

Ecological Assessments

The content of this document is draft and relates to material [or data] which is still in the course of completion in travel to Gate 2 and should not be relied upon at this early stage of development. We continue to develop our thinking and our approach to the issues raised in the document in preparation for Gate 2.

Grand Union Canal Transfer SRO

Affinity Water, Severn Trent Water, Canal & River Trust



Grand Union Canal Strategic Transfer – Ecological Monitoring: Phase 1 Report

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Grand Union Canal Strategic Transfer – Ecological Monitoring: Phase 1 Report

Prepared for: Severn Trent Water Ltd 2 St John's Street Coventry CV1 2LZ

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Grand Union Canal Strategic Transfer – Ecological Monitoring: Phase 1 Report

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1 Introduction

1.1 Background to report

The Grand Union Canal (GUC) transfer scheme is one of the Strategic Regional Option programmes in which Affinity Water (AfW) and Severn Trent Water Ltd (STWL) are jointly funded and are working together to deliver along with the Canal & River Trust (The Trust) (the GUC Transfer project team). The scheme looks to transfer water from the Midlands to the South East using the existing canal network from source water identified as surplus at Minworth Wastewater Treatment Works in Birmingham. This report relates to the transfer of water through the canal network only. The scheme will consider various transfer volumes between 50MI/d to 100MI/d and various sub-option routes in the upper sections of the canal. The main route is illustrated in Figure 1. 1.

The purpose of this document is to present the data collected as part of the 2020 Phase 1 ecological monitoring, required as part of the GUC Transfer Scheme. For Gate 1, the GUC Strategic Transfer PMB identified the need to establish baseline ecological conditions to inform the potential impacts associated with the GUC transfer scheme.

The aim of the Gate 1 monitoring programme is, in conjunction with the GUC Strategic Transfer – Ecological Literature Review and Gap Analysis report, to inform future monitoring requirements on the GUC transfer route in relation to the GUC Strategic Transfer Scheme.

It is noted that:

- Where possible, data collected in 2020 will be used to complement existing datasets.
- The monitoring programme proposed for 2020 may not be the only and final set of ecological data collected and more data may be collected as repeat surveys and/or additional reaches as this scheme progresses through the gated process.

This report presents data collected on the GUC Transfer Route. The objectives of this report are:

- To present the 2020 survey results; and
- Present recommendations for future monitoring.

For the purposes of this report, the GUC is described in three sections:

- Upper: Birmingham & Fazeley Canal (Upper), Coventry and Ashby Canals, North Oxford Canal, and GUC from Birmingham to Learnington Spa
- Middle: GUC from Learnington Spa to Tring
- Lower: GUC from Tring to Hanwell

1.2 Timeline

A timeline for the Phase 1 Ecological Monitoring project, as part of the GUC Strategic Transfer Scheme, is shown in the following table, and is further demonstrated in Illustration 1.1.

Table 1.1 Timeline

Item	Date
Severn Trent Water, Affinity Water, Environment Agency, The Trust, Natural England: GUC Ecology Workshop	March 2020
Plan Phase 1 ecological monitoring	July – August 2020
Phase 1 ecological monitoring fieldwork	August 2020 – October 2020
Phase 1 ecological monitoring report	November 2020 – March 2021
Ecology literature review and gap analysis*	November 2020 – April 2021
Monitoring informed by Phase 1 ecological monitoring and gap analysis	Gate 2

*The GUC ecology literature review and gap analysis is a separate piece of work, outside of the scope of this project. However, recommendations from both projects will be used to inform future monitoring.



Illustration 1.1 A high-level representation of the Gate 1 ecological monitoring work programme, and how this will feed into recommendations for Gate 2 monitoring.

2 Approach

2.1 Data availability review

As part of the scoping for the 2020 Phase 1 ecological monitoring surveys for the GUC Strategic Transfer, Environment Agency online databases for ecological data were reviewed¹ and results of this review were used to inform ecological data availability throughout the canal network. Invasive non-native species (INNS) records were requested from the relevant Environment Agency area teams.

Existing data were available for macroinvertebrates and phytobenthos with the most recent data having been collected in 2009. Fish data were available for the Lower section of the GUC only, with the most recent surveys undertaken in 2013. No fish survey data were available online for the Upper and Middle sections of the GUC, and no walkover data were available for the Upper, Middle or Lower sections.

In the Middle and Lower section of the GUC, there are several adjoining river waterbodies. Macroinvertebrate, macrophyte and fish monitoring locations in close vicinity to points of canal-river waterbody interaction were captured in the data review and presented alongside the canal monitoring locations.

A full list of Environment Agency monitoring locations identified is presented in Appendix A.

GIS screening was undertaken to identify designated sites adjacent to the proposed transfer route. The screening process did not identify any sites of concern in relation to project objectives. Designated sites identified are listed in Appendix B.

2.2 Monitoring locations 2020

Survey locations were selected in the Upper, Middle and Lower sections of the GUC to provide representative coverage across the reaches of interest and pick up sensitive habitat locations, whilst aligning with existing Environment Agency and GUC Transfer Scheme monitoring programmes. Methods appropriate to establishing a baseline within a canal environment were selected based on evaluation of historic datasets and discussion with technical experts from the Environment Agency and The Trust.

Monitoring locations identified for the 2020 pre-gap analysis monitoring were as detailed in Table 2.1, and Illustration 2.1 to Illustration 2.3. In the Upper and Lower canal sections, the survey locations were chosen to align as closely as possible to the water quality sampling programme already underway as part of the GUC Transfer Scheme. Water quality sampling locations were generated and agreed in collaboration with the EA area staff.

Table 2.1	Monitoring Locations		
Location	Details	Grid Reference	Notes
GUC and Co	ventry canals – Upper Section		
1 Birminghar Canal, Minw	n & Fazeley orth	41 , 29	Located at Minworth.
¹ Accessed Au	ugust 2020 from: <u>https://environme</u>	nt.data.gov.uk/ecology-fish/	OFFICIAL SENSITIVE

Location	Details	Grid Reference	Notes
2 Coventry Canal, Fazeley		42, 30	Located on Coventry Canal south of Birmingham and Fazele canal junction
3 At River Tame, Fazeley		42, 30	On Coventry Canal, at River Tame Crossing
4 Coventry Canal, Atherstone		42 , 29	Located before junction with Ashby canal
4a Oxford Canal, Willoughby		45 , 26	Located north of junction with GUC
5 Birmingham & Warwick Canal Junction, Birmingham		40, 28	Located south of Tame confluence and north of GUC start at Bordesley Green
5a DS Bordesley Junction		40, 28	Located south Bordsele Junction. GUC has no inputs between here and Site 6
6 Grand Union Canal, Copt Heath		41, 27	Located at mid-point between 5a and Stratfor and Avon Canal Junctio
7 Grand Union Canal, Leamington Trough Pound		43 , 26	Located north of Oxford and Erewash canal Junction
GUC and Coventry canals	- Middle Section		
8 Grand Union Canal. Welton Lane, Daventry	APEM additional location	45 , 26	Located east of GUC Leicester Arm junction
9 Grand Union Canal. Long Buckby Wharf	APEM additional location	46 , 26	Located west of GUC Leicester Arm junction
GUC – Lower Section*			
10 Grand Union Canal, Tring	GUC at Tring	49, 21	US of River Bulbourne (Historic EA Ecology location)

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Location	Details	Grid Reference	Notes
11 Grand Union Canal, Hemel Hempstead	GUC	50, 20	US of River Gade (Hemel)
12 Grand Union Canal, Above Batchworth Lock	GUC	50 , 19	US of River Chess and River Colne

*Monitoring location selection for the GUC – Lower Section has focused on locations upstream of the interactions with chalk streams.

