.85
156	112	113	bridge	0.0060	227.23	77,358.08
155	113	115	bridge	0.0073	262.64	77,620.72
110	115	116	bridge	0.0094	422.40	78,043.12
111	116	109	bridge	0.0126	1,217.05	79,260.18
496	109	106	constriction	0.0145	430.13	79,690.31
495	106	105	bridge	0.0182	310.75	80,001.06



Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
182	105	103	bridge	0.0205	730.50	80,731.56
112	103	102	bridge	0.0215	361.72	81,093.28
96	102	100	bridge	0.0228	492.51	81,585.78
97	100	98	bridge	0.0249	225.53	81,811.32
101	98	99	bridge	0.0273	623.82	82,435.14
102	99	104	bridge	0.0300	566.71	83,001.85
154	104	107	bridge	0.0317	488.62	83,490.47
153	107	110	bridge	0.0338	326.62	83,817.09
152	110	114	bridge	0.0352	447.58	84,264.67
222	114	120	bridge	0.0396	716.09	84,980.77
221	120	124	bridge	0.0432	438.15	85,418.92
151	124	127	bridge	0.0473	641.94	86,060.86
150	127	130	bridge	0.0504	514.98	86,575.84
149	130	131	bridge	0.0516	124.70	86,700.54
148	131	132	bridge	0.0521	52.39	86,752.93
181	132	126	bridge	0.0535	713.44	87,466.37
180	126	123	pump outlet	0.0551	294.11	87,760.48
42	123	119	pumping station	0.0000	621.68	88,382.15
21	119	118	pump inlet	0.0053	27.35	88,409.50
211	118	111	bridge	0.0001	811.93	89,221.43
210	111	108	bridge	0.0029	630.70	89,852.13
533	108	533	constriction	0.0060	378.19	90,230.32
220	533	101	bridge	0.0108	464.76	90,695.08
532	101	534	constriction	0.0127	280.17	90,975.25
219	534	97	bridge	0.0223	1,111.70	92,086.95
147	97	96	bridge	0.0263	473.01	92,559.96
497	96	95	constriction	0.0271	58.13	92,618.09
499	95	519	aqueduct	0.0297	276.83	92,894.92
515	519	518	aqueduct	0.0307	53.15	92,948.07
516	518	517	aqueduct	0.0312	64.68	93,012.76
517	517	516	aqueduct	0.0321	40.76	93,053.52
518	516	94	constriction	0.0333	81.21	93,134.73
498	94	93	bridge	0.0354	39.50	93,174.23
109	93	92	bridge	0.0372	227.79	93,402.02
108	92	91	bridge	0.0384	95.17	93,497.19
146	91	90	bridge	0.0393	55.04	93,552.23
218	90	89	bridge	0.0429	538.58	94,090.81
217	89	88	bridge	0.0475	500.56	94,591.37
504	88	87	tunnel	0.0499	174.37	94,765.73
503	87	86	tunnel	0.0524	188.08	94,953.82
502	86	85	bridge	0.0563	548.23	95,502.05

Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
216	85	84	bridge	0.0571	24.03	95,526.08
103	84	83	bridge	0.0584	240.52	95,766.59
232	83	82	bridge	0.0610	411.75	96,178.34
231	82	81	bridge	0.0632	454.29	96,632.63
215	81	80	bridge	0.0677	277.78	96,910.41
145	80	79	bridge	0.0694	166.54	97,076.95
209	79	78	bridge	0.0729	509.07	97,586.02
208	78	77	bridge	0.0744	110.18	97,696.20
95	77	76	bridge	0.0756	97.48	97,793.69
104	76	75	bridge	0.0812	365.48	98,159.17
531	75	532	constriction	0.0836	212.57	98,371.74
105	532	74	bridge	0.0936	377.29	98,749.03
214	74	73	bridge	0.1041	1,511.72	100,260.75
213	73	72	bridge	0.1088	584.83	100,845.58
212	72	71	bridge	0.1141	785.00	101,630.58
501	71	70	constriction	0.1152	119.96	101,750.54
500	70	69	bridge	0.1220	881.74	102,632.27
107	69	68	bridge	0.1272	321.55	102,953.82
144	68	67	bridge	0.1366	1,387.42	104,341.23
143	67	66	bridge	0.1412	484.61	104,825.85
514	66	515	constriction	0.1452	231.45	105,057.30
142	515	513	constriction	0.1677	822.09	105,879.39
512	513	65	bridge	0.1749	366.79	106,246.18
141	65	64	bridge	0.1776	542.95	106,789.13
140	64	63	bridge	0.1799	237.39	107,026.52
98	63	62	bridge	0.1822	148.70	107,175.22
139	62	61	bridge	0.1846	240.62	107,415.84
243	61	60	bridge	0.1872	673.89	108,089.73
242	60	59	bridge	0.1875	78.57	108,168.30
106	59	58	bridge	0.1947	1,062.75	109,231.05
238	58	57	bridge	0.1996	611.54	109,842.59
237	57	56	bridge	0.2006	270.47	110,113.06
138	56	54	bridge	0.2023	516.07	110,629.13
99	54	53	bridge	0.2040	87.64	110,716.77
137	53	40	bridge	0.2072	947.39	111,664.16
230	40	42	bridge	0.2084	430.05	112,094.21
229	42	39	pump outlet	0.2126	590.97	112,685.19
35	39	37	pumping station	0.0000	12.70	112,697.88
1	37	35	pump inlet	0.0051	19.00	112,716.89
246	35	43	bridge	0.0000	717.26	113,434.15
245	43	41	bridge	0.0042	893.04	114,327.19

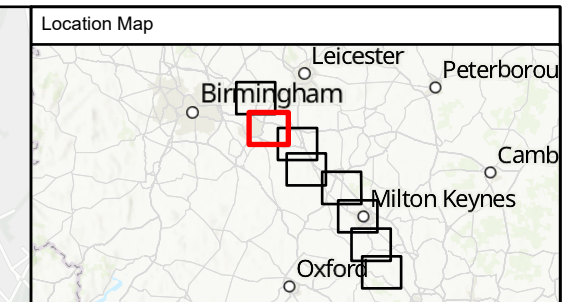
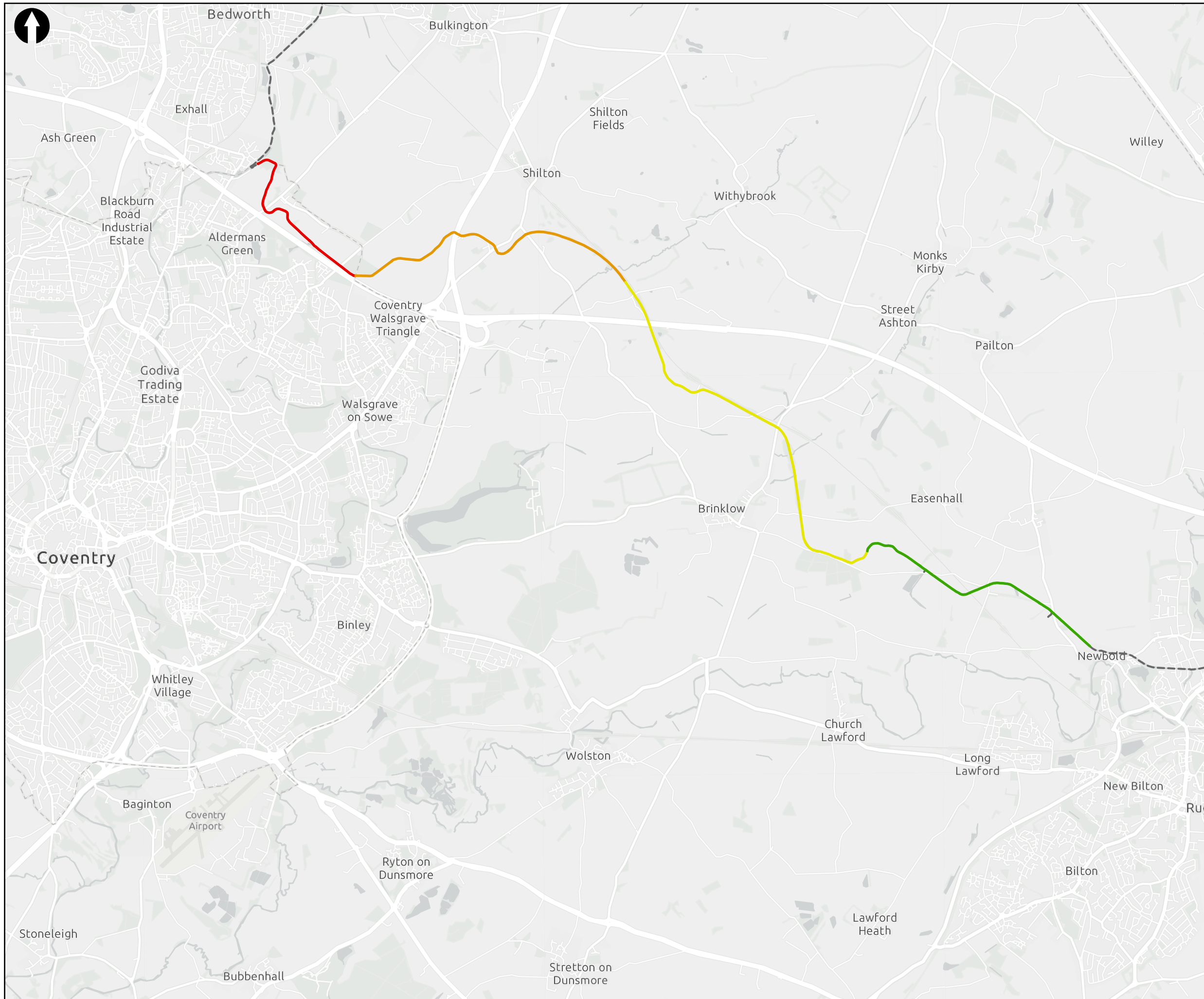
Link	Downstream node	Upstream Node	Upstream Node Type	Total Head Loss (m)	Length (m)	Cumulative Length (m)
91	41	55	bridge	0.0082	1,001.93	115,329.11
79	55	52	bridge	0.0166	1,519.93	116,849.04
81	52	51	bridge	0.0194	51.60	116,900.64
80	51	44	bridge	0.0242	391.04	117,291.68
90	44	46	bridge	0.0264	510.48	117,802.17
89	46	47	bridge	0.0295	355.27	118,157.43
76	47	48	bridge	0.0311	12.69	118,170.13
75	48	50	bridge	0.0340	357.06	118,527.19
72	50	49	bridge	0.0374	556.79	119,083.98
71	49	45	bridge	0.0395	328.93	119,412.90
70	45	38	bridge	0.0421	467.02	119,879.92
69	38	33	bridge	0.0445	266.29	120,146.22
68	33	32	bridge	0.0455	82.36	120,228.57
67	32	31	bridge	0.0473	155.95	120,384.52
66	31	30	bridge	0.0512	435.30	120,819.82
65	30	25	bridge	0.0550	771.99	121,591.81
74	25	24	bridge	0.0561	7.27	121,599.08
73	24	22	bridge	0.0587	441.14	122,040.22
64	22	21	bridge	0.0647	101.06	122,141.28
63	21	27	bridge	0.0706	573.65	122,714.93
62	27	28	bridge	0.0718	115.06	122,829.99
61	28	29	bridge	0.0723	187.51	123,017.50
88	29	26	bridge	0.0737	429.93	123,447.43
87	26	23	bridge	0.0765	225.76	123,673.18
59	23	20	bridge	0.0781	330.91	124,004.10
86	20	19	bridge	0.0822	573.07	124,577.17
85	19	18	bridge	0.0877	655.87	125,233.03
84	18	17	bridge	0.0925	597.47	125,830.50
60	17	16	bridge	0.0934	131.72	125,962.22
248	16	15	bridge	0.0952	276.13	126,238.36
247	15	14	bridge	0.0961	125.24	126,363.60
78	14	13	bridge	0.0996	417.40	126,781.00
77	13	12	bridge	0.1013	59.06	126,840.06
83	12	11	bridge	0.1049	293.39	127,133.46
82	11	10	bridge	0.1073	606.38	127,739.83
58	10	9	bridge	0.1101	370.60	128,110.43
57	9	8	bridge	0.1149	680.98	128,791.41
51	8	7	bridge	0.1154	6.39	128,797.80
56	7	6	bridge	0.1176	860.79	129,658.59
55	6	5	bridge	0.1194	103.13	129,761.72
54	5	4	bridge	0.1228	290.80	130,052.52



