

Feasibility Study

Environmental Monitoring Project

Rediscovering the River Colne

February 2020



Presented by

The Colne Catchment Action Network





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Hannah Needham, Rivers Project Officer

The Colne Catchment Action Network

hannah.needham@groundwork.org.uk

Switchboard: 01895 832 662 Mobile: 07702532769

The Colne Catchment Action Network

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Bath Road Piscatorial Society	Herts & Middlesex Wildlife Trust
Blenheim Angling Society	Herts Countryside Management Project
British Airways	Herts County Council
British Airways Angling Society	Impress the Chess
Bucks County Council	Iver & District Countryside Association
Canal & Rivers Trust	Iver Parish Council
Chesham Town Council	Landscape Futures
Chiltern District Council	London Borough of Hillingdon
Chilterns Conservation Board	London Wildlife Trust
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Colne Valley Fisheries Consultative	St Albans City & District Council
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Friends of Stockers Lake	Wild Trout Trust
Greater London Authority	Wraysbury Parish Council
Groundwork Hertfordshire	Zoological Society of London

Rediscovering the River Colne Workstream 3 Delivery Partners:

This feasibility study was produced by Groundwork South in partnership with the Colne Valley Fisheries Consultative, Community Connections Community Interest Company and the Hertfordshire and Middlesex Wildlife Trust.



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1 Abbreviations used

ARMI	Anglers Riverfly Monitoring Initiative
A	Ammonia / Ammoniacal Nitrogen (NH ₃ -N) - used as a measure of organic pollution e.g. related to wastewater
CCP CIC	Community Connections Project Community Interest Company
CVFC	Colne Valley Fisheries Consultative
EA	Environment Agency
HMWT	Hertfordshire and Middlesex Wildlife Trust
P	Phosphate / soluble reactive phosphorous – used as a measure of nutrient pollution e.g. related to chemical fertilisers
SWOP	Surface Water Outfall Programme
TW	Thames Water
WBC	Watford Borough Council
WFD	Water Framework Directive
WWQF	Watford Water Quality Forum
ZSL	The Zoological Society of London

2 Introduction

2.1 Background

Rediscovering the River Colne is a ground-breaking project that aspires to bring the River Colne to the heart of Watford and its people. The project will see the Colne corridor become a positive asset within the borough, enabling it to reach its full potential for both local people and wildlife.

We will provide sustainable solutions to resolve the issues affecting the river and to regenerate the public spaces it flows through. We aspire to providing a healthy river corridor, with clean water, diverse wildlife and low flood risk that is accessible to all and of high amenity value to local people.

Community ownership, education and awareness are key principles which will underpin each activity that we deliver. We will work to ensure that local people and businesses are empowered to champion their local river and that local stakeholders actively contribute to the outcomes of the project.

2.2 Mission statement

Workstream 3 of the Rediscovering the River Colne Project outlines out a new Environmental Monitoring Project. The project is structured as citizen science network (i.e. led by members of the public) to empower local people to take the lead on monitoring the ecological and geomorphological condition of the River Colne over time.

2.3 Objectives

The Environmental Monitoring Project will deliver a robust citizen science monitoring programme that will:

1. Engage, inspire and train local people and stakeholders to monitor the health of the River Colne
2. Complement existing environmental monitoring work conducted by partner organisations
3. Collect relevant, useful data that will be used to inform key stakeholders and deliver gains for the local environment
4. Monitor the river's recovery over the 10-year duration of the project as habitat and water quality improvements are made

2.4 Initial stakeholder engagement

Key stakeholders and partner organisations that operate in Watford were consulted to understand what environmental monitoring is already conducted along the River Colne (see Table 1):

- Community Connections Project
- Community Interest Company (CCP CIC)
 - Coordinates 'Friends of Oxhey Park' community group
 - Coordinates 'Watford on the Water' community project
- Hertfordshire and Middlesex Wildlife Trust (HMWT)
- Watford Green Gym
- Colne Valley Fisheries Consultative (CVFC)
 - Serve as the Anglers Riverfly Monitoring Initiative (ARMI) Riverfly Coordinator for the Chilterns, Herts and Middlesex Hub
- Environment Agency (EA)
- Thames Water (TW)

Table 1 - Existing environmental monitoring activities along the River Colne in Watford