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3 Methodology

Monitoring methods were workshopped and agreed in collaboration with The Trust and Environment Agency area staff prior to commencement of the Gate 1 monitoring programme.

3.1 Canal CPET

The macroinvertebrate family Chironomidae (midge larvae) colonises a wide variety of water quality habitats and the CPET method assesses nutrient enrichment based on chironomid species composition. The CPET methodology can be used to provide a robust, representative assessment of canal ecological quality and may be particularly useful in cases where there is a requirement to assess changes in nutrients.

The method involves skimming the water surface of the canal with a hand net (extendable handle with mesh size of 250 um) to collect floating chironomid pupal exuviae. Collection of three samples from different months (August, September and October 2020) was required to capture at least 80% of the species present across the whole year. Using sub-samples, two hundred chironomid pupal exuviae were identified from each sample to genus level, and a single list of taxa for the year was produced. Nutrient sensitivity scores are assigned to each chironomid taxon, and an overall canal quality assessment category (Good, Moderate, Poor or Bad)² is derived for each monitoring location.

3.2 Fish Survey and habitat walkover

The survey approach for pre-gap analysis fish monitoring was based around the adoption of habitatspecific methodologies for the different conditions present at each monitoring location, i.e. overall fishing effort was allocated amongst the broad habitat types (predominantly marginal fringe and open water) in proportion to their spatial extents within each 500m survey reach. Habitat types present at each location were identified prior to survey, with habitat maps subsequently produced (using GIS) for each monitoring location.

Point Abundance Sampling by Electric-fishing (PASE) was undertaken in marginal and macrophyte dominated areas, where possible, and seine netting was undertaken at all survey locations in areas of open water to target species that may be less likely to be captured by the PASE method. Given the high turbidity of the canal, general lack of marginal macrophyte stands and dominance of open water habitat, the methodology predominantly focused on targeted seine-netting, with some electric-fishing undertaken to supplement the seine-net catches. Overall fish density and community composition was derived for each monitoring location.

Such targeted and dynamic sampling was chosen in order to avoid closure and disruption of the canal network.

Seine netting in open water areas

Seine netting was undertaken in the canal using multiple applications of a 25m long fine mesh (10mm), deep (2m) seine net. Seine netting targeted pelagic species of all ages occupying marginal and open water habitats, which were identified during the walkover component of the survey. Young of year fish were identified to species where possible, with approximate counts used to minimize handling.

² Ruse, L. P. (1998) A biological key to canal water quality. The Journal of the Chartered Institution of Water and Environmental Management (12), Vol. 3

Point Abundance Sampling by Electric-fishing (PASE) in marginal and macrophyte dominated areas

PASE was undertaken in marginal and macrophyte dominated areas of the canal, notably where other methods (e.g. quantitative electric-fishing and wrap-around seine netting) were not feasible due to canal operation and H&S considerations.

PASE targeted juvenile life stages occupying marginal habitats and those dominated by macrophytes and structures (moorings etc.). It was anticipated that marginal areas may also be the most likely habitats for predatory fish species, notably pike, perch and zander. Fish caught were processed on the boat before being returned to the canal, and invasive non-native species were retained and humanely destroyed.

Survey Limitations

It should be acknowledged that the survey methodology applied is not fully quantitative, and results should not be regarded as fully representative of the fish communities of the GUC. Due to the semiquantitative nature of the survey methodology, it is likely that some large fish – such as carp – may have been missed.

In order to address this issue, it was recommended that drawdowns on the GUC (planned as part of the Trust's winter works programme) were attended by APEM field staff to process fish removed from the canal as part of the drawdown process. Fully quantitative data from a drawdown were to be cross-referenced with data from a co-located fish survey location to allow for calibration of the 2020 fish survey data. However, due to logistical and operational factors, this work was unable to be progressed in 2020.

Additionally, angling catch data were requested from local angling clubs, to supplement survey data. It was expected that angling catch data would highlight large, predatory species which may have otherwise been overlooked due to the semi-quantitate nature of the survey methodology. However, no records were received in time for submission of this report. A short online data search was therefore undertaken, to identify additional fish records from the GUC. This flagged online records for angling clubs operating in the southern reaches of the GUC. Further review of angling catch data and drawdown of the canal for fish populating assessment will be considered for carry-over to Gate 2 monitoring – further detail is provided under Section 6.2.

The canal environment itself brings a number of challenges. Notably, extremely high turbidity limited the ability to safely undertake electric-fishing; therefore, surveys majored in the targeted seine-netting approach. Furthermore, several reaches of the GUC (certain Sub-Option routes) flow through highly urbanised areas of Birmingham, Greater Birmingham and Greater London. This brought further difficulties, particularly in central Birmingham, where debris in the channel made survey conditions challenging, due to snagging equipment and reduced ability to safely navigate the watercourse.

Access was not granted at Location 7 (GUC at Learnington Trough Pound). As agreed with The Trust, to avoid disturbing the activities of local stakeholders, a survey was not undertaken at this location. Alternative monitoring locations were considered; however, there was deemed to be adequate coverage of survey locations to provide suitable data for assessment of fish populations without replacing Location 7.

3.3 Invasive non-native species

INNS were identified through the surveys described above; however, INNS may be under-reported without targeted surveying, e.g. bloody red shrimp

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Environment Agency monitoring data were used to supplement the INNS assessment. Data were supplied in August 2020, following a request to local area teams.

4 Results

4.1 Canal CPET

4.1.1 Interpretation of Results

The stretch of the canal network running from Minworth then south through Birmingham towards Leamington Spa demonstrates the greatest degree of ecological pressure via poor water quality, as indicated by the canal quality classifications³ calculated for monitoring locations within this reach (for monitoring locations, see Illustration 2.1 and Illustration 2.2). The canal quality assessment classification was Poor for monitoring Location 1 (Birmingham & Fazeley Canal, Minworth), Location 5 (Birmingham & Warwick Canal Junction), Location 5a (DS Bordesley Junction), Location 7 (Leamington Trough Pound), and Location 8 (Welton Lane, Daventry). The canal quality assessment classification was Bad for Location 6 (Copt Heath). These monitoring locations – located on the Birmingham & Fazeley canal, Birmingham & Warwick Canal, and GUC – were found to have relatively similar chironomid community compositions, dominated by taxa tolerant of poor water quality and pollution.