<b>Link</b>	<b>Downstream node</b>	<b>Upstream Node</b>	<b>Upstream Node Type</b>	<b>Total Head Loss (m)</b>	<b>Length (m)</b>	<b>Cumulative Length (m)</b>
53	4	3	bridge	0.1275	166.49	130,219.01
50	3	2	bridge	0.1302	279.44	130,498.44
52	2	1	Transfer	0.1310	15.49	130,513.94

## D. Canal Bank Engineering

### D.1 Map of Embankment Height Increases – Oxford and Coventry Canals



**Key to Symbols**

--- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Height Increase**

- >50mm
- >100mm
- >150mm
- >200mm

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Embankment engineering from WSP (2022)

Author names redacted

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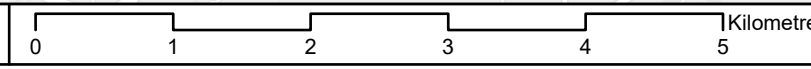
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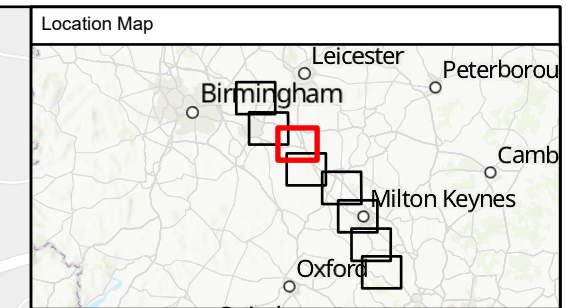
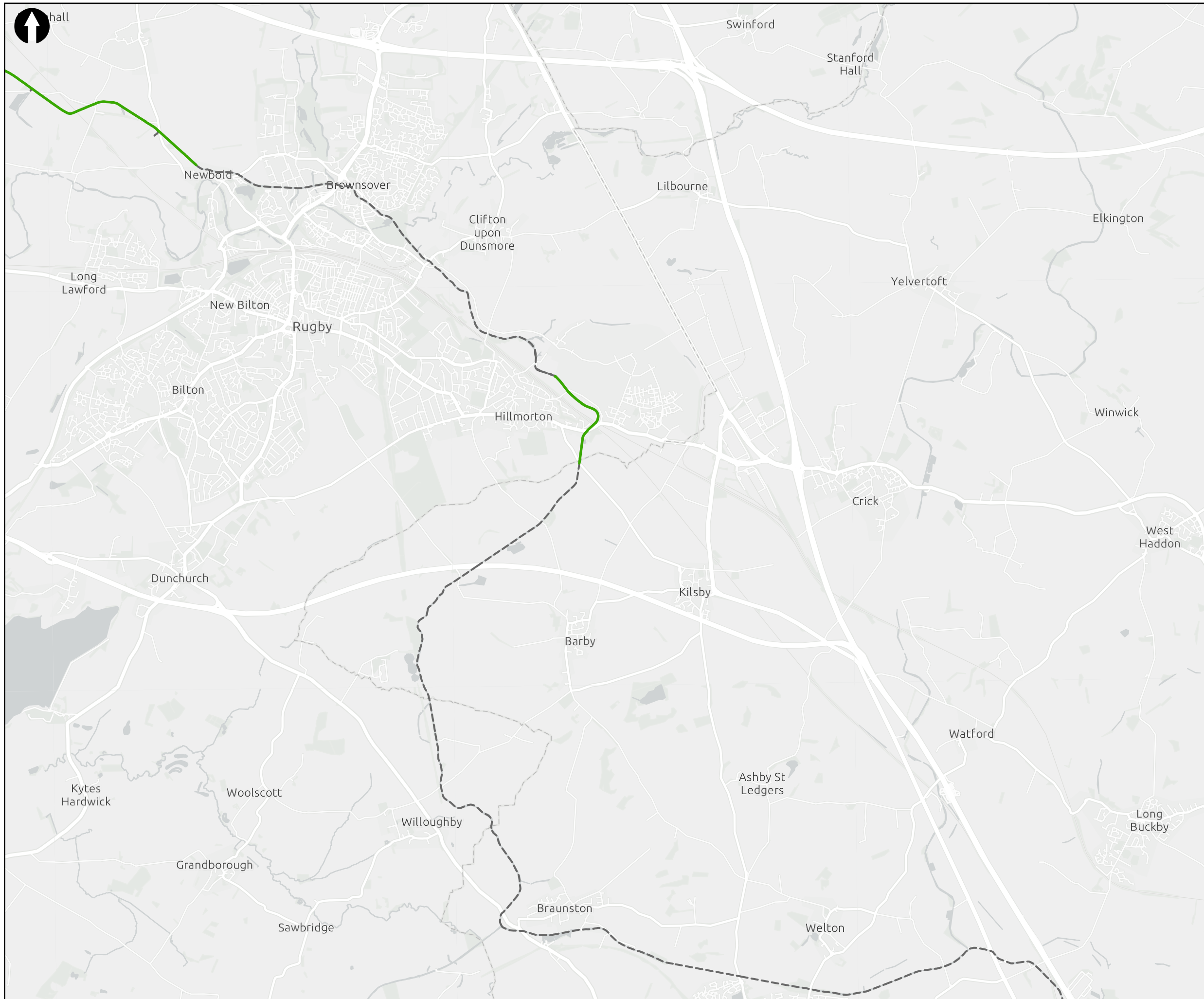
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Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases  
 Sheet 1 of 7