Organisation	Activity	Location	Frequency
Colne Valley Fisheries Consultative	Hosts an online tracking application for recording the location of: <ul style="list-style-type: none"> Invasive plant species Pollution incidents 	<ul style="list-style-type: none"> The River Colne All Colne tributaries All Colne distributaries 	All year round
	Riverfly monitoring coordinator	5 sites along the Colne in Watford	Monthly
Community Connections Project CIC	Removal of invasive plants: <ul style="list-style-type: none"> Himalayan Balsam Japanese Knotweed 	The Colne in Watford	May - August
	Signal Crayfish trapping	The Colne in Watford	All year round
Green Gym	Removal of invasive plants: <ul style="list-style-type: none"> Himalayan Balsam Japanese Knotweed 	The Colne in Watford	May - August
Environment Agency	Water chemical monitoring (long-term)	<ul style="list-style-type: none"> Bushey Mill Lane (upstream of Watford) Hampermill, Oxhey (downstream of Watford) 	Monthly
	Deploy data sondes to measure water quality (short-term)	Various. Surrounding the Water Lane outfall (Feb 2019 – present)	Deployed temporarily to investigate specific incidents
Thames Water	Surface Water Outfall Programme	Various locations	To investigate severe or ongoing pollution incidents

2.5 Plans and directives supported by this feasibility study

The monitoring activities identified through this feasibility study aim to support the objectives of the following plans and directives:

- Watford Borough Council’s Corporate Plan 2019/2020:
 - CP18: Develop a River Colne improvement strategy to enhance the river and its surrounds as a green asset for Watford
- Watford Green Infrastructure Plan (Landuse Planning, March 2011)
- The Mayor of Watford’s Manifesto pledges:
 - Protecting our local environment
 - A sustainable town
 - Bringing communities together
- Thames River Basin Management Plan
- Water Framework Directive
- The Colne Catchment Action Plan

3 Project Scope

3.1 A New Citizen Science Network

3.1.1 Rationale

The Environmental Monitoring Project will be structured as a citizen science programme which will deliver the following benefits:

- Connect local people with the River Colne and raise awareness of the threats it faces
- Inspire the community to enjoy the river and the wildlife it supports
- Encourage local people to take responsibility for the condition of the River Colne and take action to protect it

3.1.2 Partnership working

The project will build upon the ongoing monitoring work conducted by local organisations. Where required, skilled individuals from partner organisations will contribute by providing training and coordinating monitors.

3.1.3 Monitoring opportunities

The project will measure a range of parameters to track changes in water quality, biodiversity and the river’s geomorphology. Volunteers will be invited to enrol for one or more monitoring activities of their choice (see Table 2).

Monitoring activity		Volunteer monitoring timetable											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water quality	Riverfly monitoring												→
	Outfall Safari <i>Every 4 years</i>												
	Water chemical testing												→
Biodiversity & Geomorphology	Geomorphological surveys												
	Invasive plant species												
	Dragonfly surveys												
	Fish surveys												

Table 2 - Environmental monitoring activities for citizen scientists

3.1.4 Training

No previous experience is required to enrol as a citizen scientist. All new volunteers will receive free training in the monitoring activity of their choice.

3.1.5 Equipment

All surveying tools and personal protective equipment will be provided to volunteers free of charge.

3.1.6 Volunteer recruitment

A promotional strategy will be developed to ensure that the citizen science network attracts and engages a diverse range of people from across the community in Watford.

The group will connect with the wider community by participating in the 'Friends of the River Colne' (FOTRC) network (proposed in Workstream 4 – the community engagement project). The citizen science network could gain volunteers by partnership working and sharing resources with other organisations within the FOTRC.

3.1.7 Volunteer retention

A volunteer coordination strategy will be developed to ensure that the programme supports and retains volunteers. The programme will:

- Benefit the volunteers by providing:
 - Rewarding and enjoyable opportunities to improve the local environment
 - Opportunities to learn and develop skills
- Be as flexible as possible in order to accommodate peoples' different:
 - Timetables and availability
 - Capacity for commitment
- Be as accessible as possible in order to include and empower people who have:
 - Differing physical abilities
 - Learning disabilities
 - Mental health issues
- Be welcoming and inclusive for all people regardless of their:
 - Age
 - Ethnicity or race
 - Religion or belief
 - Social or educational background

3.1.8 Connected citizen scientists

An online communications network will be established to connect citizen scientists. The online community will use social media and an email mailing list (or other depending upon the preference of the citizen scientists).