The canal quality assessment classification for Location 2 (Coventry Canal, Fazeley), Location 4 (Coventry Canal, Atherstone) and Location 4a (Oxford Canal, Willoughby) was Moderate. These monitoring locations are on the Coventry and Oxford canals, on the north-east arm of the proposed transfer route (see Illustration 2.1). The chironomid communities at these monitoring locations included species that are less tolerant of poor water quality and pollution, compared to locations on the western arm, and some pollution-sensitive taxa were also identified, suggesting an improvement in water quality at monitoring locations on the Coventry Canal and Oxford Canal.

Location 9 (Long Bucky Warf) is located on the GUC after the confluence with the Oxford Canal (see Illustration 2.2). The canal quality assessment classification for Location 9 (Long Bucky Warf) was Moderate. This indicates an improvement in canal ecological quality, relative to upstream locations on the GUC (Birmingham arm). The canal quality assessment classification for Location 9 (Long Bucky Warf) was similar to Location 2, Location 4 and Location 4a on the Coventry and Oxford canals.

Data suggested that canal ecological quality was similar at the lower reaches of the GUC, in the southeast; the canal quality assessment classification for Location 11 (Hemel Hempstead) and Location 12 (Above Batchworth Lock) was Moderate (for monitoring locations, see Illustration 2.3). The canal quality classification for Location 10 (Tring) was Poor; however, a low number of pupal skins were collected and therefore this classification is regarded as uncertain (see *Data Limitations*, below), and over 10% of the community identified at Location 10 was in fact comprised of pollution-sensitive taxa. The greatest degree of community diversity was observed at the most southernly monitoring location, Batchworth Lock. At Batchworth, the GUC is influenced by inputs from the River Gade and River Colne, and the positive effects of this on canal ecology are evident in the chironomid community. Batchworth Lock was the only canal location at which fast-water taxa *Cardiocladius* was found, and the greatest abundance of pollution-sensitive taxa was observed at this location.

Data Limitations

As indicated above, a low number of pupal exuviae were collected at Location 10 (Tring), and therefore the Poor classification is regarded as uncertain. Only 326 pupal skins were collected – this should be 600 for accurate analysis. Chironomid pupal exuviae generally become caught at canal structures,

³ Ruse, L. P. (1998) A biological key to canal water quality. The Journal of the Chartered Institution of Water and Environmental Management (12), Vol. 3

within in-channel macrophyte growth, or within in-channel debris. A relative lack of these elements at Location 10 (Tring) may explain the low number of pupal exuviae collected.

4.1.2 Monitoring location evaluations

A summary evaluation of each canal CPET monitoring location is given in Table 4.1.

Table 4.1 Canal CPET monitoring location evaluations

Location No.	Location name	Location Evaluation
		Classification: Poor
1	Birmingham & Fazeley Canal, Minworth	Characteristic of poor water quality. The chironomid community at this location was found to be tolerant of poor water quality and pollution.
		Classification: Moderate
2	Coventry Canal, Fazeley	The chironomid community at this location was found to be less tolerant of poor water quality and pollution, compared to locations on the south-west arm. Some pollution-sensitive taxa were identified.
		Classification: Good
3	At River Tame, Fazeley	CPET sampling was undertaken on the River Tame. This allowed for independent ecological assessment of the River Tame.
3		The methodology is not designed for river water bodies; however, samples collected indicate an absence of significant water quality pressure at the River Tame monitoring location.
		Classification: Moderate
4	Coventry Canal, Atherstone	The chironomid community at this location was found to be less tolerant of poor water quality and pollution, compared to locations on the south-west arm. Some pollution-sensitive taxa were identified.
		Classification: Moderate
4a	Oxford Canal, Willoughby	The chironomid community at this location was found to be less tolerant of poor water quality and pollution, compared to locations on the south-west arm. Some pollution-sensitive taxa were identified.
	Dirminghom 8	Classification: Poor
5	Birmingham & Warwick Canal Junction, Birmingham	Characteristic of poor water quality. The chironomid community at this location was found to be tolerant of poor water quality and pollution.
5a	DS Bordesley Junction	Classification: Poor

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Location No.	Location name	Location Evaluation
		Characteristic of poor water quality. The chironomid community at this location was found to be tolerant of poor water quality and pollution.
		Classification: Bad
6	Grand Union Canal, Copt Heath	Characteristic of poor water quality. The chironomid community at this location was found to be tolerant of poor water quality and pollution.
	Crand Union Conel	Classification: Poor
7	Leamington Trough Pound	Characteristic of poor water quality. The chironomid community at this location was found to be tolerant of poor water quality and pollution.
		Classification: Poor
8	8 Grand Union Canal. Welton Lane, Daventry	Characteristic of poor water quality. The chironomid community at this location was found to be tolerant of poor water quality and pollution.
		Classification: Moderate
9	Grand Union Canal. Long Buckby Wharf	The chironomid community at this location was found to be less tolerant of poor water quality and pollution, compared to locations upstream on the GUC. This location is downstream of the confluence of the GUC with the Coventry/Oxford Canal. Some pollution-sensitive taxa were identified.
		Classification: Poor
10	Grand Union Canal, Tring	The Poor classification may reflect low number of pupal skins collected. Only 326 pupal skins were collected – this should be 600 for accurate analysis.
		Some pollution-sensitive taxa were identified.
		Classification: Moderate
11	Grand Union Canal, Hemel Hempstead	The chironomid community at this location was found to be less tolerant of poor water quality and pollution, compared to locations upstream on the GUC. Some pollution-sensitive taxa were identified.
	Grand Union Canal	Classification: Moderate
12	Above Batchworth Lock	This is the only canal location at which fast-water taxa <i>Cardiocladius</i> was found. At Batchworth, the GUC is influenced by faster-flowing inputs from the Colne and Gade rivers. The greatest number of taxa

Location No.	Location name	Location Evaluation
		were identified at this location, with the greatest abundance of pollution-sensitive taxa.

4.2 Fish Survey and habitat walkover

4.2.1 Interpretation of Results

4.2.1.1 Habitat Walkover

In-channel habitat types were identified as part of the fish survey methodology employed, and habitat maps of each survey location are in displayed in Figure 4. 1 to Figure 4. 12. Across all survey locations, two primary habitat types were recorded: open water and (heavily modified) marginal fringe. Marginal fringe comprised that along the margins of the canal and was inclusive of the reinforced canal bank. Marginal structures relating to boating activity and overhanging bankside vegetation were also commonly identified.

Habitat walkovers identified an absence of significant semi-naturalised canal habitat. All banks were modified and reinforced, with an absence of semi-naturalised canal banks. At the majority of survey locations, habitat walkovers did not identify any significant emergent macrophyte stands. Macrophyte growth was generally sparse, with very limited in-channel abundance; narrow stands of emergent linear marginal vegetation were identified at only a few locations – Location 1 (Birmingham & Fazeley Canal, Minworth), Location 4 (Coventry Canal, Atherstone) and Location 4a (Oxford Canal, Willoughby). Bankside vegetation was also very limited, with much of the bank top dominated by towpath throughout. Where towpaths are not maintained, bankside vegetation largely comprises over-hanging scrub and minor stands of broadleaf woodland.