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**Key to Symbols**

--- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

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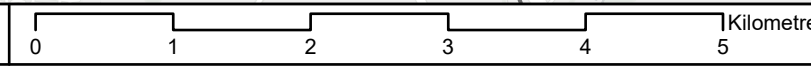
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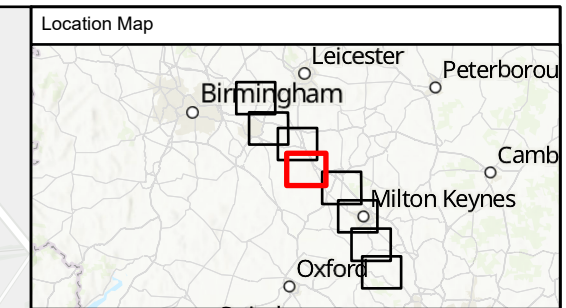
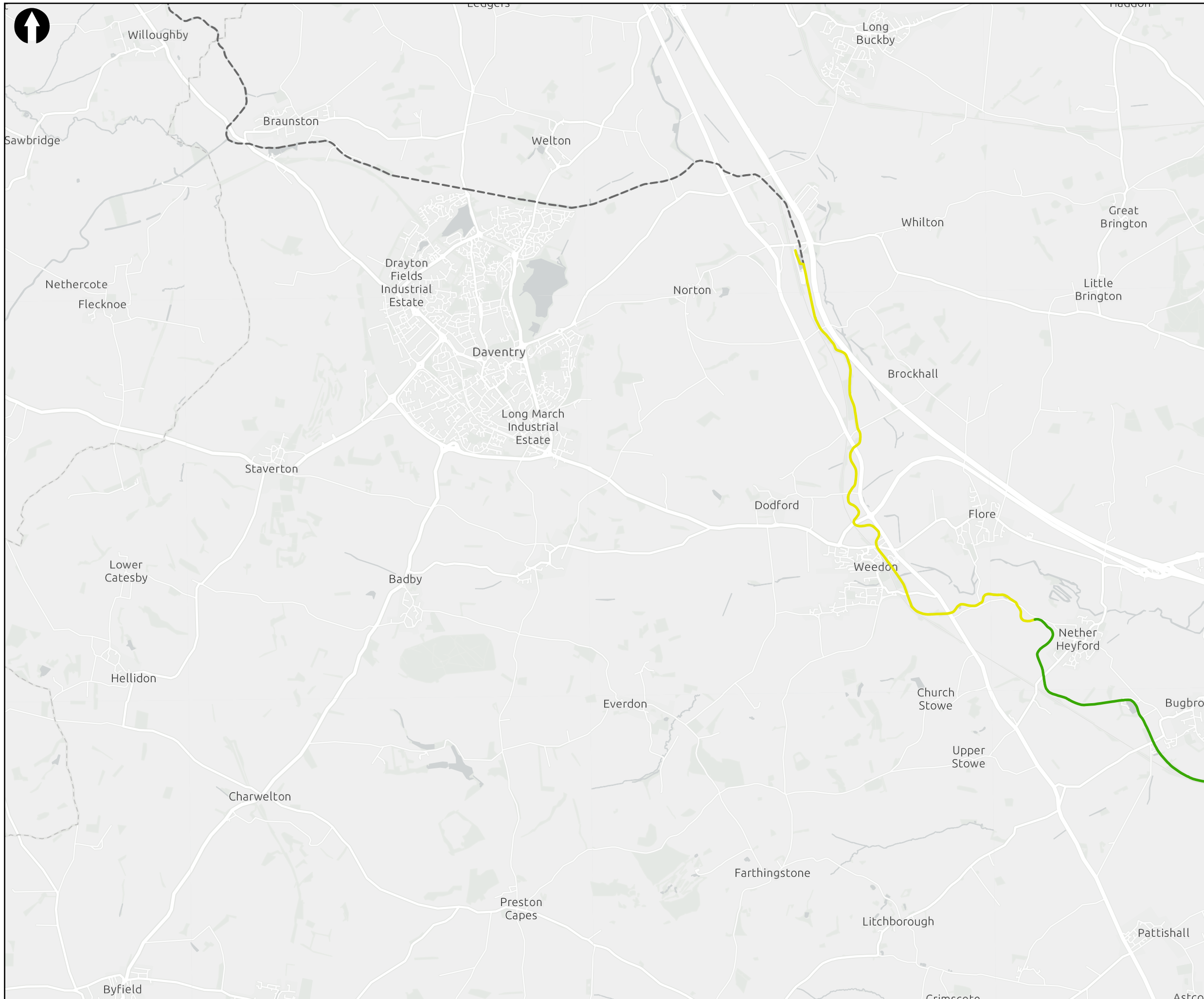
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Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases  
 Sheet 2 of 7

Designed		Check	
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Scale at A3	Status	Rev	Security
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**Key to Symbols**

--- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Height Increase**

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Rev	Date	Drawn	Description	Ch'k'd	App'd
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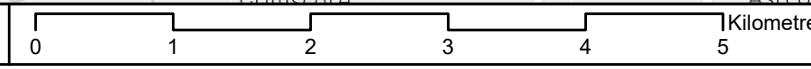
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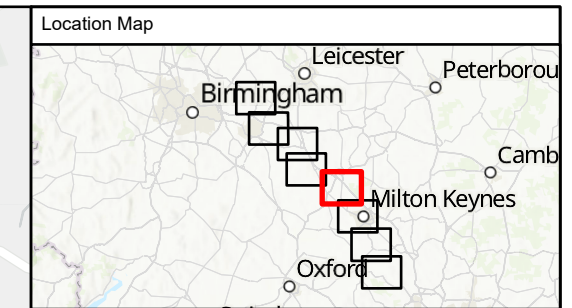
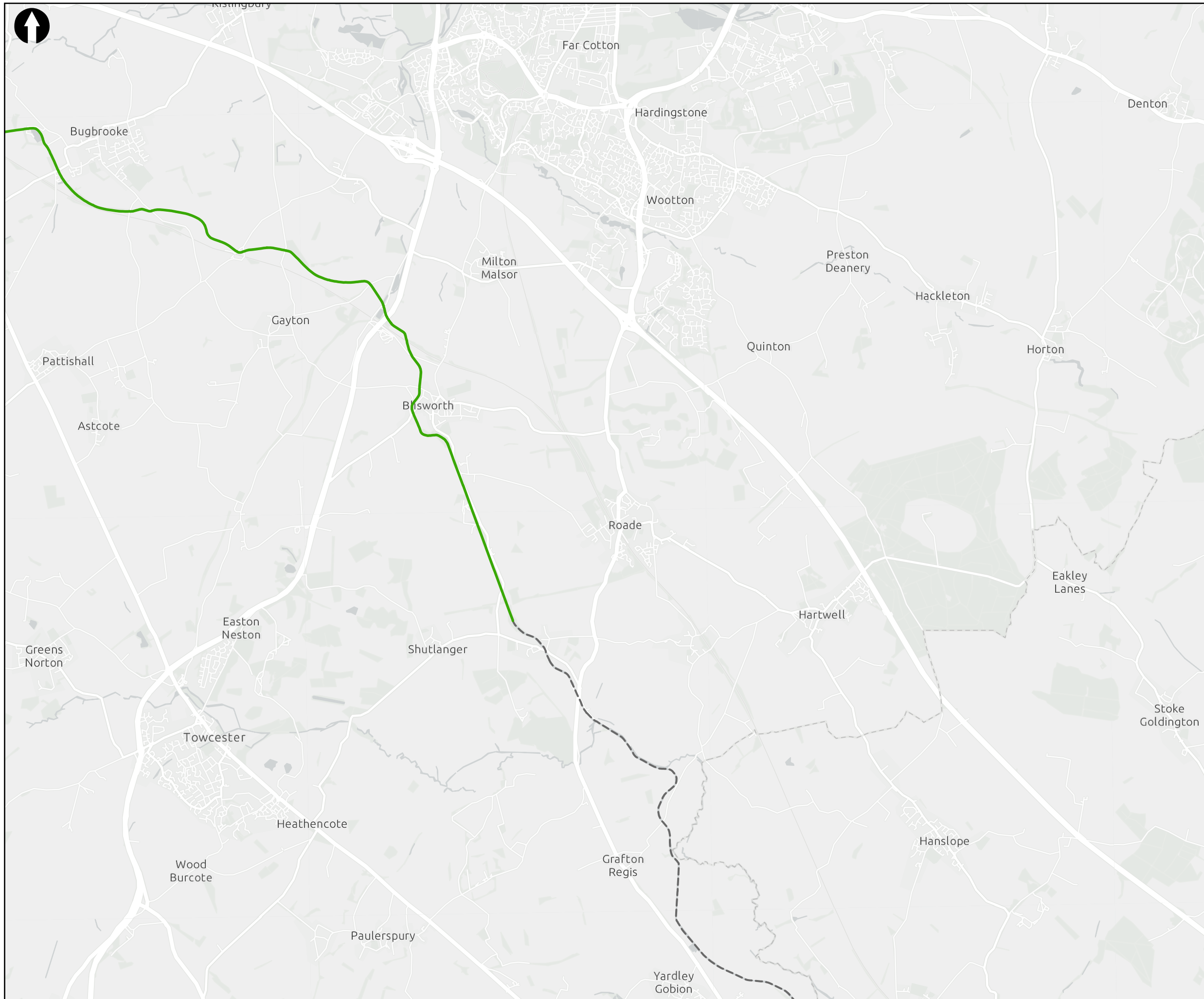
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Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases  
 Sheet 3 of 7

Designed		Check	
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**Key to Symbols**

--- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Height Increase**

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 Embankment engineering from WSP (2022)

Author names redacted

Rev	Date	Drawn	Description	Ch'k'd	App'd
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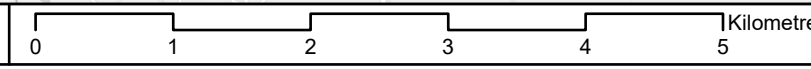
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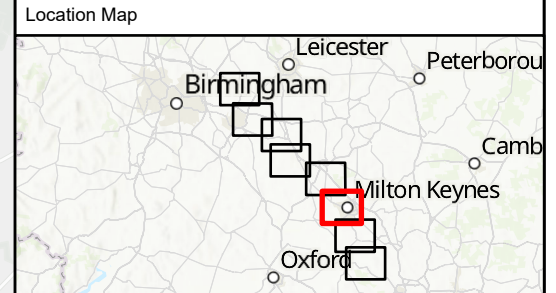
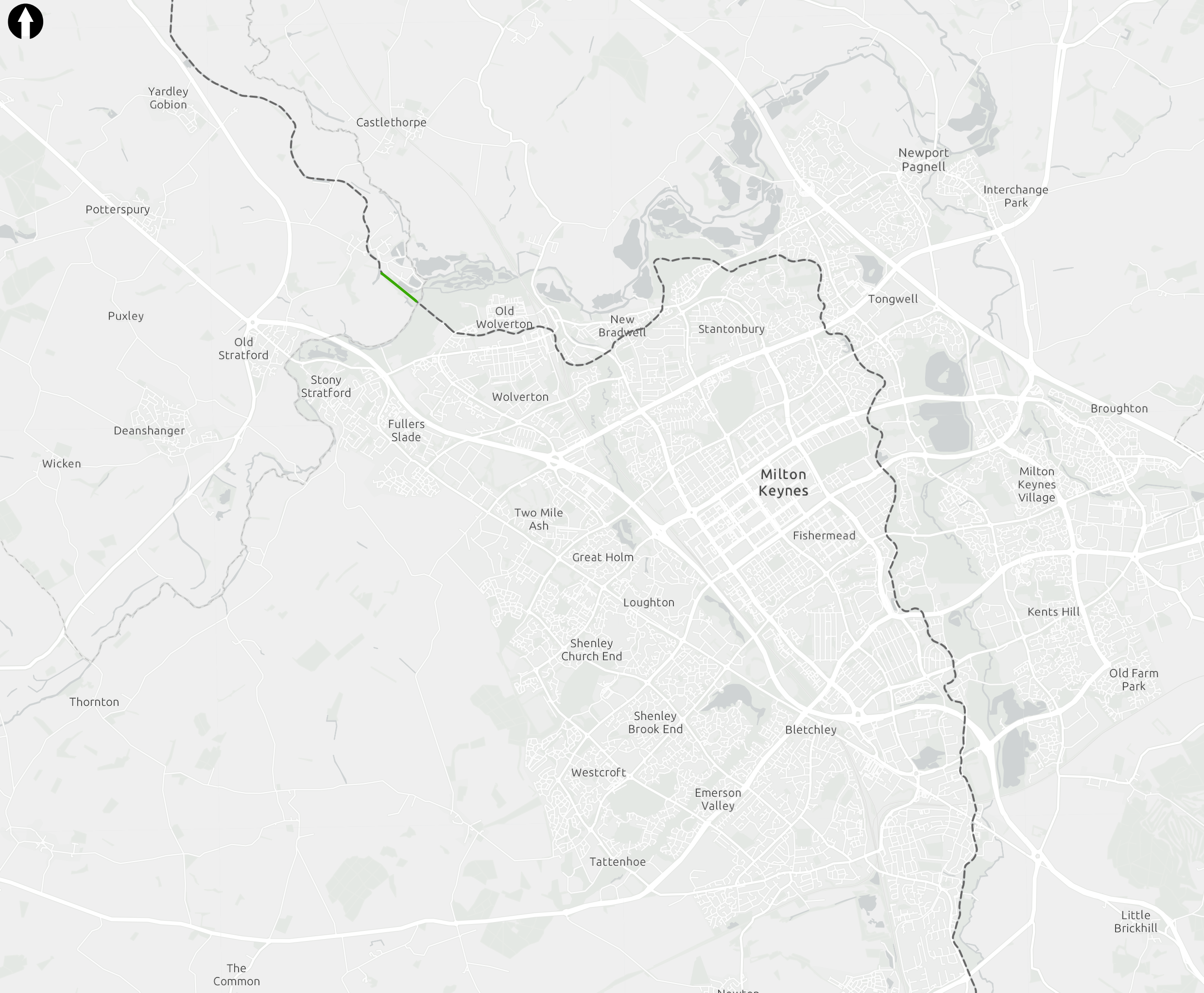
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Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases  
 Sheet 4 of 7

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Scale at A3	Status	Rev	Security
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**Key to Symbols**

--- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Height Increase**

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- >100mm
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**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
Embankment engineering from WSP (2022)

Author names redacted

Rev	Date	Drawn	Description	Ch'k'd	App'd
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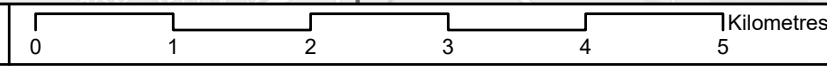
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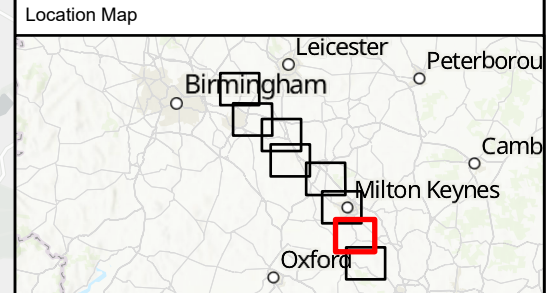
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Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases  
 Sheet 5 of 7

Designed		Check	
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**Key to Symbols**

--- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Height Increase**

- >50mm
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**Notes**

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Embankment engineering from WSP (2022)

Author names redacted

Rev	Date	Drawn	Description	Ch'kd	App'd
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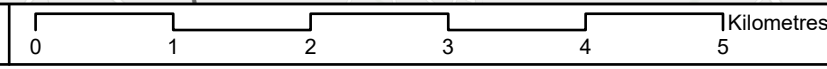
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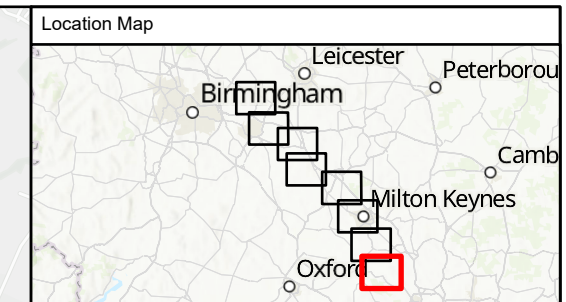
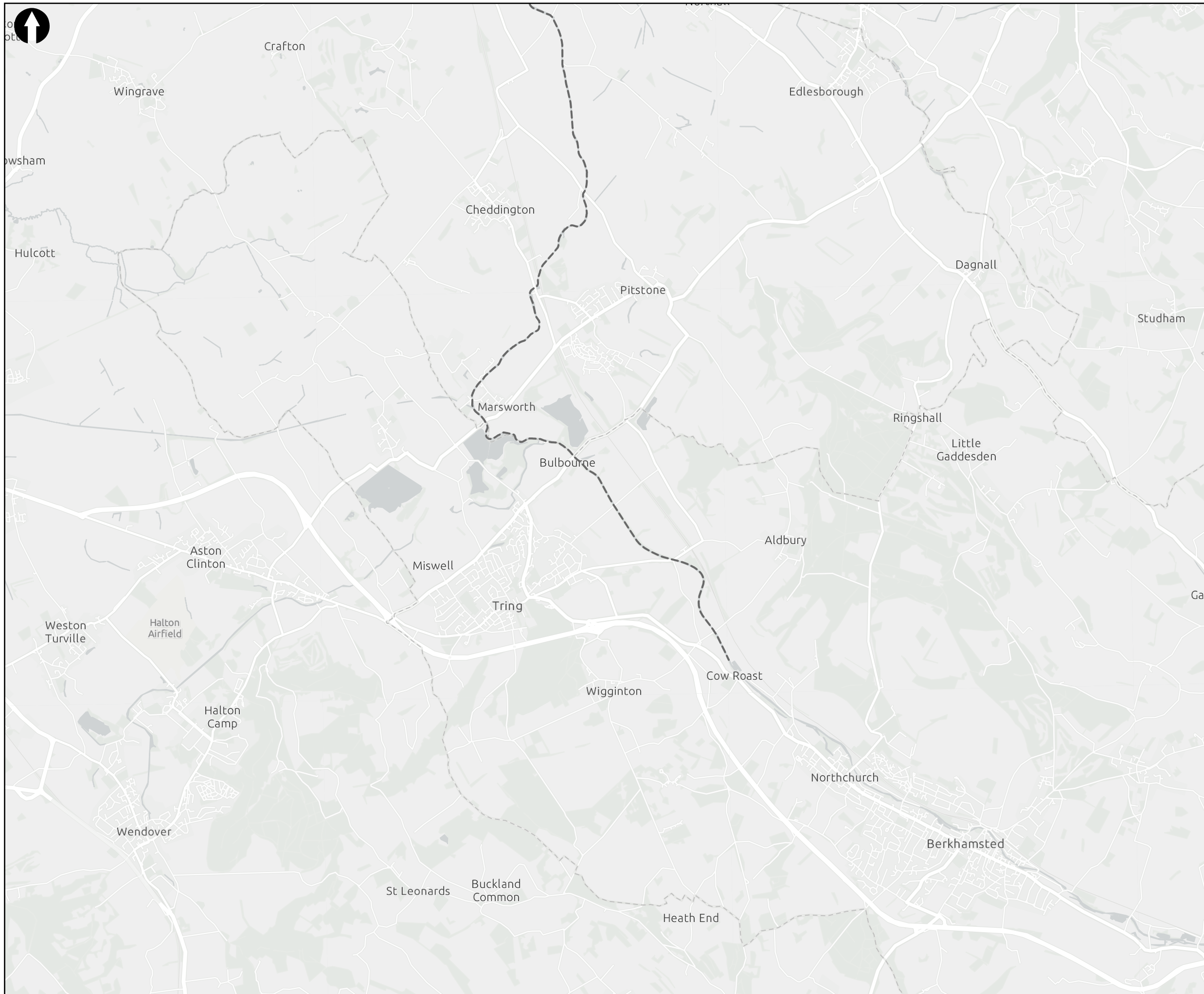
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Grand Union Canal - Gate 2 Environmental Assessments  
Embankment Height Increases  
Sheet 6 of 7

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
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**Key to Symbols**

--- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Height Increase**

- >50mm
- >100mm
- >150mm
- >200mm

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Embankment engineering from WSP (2022)