At Minworth, the Birmingham & Fazeley Canal is bordered by mixed industrial development and agricultural land. East of here, towards Fazeley and Atherstone, land-use adjacent to the Coventry Canal becomes increasingly dominated by agriculture, with some suburban development.

The Grand Union Canal is heavily urbanised in its upper reaches at Birmingham. Moving south, towards Solihull, Learnington Spa and Daventry, there is a lesser degree of urbanisation, and an increasing dominance of agricultural land-use and suburban development.

In the south-east, at Tring, land use is a mix of suburban development and agricultural fields. South of Tring, the degree of urbanisation increases towards Hemel Hempstead and Batchworth Lock, as the canal moves south . In the south-east, the canal becomes interconnected several surface water bodies; notably, the chalk rivers of the Colne valley, including the River Colne, River Bulbourne and River Gade.

4.2.1.2 Fish Survey Data

Fish surveys indicated varying fish community diversity and abundance throughout the course of the Birmingham & Fazeley Canal, Coventry Canal, Oxford Canal and Grand Union Canal (see Illustration 4.1).

At a number of monitoring locations, the fish community was dominated by one or two species in high abundance – primarily roach. This is particularly notable at Location 5 (Birmingham and Warwick Canal Junction) and Location 8 (Welton Lane). At location 5 (Birmingham and Warwick Canal Junction), roach were recorded in abundance of 60 fish/100m² (size range: 30 – 230 mm), and perch were recorded in



abundance of roughly 18 fish/100m² (size range: 30 - 170 mm). At location 8 (Welton Lane), roach were recorded in abundance of 50 fish/100m² (size range: 28 - 260 mm), and bream were recorded in abundance of roughly 22 fish/100m² (size range: 24 - 292 mm). At both locations, individuals of other species were recorded in relatively low abundance.

The 2020 survey data found that abundance and diversity of the fish community was notably low at Location 5a (DS Bordesley Junction) and Location 6 (Copt Heath). At Location 5a, only 14 fish/100m² were recorded, with the community comprising of only roach, perch and bullhead. This likely reflects the heavily urbanised nature of the canal here, being close to central Birmingham and bordered by industrial development. The habitat survey undertaken identified very little bankside vegetation or shading.

Community diversity was greatest at monitoring locations in the south-east at Location 10 (Tring), Location 11 (Hemel Hempstead), and Location 12 (Above Batchworth Lock); although overall abundance of fish was low at Location 12 (Above Batchworth Lock). Bleak were recorded at all three monitoring locations. As a primarily river species, the presence of bleak at these locations likely reflects the high degree of connectivity between the GUC and the neighbouring chalk streams (notably the rivers Bulbourne, Colne, Gade and Chess). Furthermore, species abundance was most evenly distributed between the community at Location 11 (Tring); generally, this is reflective of a more stable, more ecologically sound, fish community.



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Illustration 4.1 Fish species abundance (fish/100m²) at monitoring locations on the Birmingham & Fazeley Canal, Coventry Canal, Oxford Canal and Grand Union Canal

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Zander (*Sander lucioperca*) is non-native species in UK waters; introduced legally into lakes at Woburn Park in 1878 and later into the Great Ouse Relief Channel. Zander have subsequently spread and can now be found in the Oxford Canal, Ashby Canal, Coventry Canal, and GUC, alongside several other UK canal water bodies. Within the canal environment, zander typically do well in turbid, murky waters that are heavily boated (The Trust, 2020). In these environments, zander have been found to actively target gudgeon and other small fish, such as roach, as prey species (Smith, 2020).

The fish surveys identified the presence of zander at several survey locations. While this does not provide a definitive assessment of zander distribution throughout the GUC; it does provide an indication of where this species may be prevalent. Zander were recorded at the following locations:

- 4. Coventry Canal, Atherstone (see Illustration 2.1):No. of zander caught: 1; size range: 170 mm
- 4a. Oxford Canal, Willoughby (see Illustration 2.1): No. of zander caught: 2; size range: 115 335 mm
- 8. GUC, Daventry (see Illustration 2.2): No. of zander caught: 7; size range: 81 215 mm
- 9. GUC, Long Buckby Warf (see Illustration 2.2): No. of zander caught: 4; size range: 105 290 mm

These are amongst the more rural, and less urbanised reaches of the GUC. However, annual boat movement data recorded at locks in close proximity to these survey locations (as provided by The Trust), demonstrate significant boat traffic at these locations; with >5000 annual boat movements at Atherstone (average 2000-2019) and >9000 annual boat movements at Willoughby (average 2000-2019). No gudgeon were recorded in reaches where zander were identified.

Angling Catch Data

Angling catch data were requested from angling clubs which manage the reaches of canal where surveys were undertaken. Unfortunately, no records were received in time for submission of this report.

A short online data search was therefore undertaken, to identify additional fish records from the GUC. This flagged online records for angling clubs operating in the southern reaches of the GUC.

The Watford Piscators operate on a section of canal between Watford and Rickmansworth, just upstream of Batchworth Lock (Location 12). Their records document large carp, chub and bream as common catches within this southern reach of the GUC, along with roach and perch. URACS, Blenheim Angling and North Harrow Waltonians operate on a section of canal which stretches south from Batchworth Lock. They note species to be found at their most upstream pound, at Batchworth Lock, as: bream, carp, roach, tench and pike.

Cross-referenced with survey data from Batchworth Lock (Location 12), this indicates that – as expected – the mixed seine-netting and PASE electric-fishing approach did not pick up presence of some large predatory species, including carp.

4.2.2 Monitoring location evaluations

A summary evaluation of each fish monitoring location is given in Table 4.2.

Report Status: Draft

Location No.	Location name	Location Evaluation
		Species: Bream, gudgeon, perch, pike, roach.
	Birmingham &	Community dominated by roach, with perch and bream also relatively abundant. Greatest number of pike recorded at this location.
1	Fazeley Canal,	INNS: Signal Crayfish
	Minworth	Site Suitability: Main road and Minworth STW to the south; agricultural fields to the north; some linear marginal and overhanging vegetation on the north bank. Generally good site suitability.
		Species: Bream, perch, pike, roach, ruffe.
		Community dominated by roach; bream, perch, pike and rough were recorded in comparatively low numbers.
2	Coventry Canal, Fazeley	INNS: None observed.
		Site Suitability: Some scrub and overhanging vegetation on the south bank. Large debris and rubbish picked up in seine nets; dead rat. Location in proximity to some urban development; subject to rubbish dumping, fly tipping, which may have negative impacts on fish communities.
3	At River Tame, Fazeley	Location 3 was not monitored. Location 2 was extended as an alternative.
	Coventry Canal, Atherstone	Species: Bream, perch, pike, roach, ruffe, zander.
		Community dominated by bream and roach, with some perch and ruffe. Only one pike recorded. Most northernly record of zander (only one individual recorded).
4		INNS: Signal crayfish, zander
		Site Suitability: Some low scrub and marginal vegetation; with some shade from over-hanging scrub and bankside vegetation. Largely agricultural land use. Generally good site suitability.
		Species: Bream, perch, roach, zander.
	Ovford Capal	Community heavily dominated by roach, with some bream and perch recorded. Two zander were recorded.
4a	Willoughby	INNS: Signal crayfish, zander
		Site Suitability: Some low scrub and marginal vegetation; with some shade from over-hanging trees. Largely agricultural land use; house set-back from bankside. Generally good site suitability.