Author names redacted

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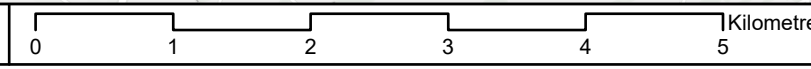
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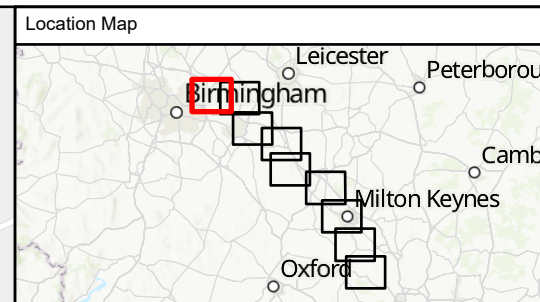
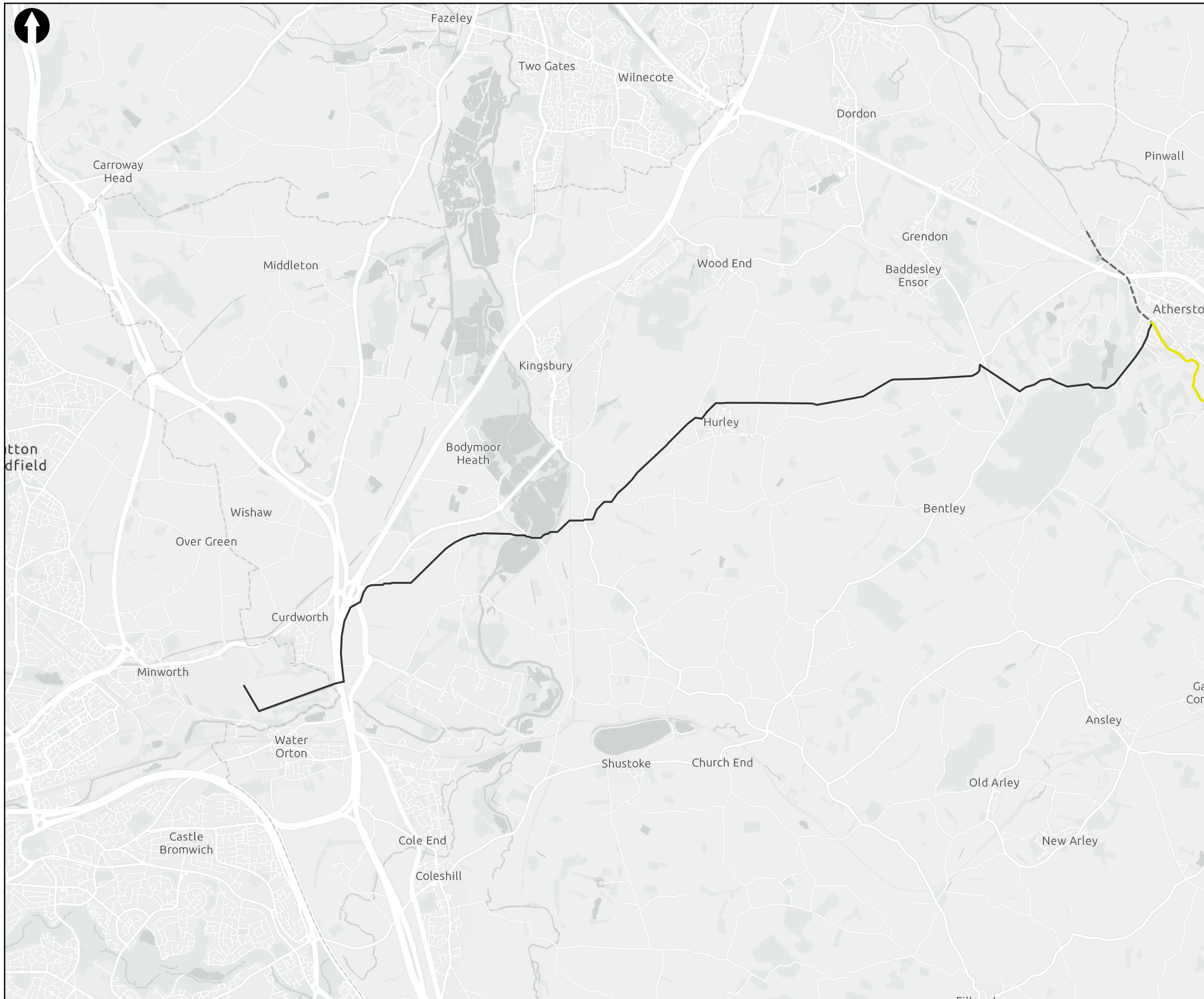
Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases  
 Sheet 7 of 7

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3 1:55,000	Status INF	Rev 01	Security STD





## D.2 Map of Embankment Height Increases – Grand Union Canal



**Key to Symbols**

- Minworth WwTW to Atherstone via pipeline
- - - Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

**Embankments**

**Height Increase**

- >50mm
- >100mm
- >150mm
- >200mm

**Notes**

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Embankment engineering from WSP (2022)

Author names redacted

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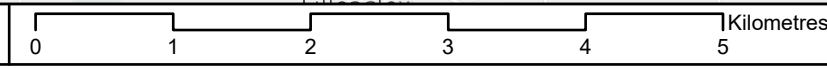
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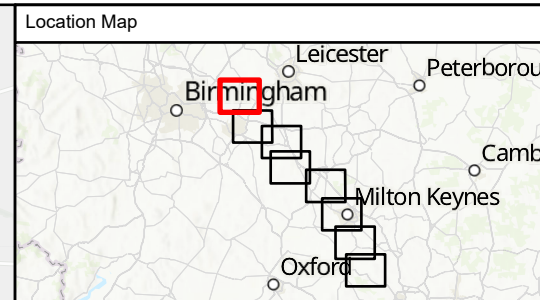
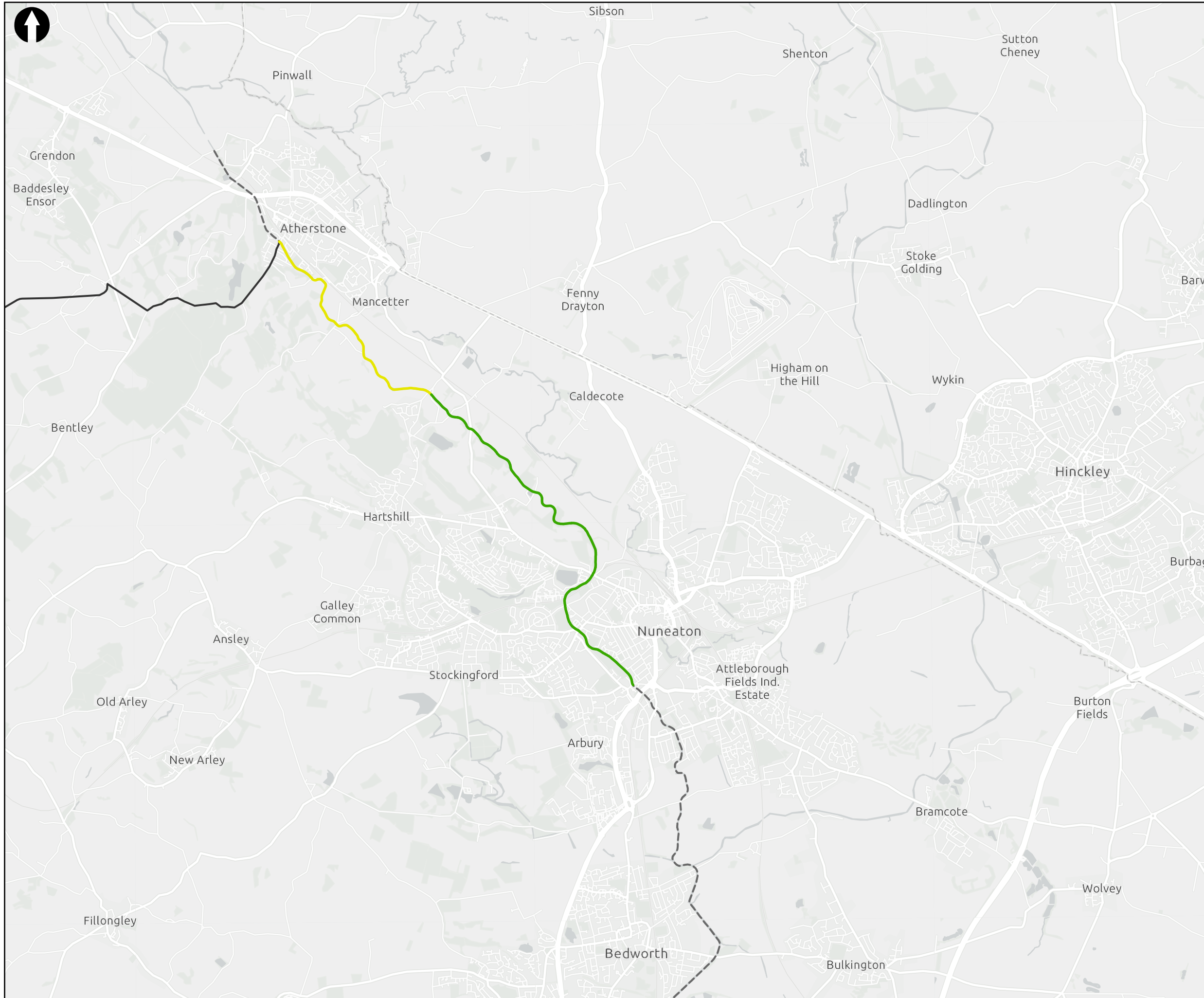
Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases  
 Sheet 1 of 2

Designed		Check	
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Scale at A3	Status	Rev	Security
1:55,000	INF	01	STD



Drawing Number **GUC Embankments**





Key to Symbols

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC

- Embankments
- Height Increase
- >50mm
  - >100mm
  - >150mm
  - >200mm

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS  
 Embankment engineering from WSP (2022)

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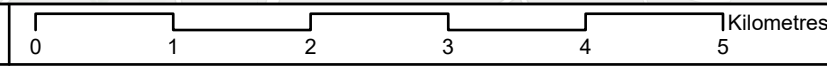
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**Embankment Height Increases**  
 Sheet 2 of 2

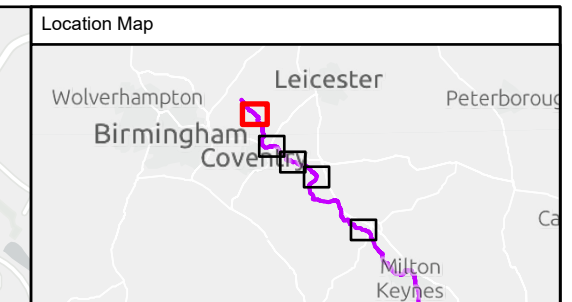
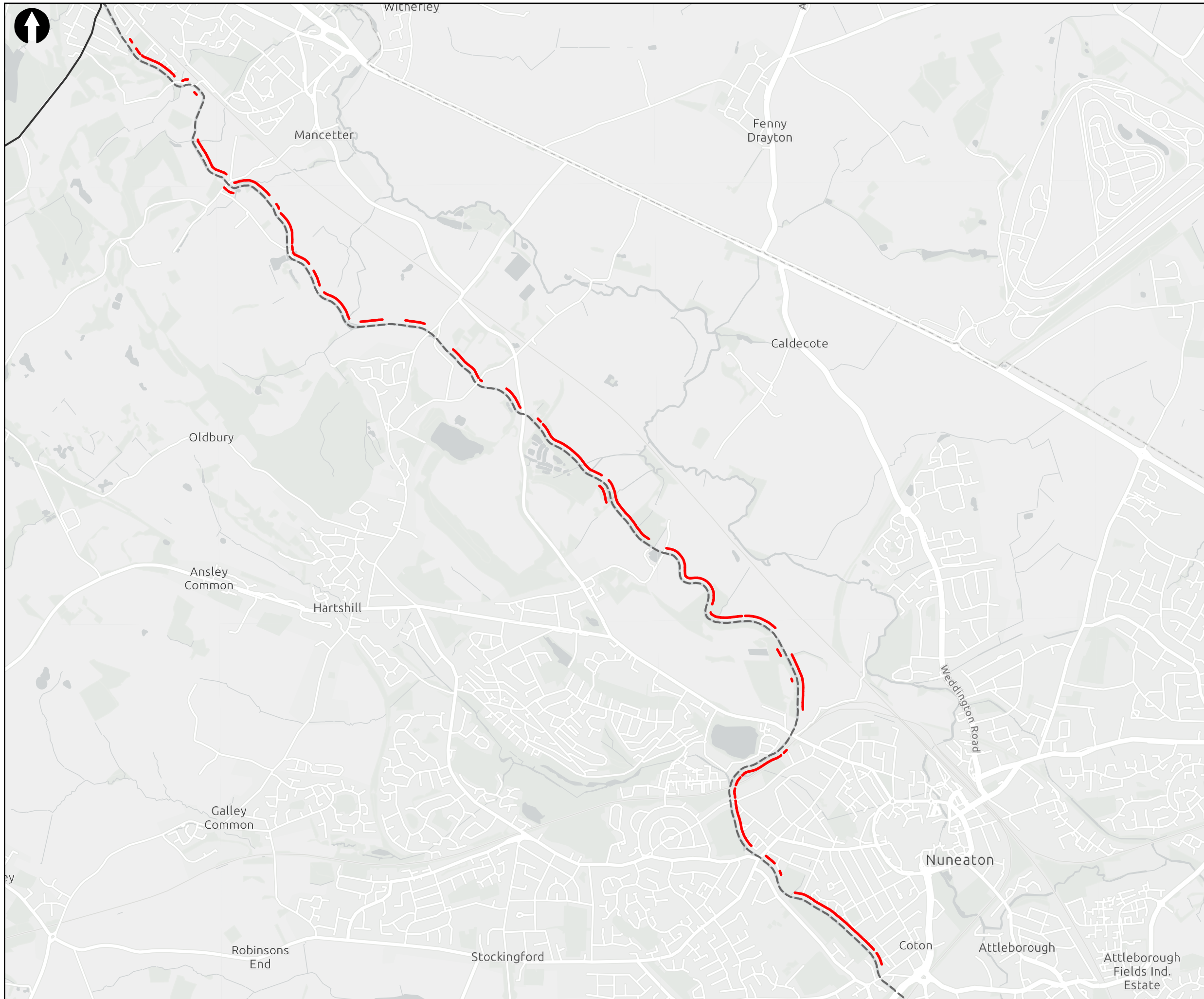
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Scale at A3	Status	Rev	Security
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Drawing Number **GUC Embankments**



### **D.3 Map of Areas of Predicted Water Level Rises, where Soft Engineered Banks are present**



Key to Symbols

- Minworth WwTW to Atherstone via pipeline
- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- Embankment Height Increase >50mm Coincident with Soft Bank Protection

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS  
 Embankment engineering from WSP (2022)  
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Author names redacted

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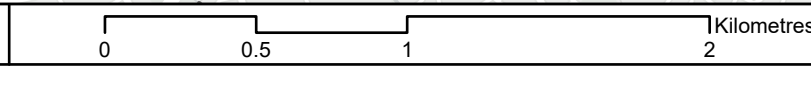
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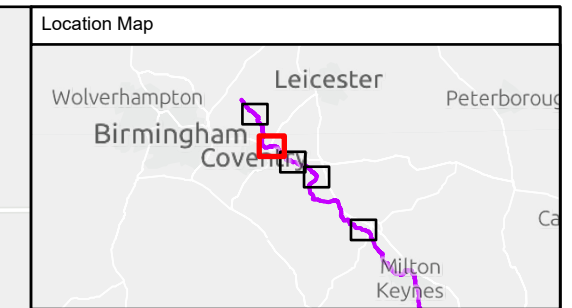
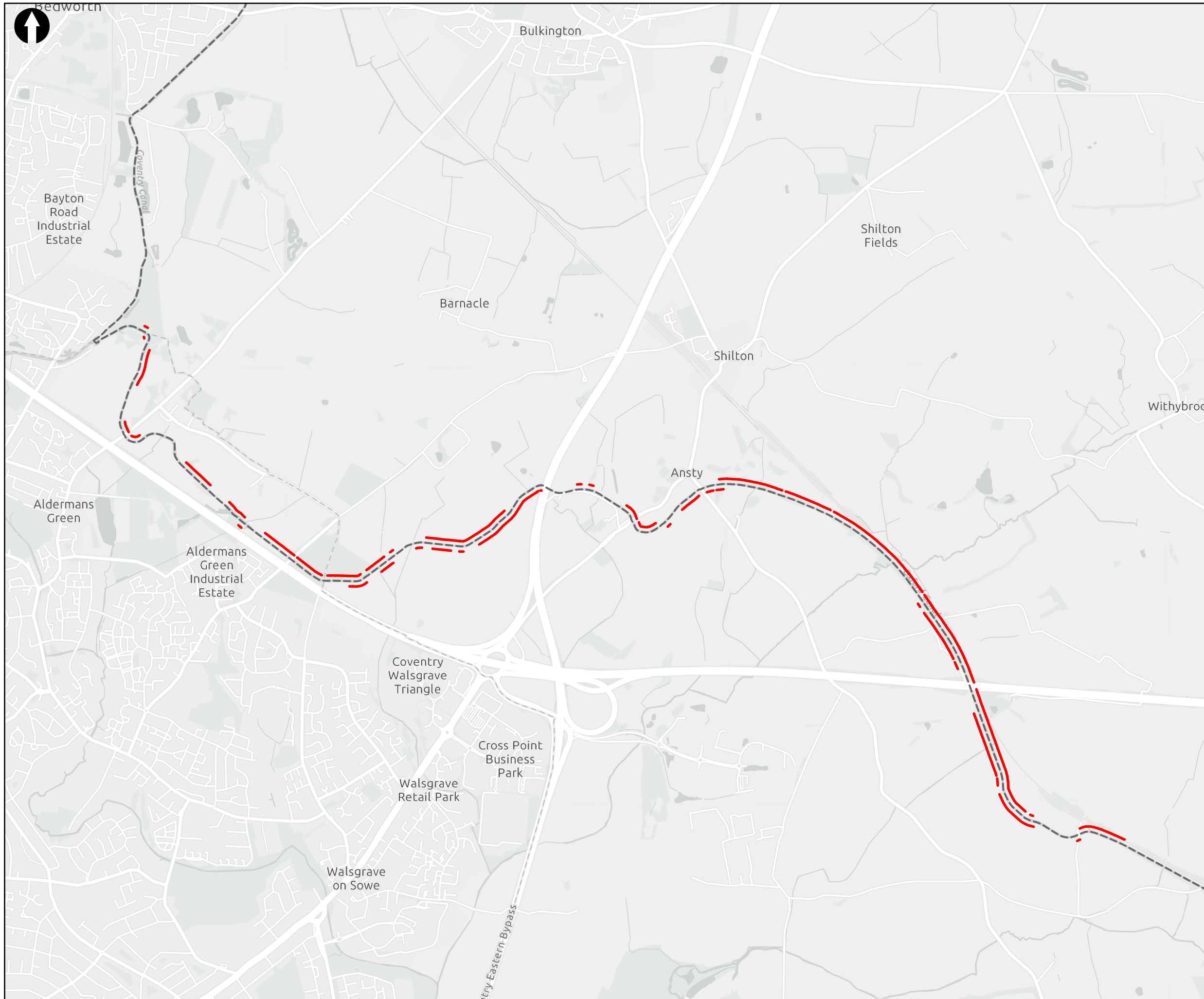


Title  
 Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases Coincident with Soft Bank Protection  
 Sheet 1 of 5

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:25,000	INF	01	STD







Key to Symbols

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- Embankment Height Increase >50mm Coincident with Soft Bank Protection

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS  
 Embankment engineering from WSP (2022)  
 Canal & River Trust (2022)