Location No.	Location name	Location Evaluation
		Species: Bream, perch, pike, roach, ruffe.
	Birmingham &	Community heavily dominated by roach; however, a large abundance of perch was also recorded. Small numbers of bream, pike and ruffe recorded.
5	Warwick Canal	INNS: None observed.
	Junction, Birmingham	Site Suitability: Heavily urbanised area, close to central Birmingham; heavily modified; several canal structures (bridges); good shading from overhanging broadleaf trees; open water in the middle of the channel more open and less shaded. Generally good site suitability, despite heavily urbanised location.
		Species: Perch, roach, bullhead.
		Relatively few fish recorded, with perch in greatest abundance. Some roach and bullhead recorded.
5a	DS Bordesley Junction	INNS: None observed.
		Site Suitability: Heavily urbanised area, close to central Birmingham; industrial buildings by the bank; heavily modified; very open with little bankside vegetation and very little shading; deep, open water; lots of anthropogenic debris in the channel making it challenging to survey.
	Grand Union Canal, Copt Heath	Species: Perch, roach, ruffe.
6		Perch and roach most abundant – roach in relatively low abundance, compared to survey locations north-east of Birmingham. Several ruffe also recorded.
6		INNS: None observed.
		Site Suitability: Located south of Birmingham, with urban and agricultural land use. Some bankside scrub, with shading from over-hanging broadleaf trees. High turbidity.
7	Grand Union Canal, Leamington Trough Pound	No survey was undertaken at Location 7 – access not granted. See <i>Survey Limitations</i> under Section 3.2.
		Species: Bream, perch, roach, ruffe, zander.
8	Grand Union Canal. Welton Lane, Daventry	Large abundance of roach recorded (400+ individuals), with bream also in abundance. Some perch and ruffe recorded. Seven zander recorded. INNS: Zander

Location No.	Location name	Location Evaluation
		Site Suitability: Located close to Daventry, with mixed urban and agricultural land use. Some bankside scrub, with shading from over-hanging broadleaf trees. Several moored canal boats. Generally good site suitability.
		Species: Bream, perch, pike, roach, ruffe, three-spined stickleback, zander.
	Grand Union	Roach most abundant, with a number of bream and perch recorded. Several, pike, ruffe and three-spined stickleback also recorded. Four zander were recorded.
9	canal. Long	INNS: Zander, signal crayfish
	Buckby Wharf	Site Suitability: Located below the confluence of the GUC and Oxford Canal. Some bankside scrub, with shading from over-hanging broadleaf trees. Several moored canal boats; house set-back from bankside. Generally good site suitability.
	Grand Union Canal, Tring	Species: Bleak, bream, hybrid bream & roach, perch, pike, roach, ruffe.
10		Species abundance was more evenly distributed, with bleak, hybrid bream & roach, perch and roach most abundant. Some bream, pike and ruffe also recorded.
10		INNS: None observed.
		Site Suitability: Significant shading from over-hanging broadleaf woodland. Several moored canal boats. Generally good site suitability. Land-use is mixed urban and rural.
		Species: Bleak, chub, gudgeon, perch, pike, roach, ruffe.
11	Grand Union Canal, Hemel Hempstead	Roach most abundant, and the largest number of gudgeon were recorded. Only record of chub – with 5 individuals recorded – and one of few records of bleak – with 3 individuals recorded. Several ruffe, pike and perch also recorded.
		INNS: None observed.
		Site Suitability: Shading from over-hanging broadleaf woodland. Open water in the middle of the channel and less shaded. Generally good site suitability. Land-use is mixed urban and parkland.
		Species: Bleak, gudgeon, perch, pike, roach, ruffe.
12	Grand Union Canal, Above Batchworth Lock	Overall low abundance of fish recorded; roach were recorded in greatest abundance (but only 10 individuals). Ruffe and perch recorded in similar numbers, with several bleak, pike and gudgeon also recorded.
		INNS: Signal crayfish

Location No.	Location name	Location Evaluation
		Site Suitability: Shading from over-hanging broadleaf trees. Open water in the middle of the channel and less shaded. A number of moored canal boats throughout the survey reach. Heavily urbanised area, north-west of London.

4.3 Invasive non-native species

Records of invasive non-native species present within the reaches of interest were supplied by the Environment Agency and are listed in Table 4.3 (macroinvertebrates) and Table 4.4 (macrophytes).

Fish (Zander)

Fish surveys identified the presence of zander at several survey locations (see 4.2.1.2).

Macroinvertebrates

Zebra mussel (*Dreissena polymorpha*) and demon shrimp (*Dikerogammarus haemobaphes*) have been identified in both the upper (Birmingham & Fazley Canal and Oxford Canal) and lower (GUC, south of Berkhamstead) reaches of the study area – see Table 4.3. Both species are relatively widespread in the southern section of the GUC and are likely increasing in prevalence (likely as a product of human related-activities, such as navigation). Owing to the already wide-spread distribution of these species, the GUC Strategic Transfer is unlikely to pose a great risk in increasing their range.

Signal crayfish (*Pacifastacus leniusculus*) were identified at several survey locations on the Birmingham and Fazeley, Coventry, and Grand Union canals: Location 1 (Birmingham & Fazeley Canal, Minworth), Location 4 (Coventry Canal, Atherstone), Location 4a (Oxford Canal, Willoughby), Location 9 (Long Bucky Warf), and Location 10 (Above Batchworth Lock). It is likely that signal crayfish are widespread throughout the study area, and records obtained from the Environment Agency demonstrate that this species is already well established in the chalk rivers of the south east region, which interact with the GUC.

It is known that quagga mussel (*Dreissena bugensis*) is present in the south east of England, originally identified in the Wraysbury River and Wraysbury Reservoir. The Wraysbury River is distributary of the River Colne towards the south of the Colne Valley, leaving the River Colne at West Drayton and rejoining the main channel just upstream of the confluence with the River Thames. Quagga mussel has extended its range in the south east – although no records were supplied for the GUC study area in the data provided by the Environment Agency.

Macrophytes

Floating pennywort (*Hydrocotyle ranunculoides*) was identified on the River Colne and lower reaches of the GUC. Significant work has been undertaken to remove pennywort in the Colne catchment as part of a project run by a steering group of local stakeholders and the Environment Agency. No records of invasive non-native macrophytes were provided by the Environment Agency for the upper reaches of the GUC.