Author names redacted

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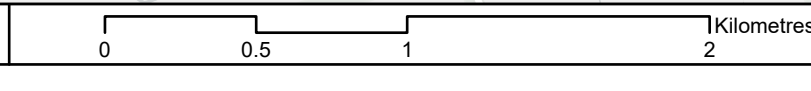
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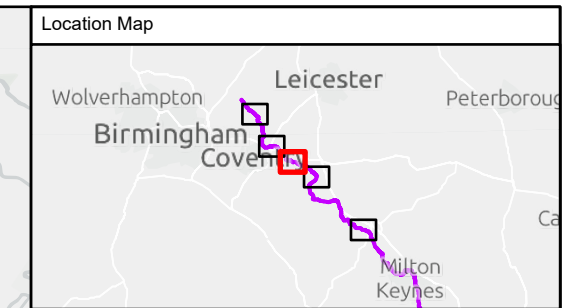
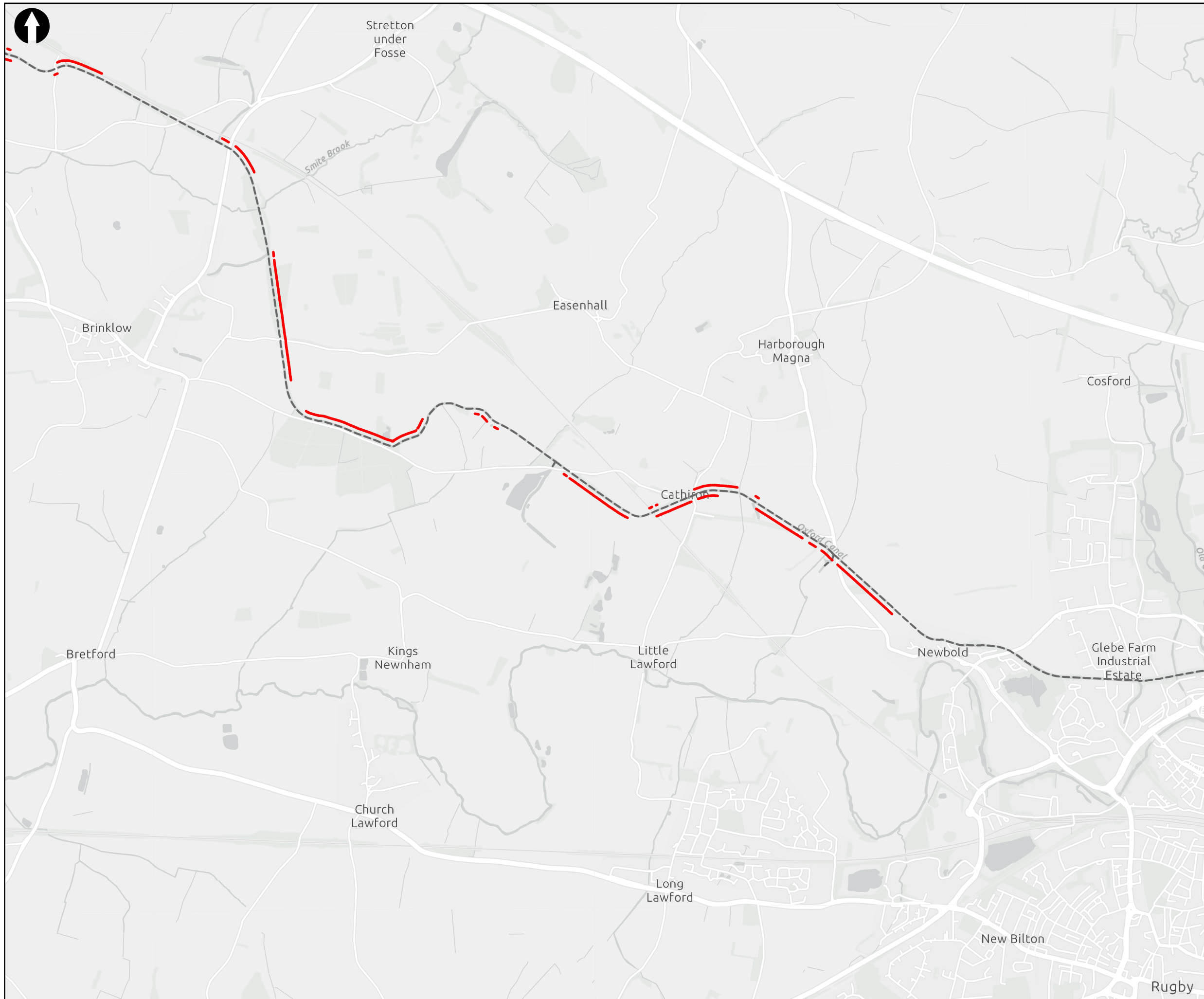
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Title  
 Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases Coincident with Soft Bank Protection  
 Sheet 2 of 5

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3	Status	Rev	Security
1:25,000	INF	01	STD







Key to Symbols

- Atherstone to Leighton Buzzard via Coventry Canal, Oxford Canal and the GUC
- Embankment Height Increase >50mm Coincident with Soft Bank Protection

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS  
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 Canal & River Trust (2022)

Author names redacted

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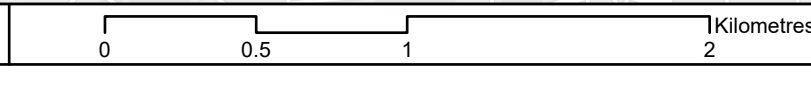
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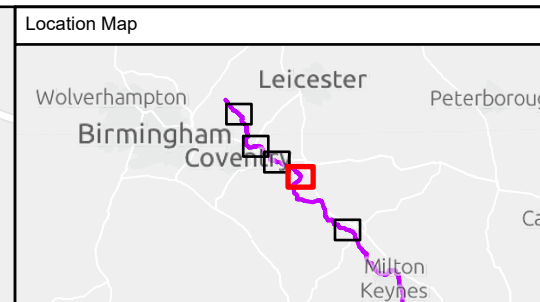
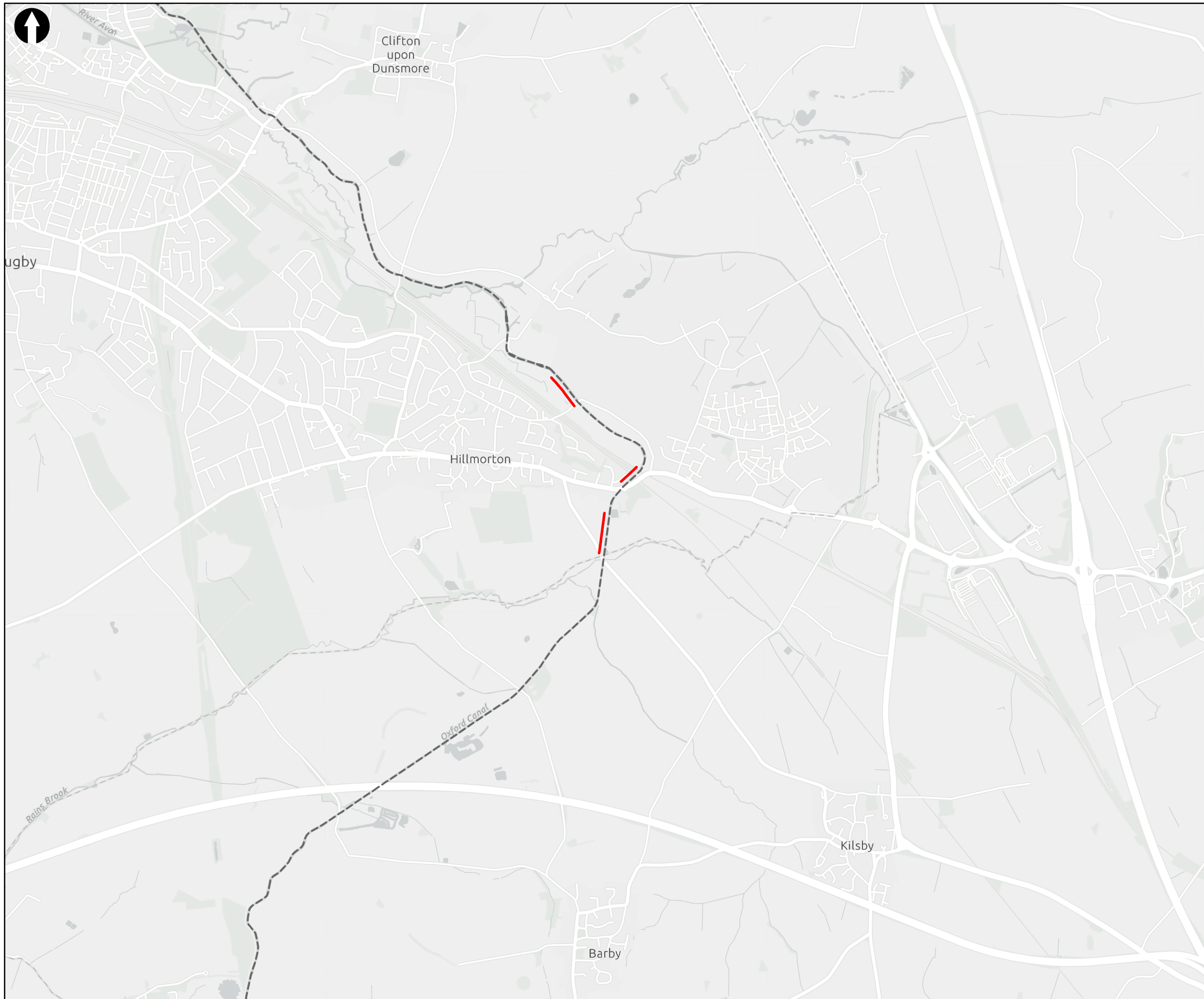
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Title  
 Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases Coincident with Soft Bank Protection  
 Sheet 3 of 5

Designed		Check	
Drawn		Coordination	
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Key to Symbols

Atherstone to Leighton Buzzard  
 --- via Coventry Canal, Oxford Canal and the GUC

Notes  
 Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS  
 Embankment engineering from WSP (2022)  
 Canal & River Trust (2022)