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Site Code	Location	Grid Reference	Notes
GUC – Upper Section			
Demon shrimp (Dikerogammarus haemobaphes)	Birmingham Fazeley Canal	SK2031201897	At Fazeley Junction
Demon shrimp (Dikerogammarus haemobaphes)	Oxford Canal	SP3623284593	North of Coventry
Zebra mussel (<i>Dreissena</i> polymorpha)	Oxford Canal	SP3623284593	North of Coventry
GUC Lower Section*			
Demon shrimp (Dikerogammarus haemobaphes)	River Bulbourne	TL0265406341	US of GUC
Demon shrimp (Dikerogammarus haemobaphes)	River Gade	TQ0907296255	Location in connection with GUS (US and DS)
Demon shrimp (Dikerogammarus haemobaphes)	River Colne	TQ0530094200	DS of GUC, Gade & Chess
Zebra mussel (Dreissena polymorpha)	River Bulbourne	TL0265406341	
Zebra mussel (Dreissena polymorpha)	GUC (Pix Farm Reach)	TL0270006300	River Bulbourne section
Signal crayfish (Pacifastacus leniusculus)	River Bulbourne	TL0265406341	US of GUC
Signal crayfish (Pacifastacus leniusculus)	River Gade	TL0412810065	Significantly US of GUC, <i>P. leniusculus</i> present throughout river Gade
Signal crayfish (Pacifastacus leniusculus)	River Chess	TQ0264898966	Significantly US of confluence with River Colne and GUC

Table 4.3 Environment Agency Records of INNS (macroinvertebrates)

Report Status: Draft

Site Code	Location	Location Grid Reference		
Signal crayfish (Pacifastacus leniusculus)	River Colne	TL1418501305	Significantly US of GUC	
*This list comprises species that were incidentally recorded during macrophyte/invertebrate surveys. Durelative paucity of sampling within the canal there are likely to be other INNS present in the GUC that have recorded e.g. Red Swamp Crayfish (<i>Procambarus clarkii</i>).				
Table 4.4 Enviror	nment Agency Records o	f INNS (macrophytes)		
Site Code	Location	Grid Reference	Notes	
GUC Lower Section*				
Canadian/ nuttall's waterweed (<i>Elodea</i> canadensis/ nutalii)	River Colne	TL2060005700	Significantly US of GUC	
Floating pennywort (Hydrocotyle ranunculoides)	GUC – Hemel Hempstead	TL0336306276	DS of River Bulbourne confluence, US of River Gade confluence,	
Floating pennywort (Hydrocotyle ranunculoides)	River Colne	TQ0450588290	US of Denham	
Floating pennywort (Hydrocotyle ranunculoides)	GUC (Colne)	TQ0537179039	D/S of West Drayton	
Himalayan balsam (Impatiens glandulifera)	River Colne	TL1816303619	Significantly US of GUC, <i>I. glandulifera</i> present throughout the Colne valley.	
Curly waterweed (Lagarosiphon major)	River Colne	TL0265406341	Significantly US of GUC	

*This list comprises species that were incidentally recorded during macrophyte/invertebrate surveys. Due to the relative paucity of sampling within the canal there are likely to be other INNS present in the GUC that have not been recorded.

5 Summary

5.1 Canal CPET

Results from Canal CPET monitoring are indicative of ecological pressure via poor water quality at monitoring locations on the proposed transfer routes in the Upper Canal. This includes reaches of the Birmingham & Fazeley Canal from Minworth, the Birmingham & Warwick Canal at Birmingham, and the GUC as it passes south through Birmingham and Solihull, and then east through Learnington Spa and towards Daventry.

The data are indicative of a lesser degree of ecological pressure via poor water quality at monitoring locations on the eastern arm of the canal network. This includes reaches of the Coventry Canal as it passes through Atherstone and Fazeley, and the Oxford Canal before its confluence with the GUC, east of Daventry. Here, the chironomid community demonstrated a greater degree of sensitivity to poor water quality and pollutants and were indicative of improved ecological condition, relative to the western arm of the proposed transfer route.

The greatest community diversity and abundance of pollution-sensitive taxa was observed at the most southernly monitoring location, at Batchworth Lock. Despite likely water quality pressure (given the proximity to Greater London), the locations in the south east demonstrated an ecological condition which was improved, relative to that seen in the heavily urbanised reaches of the midlands (primarily around Birmingham). This likely reflects the high degree of connectivity between the GUC and several neighbouring river water bodies at this location. River confluences may have a positive effect via contribution of species to the canal network and improvement in water quality.

5.2 Fish Survey and Habitat Walkover

Fish surveys indicated varying fish community diversity and abundance throughout the course of the Birmingham & Fazeley Canal, Coventry Canal, Oxford Canal and Grand Union Canal. Throughout much of the Midlands, and notably the areas around Birmingham, fish diversity was relatively low, and the community tended to be dominated by one or two species.

However, in the south-east region, fish community diversity generally improved, and species abundance was more evenly distributed throughout the community. As demonstrated by the presence of bleak (a primarily riverine species), the adjoining river waterbodies likely contribute to the greater diversity of species observed within the southern reach of the GUC from Tring to Batchworth Lock.

It should be acknowledged that the survey methodology applied is not fully quantitative, and results should not be regarded as fully representative of the fish communities of the GUC due to the semi-quantitative nature of the survey methodology. Recommendations to calibrate the Gate 1 survey data are made under Section 6.2.

5.3 Invasive Non-native Species

Species identified included zander, identified throughout the midlands, and signal crayfish, identified throughout the upper, middle and lower canal reaches surveyed.

Records of invasive non-native species present within the reaches of interest were supplied by the Environment Agency. This highlighted a number of additional species, including invasive non-native macroinvertebrate species such as zebra mussel (*Dreissena polymorpha*) and demon shrimp (*Dikerogammarus haemobaphes*) and invasive non-native macrophyte species such as floating pennywort (*Hydrocotyle ranunculoides*), It should be noted these species were recorded predominantly in the South East region.

6 Recommendations

Recommendations for future monitoring are outlined below. These recommendations should be considered in conjunction with recommendations made as part of the Gate 1 GUC Strategic Transfer – Ecological Literature Review and Gap Analysis report; this will aid in further identifying canal reaches of significance, or of notable ecological concern, where future monitoring should be targeted.

6.1 Canal CPET

It is recommended the canal CPET monitoring is continued into Gate 2. Canal CPET samples can be collected from April to October; collection of three samples from different months is required to capture at least 80% of the species present across the whole year. Samples collected in 2020 were collected from late August to October. If monitoring were to commence in spring 2021 (April or May), this would likely allow for identification of a greater wealth of species, improving the accuracy of assessment at each monitoring location. A second year of canal CPET monitoring data would increase overall reliability and robustness of the data and allow for continued assessment of ecological pressure via poor water quality and nutrient enrichment.

For continuity and comparability, it is recommended that canal CPET monitoring is continued at the same locations unless the route is no longer required as a result of the SRO optioneering activities. However, it is acknowledged that this may require further consideration, as the GUC Strategic Transfer Scheme progresses in determining the proposed route of water transfer.

6.2 Fish Survey and Habitat Walkover

As part of the fish survey methodology, it was recommended that drawdowns on the GUC (planned as part of the Trust's winter works programme) were attended by APEM field staff to process fish removed from the canal as part of the drawdown process. Due to logistical and operational factors, this work was unable to be progressed in 2020. It is recommended that this work is undertaken in Gate 2.

If possible, it is recommended that a planned drawdown event by The Trust is attended, in order to process fish removed from the canal as part of the drawdown process. This will be dependent on the location of drawdown events, and whether they are located within reasonable proximity to 2020 fish monitoring locations (and the proposed transfer route). If no drawdowns meet the required location specification, then it is advised that discussion is held between the GUC PMB and The Trust regarding the feasibility of undertaking a canal drawdown for the sole purpose of fish community assessment.

Fully quantitative data from a drawdown would be cross-referenced with data from a co-located fish survey location. This will allow for calibration of the Gate 1 fish survey data, allowing for greater assessment of the limitations associated with the mixed seine-netting and PASE electric-fishing approach.

Additionally, it is recommended that angling catch data are again requested from local angling clubs, to supplement Gate 1 survey data. It is expected that angling catch data would highlight large, predatory species which may have otherwise been overlooked due to the semi-quantitate nature of the survey methodology.

6.3 Invasive Non-native Species

It is recommended that targeted INNS surveys are undertaken in Gate 2. Data collected as part of the 2020 monitoring programme and supplied by the Environment Agency indicates that INNS are already widely distributed throughout the canal network. One of the greatest risks posed by INNS in the canal network is species expansion to river water bodies that are in close connection with the canal. Therefore, it is recommended that targeted INNS surveys are undertaken at locations where river water bodies are in close connection with the canal network – for example, at Batchworth Lock. Here, the GUC has confluences with the River Colne and River Chess.

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Surveys for invasive non-native bivalve species (primarily, zebra mussel and quagga mussel) and invasive non-native amphipods (primarily demon shrimp and killer shrimp) are recommended. Further surveys aimed at signal crayfish and zander are not recommended at this stage, as the available data indicate that these species are already widespread. The Environment Agency employ varying methods for monitoring such species; including presence/absence surveys via bank scrapes and installation of colonisers for non-native bivalves. Multi-habitat methodologies for monitoring invasive shrimp species are also used. If targeted INNS monitoring is taken forward, it is recommended that a repeatable, standardised methodology be agreed in consultation with the Environment Agency.

Surveyors should also look to identify any invasive non-native macrophyte species – notably floating pennywort, which has been of particular concern in the southern reaches of the GUC. This may be done via a bankside walk-over, using a grappling hook to sample open water canal habitats. INNS identified on the canal bank (for instance, Himalayan balsam) during the course of the walk-over should also be noted.

Recommendations regarding the number and distribution of monitoring locations should be made in conjunction with findings of the Gate 1 GUC Strategic Transfer – Ecological Literature Review and Gap Analysis report. This will aid in further identifying canal reaches of notable concern regarding INNS, and guide where future monitoring should be targeted.

6.4 Canal PSYM

During the scoping phase of pre-gap analysis monitoring in July-August 2020, it was recommended that canal PSYM (Predictive SYstem for Multimetrics) surveys be undertaken in spring 2021. PSYM provides a method for assessing biological quality of still waters in England and Wales, with a specific methodology outlined for assessment of canal waterbodies. Canal PSYM must be conducted during the spring months in order to be comparable with the PSYM reference baseline dataset; for this reason, the canal PSYM was not undertaken as part of the 2020 Phase 1 ecological monitoring programme (August 2020 – January 2021).

The heavily modified and high turbidity nature of the canal network was noted throughout the Gate 1 monitoring programme, and it is therefore considered that the relative value of data collected via this methodology may be low throughout much of the canal network. However, both CPET and fish monitoring data indicate greater ecological community diversity at canal reaches with a high level of connectivity to neighbouring river water bodies. Therefore, it is recommended that canal PSYM surveys are targeted only at canal reaches in close proximity to river/canal confluences.

Recommendations regarding the requirement for Canal PSYM monitoring (including the number and distribution of monitoring locations) should be made in conjunction with findings of the Gate 1 GUC Strategic Transfer – Ecological Literature Review and Gap Analysis report. This will aid in further identifying canal reaches of notable ecological value. This information should guide if, and where, future monitoring using the canal PSYM methodology would be appropriate in assessing canal ecological quality.

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FIGURES





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Figure 4.1 Location 1. Birmingham & Fazeley Canal, Minworth – Habitat Map



Figure 4. 2 Location 2. Coventry Canal, Fazeley – Habitat Map



Figure 4. 3 Location 4. Coventry Canal, Atherstone – Habitat Map



Figure 4. 4 Location 4a. Oxford Canal, Willoughby – Habitat Map



Figure 4. 5 Location 5. Birmingham & Warwick Canal Junction, Birmingham – Habitat Map



Figure 4. 6 Location 5a. Grand Union Canal, DS Bordesley Junction – Habitat Map



Figure 4. 7 Location 6. Grand Union Canal, Copt Heath – Habitat Map



Figure 4.8 Location 8. Grand Union Canal, Welton Lane, Daventry – Habitat Map



Figure 4.9 Location 9. Grand Union Canal, Lock Buckby Wharf – Habitat Map



Figure 4. 10 Location 10. Grand Union Canal, Tring – Habitat Map



Figure 4. 11 Location 11. Grand Union Canal, Hemel Hempstead – Habitat Map



Figure 4. 12 Location 12. Grand Union Canal, Above Batchworth Lock – Habitat Map



Appendix A – Environment Agency Monitoring Locations

Water body	Site ID	Grid ref	Data	Data count			
	GUC and Coventry canals – Upper Section						
GUC (Tame)	50103	409394, 287675	1995 - 2009	11			
GUC (Tame)	50883	419400, 272300	1985 - 2008	22			
GUC (Blythe)	51530	419100, 275100	1991 - 1999	2			
GUC	52995	418146, 280072	<u> 1987 – 2008</u>	20			
GUC (LS)	53298	454080, 265890	1986 - 2004	6			
GUC (LS)	75872	429840, 265530	2000 - 2006	8			
	GUC	- Middle Section					
GUC (Ouzel)	54485	88000, 36300	1985 – 2007	8			
GUC (Nene)	55875	59700, 69400	<mark>1</mark> 989 – 2001	15			
GUC (Nene)	55879	64700, 59100	1 999 – 1999	1			
GUC (Nene)	55881	72400, 53400	1 989 – 1999	23			
GUC (Nene)	55882	65100, 59000	<mark>1</mark> 989 – 1999	20			
GUC (Nene)	55883	60500, 65600	1996 – 1999	3			
GUC (Nene)	55884	57900, 65100	1 989 – 1999	23			
GUC (Northampton)	55885	72500, 58100	<u> 1989 – 1998</u>	14			
GUC (Ouzel)	56415	93400, 17600	1 996 – 2009	15			
GUC (Ouzel)	56418	92800, 16200	1995 – 2003	2			
GUC (Ouzel)	56422	91900, 14800	1 995 – 2008	16			
GUC (Ouzel)	56440	88000, 36300	1 987 – 2000	11			
GUC (Tove)	56467	76300, 48000	1 999 – 2008	9			
GUC (Ouzel	56708	91900, 14800	1 989 – 2002	3			
GUC (Tove)	87858	80600, 41300	2003 - 2003	2			
	GUC	- Lower Section					
GUC (Boxmoor Reach)	33896	503890, 206150	1 998 – 2009	8			
GUC (GADE)	33897	508530, 199230	1998 – 2009	16			
GUC (Kings Langley Reach)	33899	507770, 201820	1998 – 2009	8			