Author names redacted

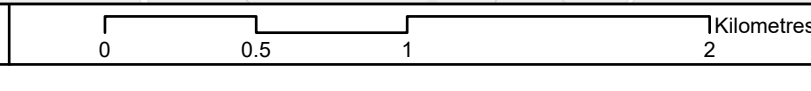
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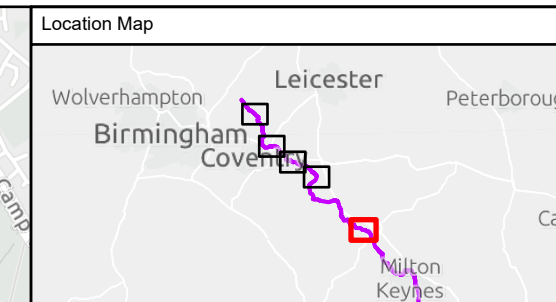
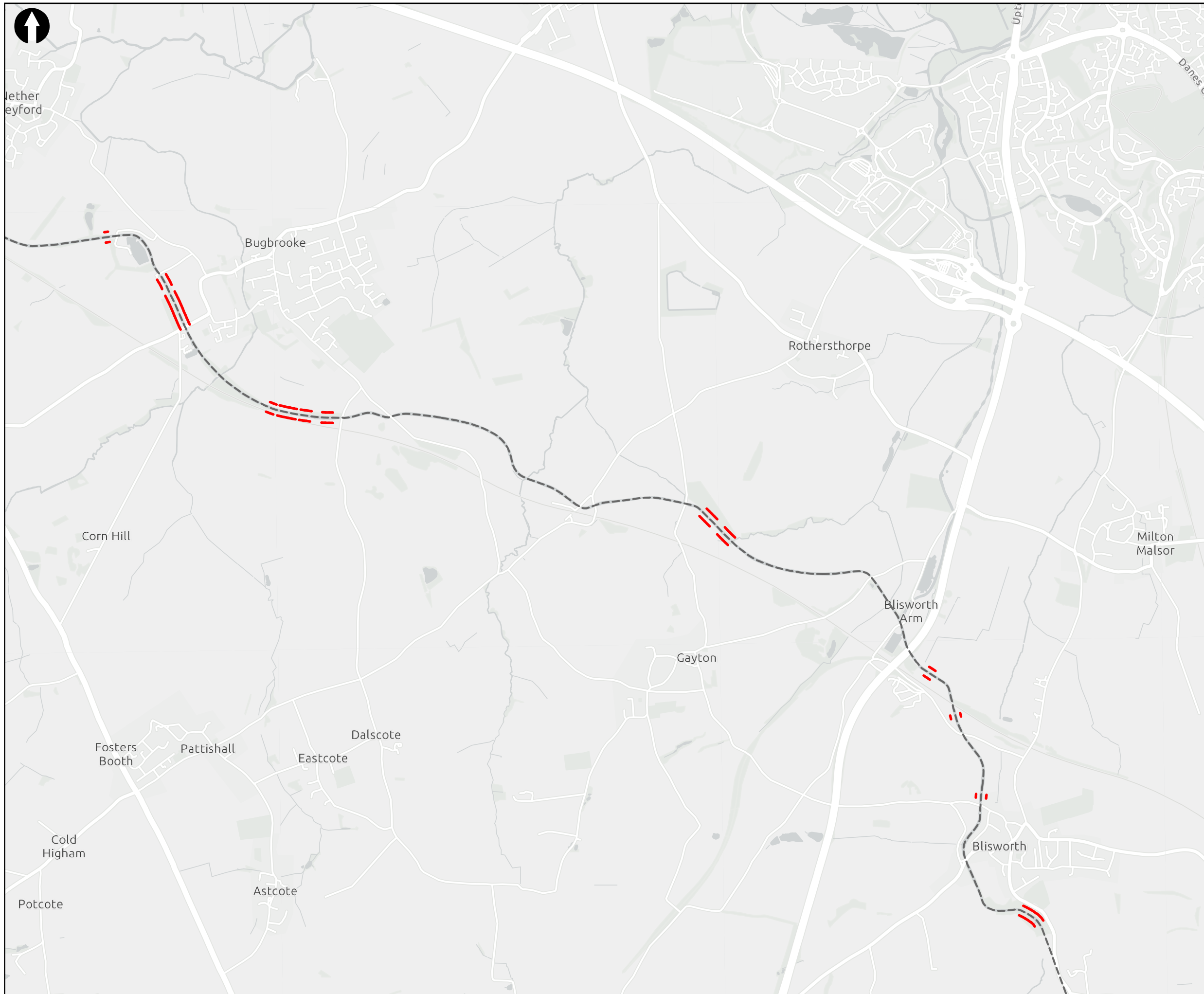
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 Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases Coincident with Soft Bank Protection  
 Sheet 4 of 5

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3 1:25,000	Status INF	Rev 01	Security STD



Drawing Number  
 Embankment Engineering Heights and Softbank





Key to Symbols

- via Coventry Canal, Oxford Canal and the GUC
- Embankment Height Increase >50mm Coincident with Soft Bank Protection

Notes

Service Layer Credits: Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS  
 Embankment engineering from WSP (2022)  
 Canal & River Trust (2022)

Author names redacted

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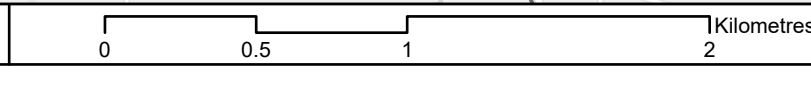
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Title  
 Grand Union Canal - Gate 2 Environmental Assessments  
 Embankment Height Increases Coincident with Soft Bank Protection  
 Sheet 5 of 5

Designed		Check	
Drawn		Coordination	
GIS Check		Approved	
Scale at A3 1:25,000	Status INF	Rev 01	Security STD





## E. Species Survey Forms

### E.1 Otter

#### E.1.1 Grand Union Canal junction with Northampton Arm

Criteria	Results
Waterbody	Canal
Weather condition	Sunny
Estimated depth	2 metres
Estimated width	7 metres
Estimated flow	Slack
Is suitable habitat present?	Yes
Further description	Shrubs, trees, herbs etc
Is suitable terrestrial habitat present? Level of cover?	Yes
Food Supply	Yes – fish, amphibians etc
Presence of any barriers to dispersal	Locks
Adjoining landuse	Meadow, woodland, highway
Level of disturbance	Moderate – footpath, roads, boat traffic
Connectivity with suitable habitat	River Bulbourne
Pollution	No
Conclusion – Likely otter presence?	Moderate to high potential

#### E.1.2 River Ouzel & GUC

Criteria	Results
Waterbody	Canal
Weather condition	Sunny
Estimated depth	0.8 metres
Estimated width	8 metres
Estimated flow	Slack
Is suitable habitat present?	Yes
Further description	Trees, reeds
Is suitable terrestrial habitat present? Level of cover?	Yes.
Food Supply	Canal and adjacent riparian habitat
Presence of any barriers to dispersal	Lock. Urbanised reach
Adjoining landuse	Residential, meadow, recreation
Level of disturbance	High
Connectivity with suitable habitat	River Ouzel and associated floodplain
Pollution	Not evident, but not impossible
Conclusion – Likely otter presence?	Moderate to high potential

### E.1.3 GUC north of Tring

Criteria	Results
Waterbody	Canal
Weather condition	Sunny but cool
Estimated depth	2.25 metres
Estimated width	8 metres
Estimated flow	Slack
Is suitable habitat present?	Yes
Further description	Banks of reeds and sedges
Is suitable terrestrial habitat present? Level of cover?	Yes
Food Supply	Canal, reservoirs etc.
Presence of any barriers to dispersal	Three locks in the vicinity
Adjoining landuse	Path, wooded area
Level of disturbance	Moderate to high. Canal and path present.
Connectivity with suitable habitat	Tring reservoirs nearby, with good connectivity
Pollution	Oil film and litter
Conclusion – Likely otter presence?	Yes

## E.2 Water vole

### E.2.1 Grand Union Canal junction with Northampton Arm

Criteria	Results
Waterbody	Canal
Bank profile	Steep
Estimated depth	2 metres
Estimated width	7 metres
Estimated flow	Slack
Bordering land use	Meadow, woodland, highway
Predominant shore/bank substrate	Artificial/reinforced
Vegetation Cover <sup>14</sup>	Bankside trees – A Bushes – A Herbs – O Reeds and Sedge – N Tall Grasses – N Short Grasses – O Submerged Weed - N
Habitat description	Canal intersection. Trees along banks.
Vegetation structure and availability of food sources	Large shrubs, trees on one bank 500m.
Level of shading	15%
Connectivity with areas of suitable habitat	Limited – lots of arable

<sup>14</sup> D= Dominant, A = Abundant, O = Occasional, F= Frequent, R= Rare.

Criteria	Results
Disturbance	High – footpath, roads, boat traffic
Conclusion – Likely water vole presence?	Moderate potential, esp, in adjacent habitats

### E.2.2 River Ouzel & GUC

Criteria	Results
Waterbody	Canal
Bank profile	Reinforced
Estimated depth	0.8 metres
Estimated width	8 metres
Estimated flow	Slack
Bordering land use	Residential, woodland, recreation
Predominant shore/bank substrate	Concrete
Vegetation Cover <sup>15</sup>	Bankside trees – O Bushes – R Herbs – R Reeds and Sedge – R Tall Grasses – N Short Grasses – O Submerged Weed - N
Habitat description	Urban canal environment
Vegetation structure and availability of food sources	<b>Reeds</b>
Level of shading	10%
Connectivity with areas of suitable habitat	Good – River Ouzel and associated floodplain
Disturbance	High – boats, people
Conclusion – Likely water vole presence?	Moderate to high potential, especially in adjacent habitats

### E.2.3 GUC north of Tring

Criteria	Results
Waterbody	Canal
Bank profile	Steep. Reinforced/hard engineered
Estimated depth	2.25 metres
Estimated width	10 metres
Estimated flow	Slack
Bordering land use	Path, woodland
Predominant shore/bank substrate	Concrete
Vegetation Cover <sup>16</sup>	Bankside trees – D Bushes – N Herbs – O Reeds and Sedge – R

<sup>15</sup> D= Dominant, A = Abundant, O = Occasional, F= Frequent, R= Rare.

<sup>16</sup> D= Dominant, A = Abundant, O = Occasional, F= Frequent, R= Rare.



Criteria	Results
	Tall Grasses – N Short Grasses – O Submerged Weed - N
<b>Habitat description</b>	Canal, floodplains grassland, scrub, shrubs and trees
<b>Vegetation structure and availability of food sources</b>	Reeds and sedges
<b>Level of shading</b>	5%
<b>Connectivity with areas of suitable habitat</b>	Tring reservoirs in vicinity
<b>Disturbance</b>	Path, canal
<b>Conclusion – Likely water vole presence?</b>	Moderate potential, esp, in adjacent habitats