Table A. 1 Summary of Environment Agency macroinvertebrate data available for GUC

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GUC (Pix Farm Reach)	34004	502700, 206300	1990 – 2009	17
GUC (Above Berkhamstead)	34026	494800, 212100	1990 - 2009	12
GUC (Pix Farm Reach)	34027	500700, 207100	1990 - 2009	15
GUC (Frogmore Reach)	34028	505830, 205680	1990 - 2002	10

Table A. 2 Summary of Environment Agency phytobenthos data available for GUC

Waterbody	Site ID	Grid ref	Data	Replicates
	GU	C – Lower Section		
GUC (Boxmoor Reach)	33896	409394, 287675	1995 - 2009	11
GUC (Pix Farm Reach)	34004	419400, 272300	1985 - 2008	22
GUC (Pix Farm Reach)	34027	419100, 275100	1991 - 1999	2

Table A. 3 Summary of Environment Agency fish data available for GUC

Waterbody / Site Name	Site ID	Grid ref	Last Surveyed
	GUC – Lower	Section	
GUC - U/S Coppermill Lock to Springwell Lock	48583	504253, 192864	2013
GUC - Springwell Backwater	51564	504255, 192053	2013
GUC - u/s Widewater Lock	47248	504909, 189057	2013

River/ Watercourse	Biosys/ NFPD Code	Location	Grid reference	Location Notes	Macro- invertebrate s*	Macrophyte s**	Fish***
GUC – Upper Section							
River Tame	28964	Tamworth	420670, 303224	US of Coventry Canal			•
River Tame	47770	Fazely	421033, 301814	US of Coventry Canal	•		
GUC – Lower Section							
Bulbourne	34305/ 194431	Bourne End	502654, 206341	US of GUC	•	•	
Bulbourne	34143	Below GUC, Chaulden	503400, 206300	DS of GUC		•	
Bulbourne	63564	Boxmoore U/S	504629, 206110	DS of GUC			•
Bulbourne	63565	Boxmoore D/S	504883, 205966	DS of GUC			•
Gade	186205	US Plough Roundabout	505483, 206480	US of GUC	•		
Gade	186206	DS Plough Roundabout	505486, 206250	US of GUC	•		
Gade	34082/ 34315/ 8109	Cassiobury Park, Watford	509072, 196255	Location in connection with GUC (US and DS)	•	•	•
Colne	33722	At Tollpitts Lane	507700, 194100	US of GUC	•		
Colne	33837	Halfway House PH, Rickmansworth	505300, 194200	DS of GUC, Gade & Chess	•		
Colne	34318	Below Weir, Maple Cross	504336, 193182	US Maple Cross STW	•		
Colne	8109	Springwell Lane	504346, 193241	U/S Springwell STW			•
			OFFICIAL SEN	SITIVE			

Table A. 4 Environment Agency macroinvertebrate, macrophyte and fish monitoring locations on river waterbodies associated with the GUC

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River/ Watercourse	Biosys/ NFPD Code	Location	Grid reference	Location Notes	Macro- invertebrate s*	Macrophyte s**	Fish***
Colne	194211	DS Maple Cross	504032, 191196	DS Maple Cross STW	•		
Colne	8111	Uxbridge	504868, 183715	2019			•
Misbourne	34295	Below Denham Village	504807, 186377	US of confluence with Colne	•	•	
Misbourne	183928/ 72803	Denham Country Park	504942, 186330	US of confluence with Colne	•	•	

*All samples collected 2019 **Surveys undertaken 2018/19

***Surveys undertaken 2019 except for location 8109 surveyed in 2013 and 28964 surveyed in 2014

Report Status: Draft

Appendix B – Designated Sites

Table B. 1 Designated sites adjacent to the GUC

Designation Type	Site Name	Adjacent Waterbody			
	GUC and Coventry canals – Upper Section				
SSSI	Alvecote Pools	Coventry and Ashby Canals			
SSSI	Ashby Canal	Coventry and Ashby Canals			
LNR	Kettle Brook	Coventry and Ashby Canals			
LNR	Hodge Lane	Coventry and Ashby Canals			
LNR	Tameside	Coventry and Ashby Canals			
SSSI	Bosworth Mill Meadow	Grand Union Canal, Leicester Line, summit pound			
SSSI	Kilby - Foxton Canal	Grand Union Canal, Leicester Line, summit to Aylestone			
LNR	Aylestone Meadows	Grand Union Canal, Leicester Line, summit to Aylestone			
LNR	Glen Hills	Grand Union Canal, Leicester Line, summit to Aylestone			
LNR	Glen Parva	Grand Union Canal, Leicester Line, summit to Aylestone			
SSSI	River Blythe	Grand Union Canal, Solihull to Birmingham			
SSSI	Shrewley Canal Cutting	Grand Union Canal, Warwick to Solihull			
LNR	Whitnash Brook	Grand Union Canal, Leamington Spa to Warwick trough pound			
	GUC – Middle Section				
SSSI	Tring Reservoirs	Grand Union Canal, Tring summit to Milton Keynes			
GUC – Lower Section					
LNR	Croxley Common Moor	Grand Union Canal, Berkhamstead to Maple Lodge (Rivers Bulbourne, Gade and Colne)			
LNR	Cassiobury Park	Grand Union Canal, Berkhamstead to Maple Lodge (RIvers Bulbourne, Gade and Colne)			
LNR	Rickmansworth Aquadrome	Grand Union Canal, Berkhamstead to Maple Lodge (Rivers Bulbourne, Gade and Colne)			
LNR	Stockers Lake	Grand Union Canal, Berkhamstead to Maple Lodge (Rivers Bulbourne, Gade and Colne)			
SSSI	Mid Colne Valley	Grand Union Canal, Maple Lodge to Uxbridge (Rivers Colne and Chess plus canal)			
LNR	Frays Valley	Grand Union Canal, Maple Lodge to Uxbridge (Rivers Colne and Chess plus canal)			
LNR	Denham Country Park	Grand Union Canal, Maple Lodge to Uxbridge (Rivers Colne and Chess plus canal)			