3.1.9 Annual citizen science conference

An annual citizen science conference will be established to enable volunteers to:

- Showcase the annual findings of each monitoring activity
- Meet with one another and share ideas
- Receive feedback on the environmental monitoring project
- Learn about opportunities to get involved in new and different monitoring activities
- Outline actions for the following year

3.2 Environmental Outcomes

3.2.1 Water quality

3.2.1.1 Watford Water Quality Forum

The Watford Water Quality Forum (WWQF) was established by the Colne Catchment Action Network in September 2019. The objectives of the WWQF are:

- To connect the key stakeholders who play a role in improving water quality in the River Colne in Watford at quarterly meetings
- To share evidence of pollution incidents and water quality issues in Watford:
 - Observations from community groups e.g. CCP CIC and CVFC
 - Pollution incidents reported by on the CVFC app (<http://www.cvfc.org.uk/pollution>)
- To streamline and expedite efforts to trace and resolve pollution issues in Watford

3.2.1.2 WWQF partners

The WWQF connects key stakeholders with an interest in, or responsibility for, maintaining good water quality in the River Colne as it flows through Watford. The forum seeks to expand its membership in future to encompass Highways England and neighbouring councils. The forum currently comprises the following partners (see Figure 1):

- Watford Borough Council
- Thames Water
- Environment Agency
- Colne Valley Fisheries Consultative
- Community Connections Project Community Interest Company
- Groundwork South

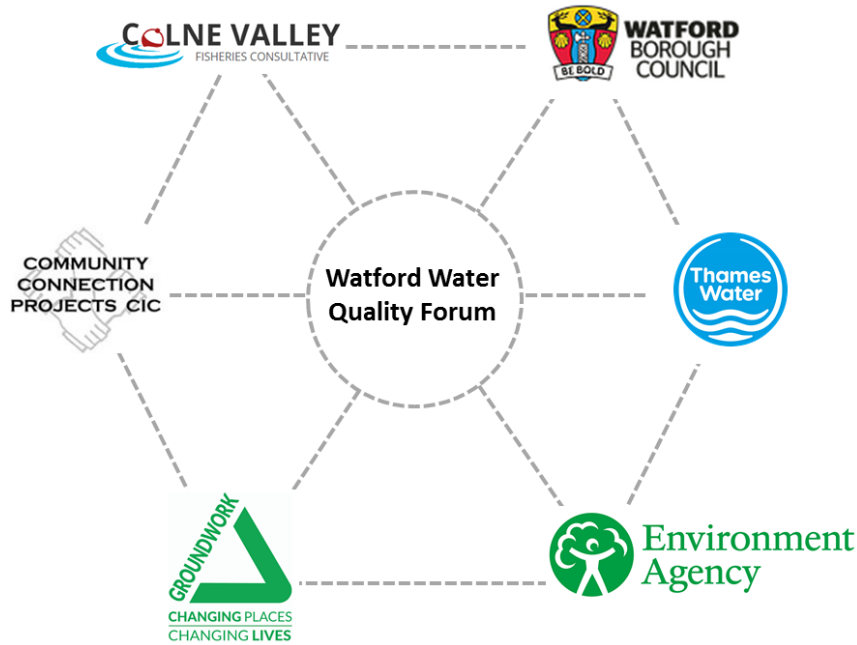


Figure 1 - Partners involved in Watford Water Quality Forum

3.2.1.3 Stronger evidence base

The citizen science project will inform and strengthen the work of the WWQF by providing additional water quality data (see Table 3).

Monitoring activity	Data provided
Riverfly Monitoring	Invertebrate biodiversity – indicative of water quality
Outfall Safari	Comprehensive map of all polluting outfalls
Water Chemical Testing	Extent and location of chemical pollution

Table 3 - Water quality evidence that will be collected by citizen scientists in the environmental monitoring project

3.2.1.4 Annual water quality report

All water quality data produced by citizen scientists will be presented in an annual water quality report. The objectives of the report are:

- To highlight any pollution hotspots along the river that may be indicative of misconnections or other network errors
- To track water quality in the Colne over time to determine the baseline from which we can improve upon

The long-term outcomes of this report will be to:

- Enable Thames Water to prioritise their resources effectively to resolve the sources of pollution identified in Watford
- Evaluate if efforts to resolve pollution issues have delivered long-lasting, measurable improvements in water quality

3.2.2 Geomorphology and biodiversity

3.2.2.1 Annual geomorphology and biodiversity reports

The geomorphology and biodiversity data collected through the project (see Table 2) will be reported upon annually to local stakeholders and the general public. The objectives of the reports will be:

- To record changes in the river habitat and the presence of key indicator species
- To track the locations and prevalence of invasive species along the river
- To track any changes to the geomorphological condition of the river

The outcomes of the reports (see Figure 2) will be to:

- To show how the physical habitat improvements undertaken as part of workstream 1 have improved the river’s geomorphology and biodiversity
- To identify new land management recommendations where required

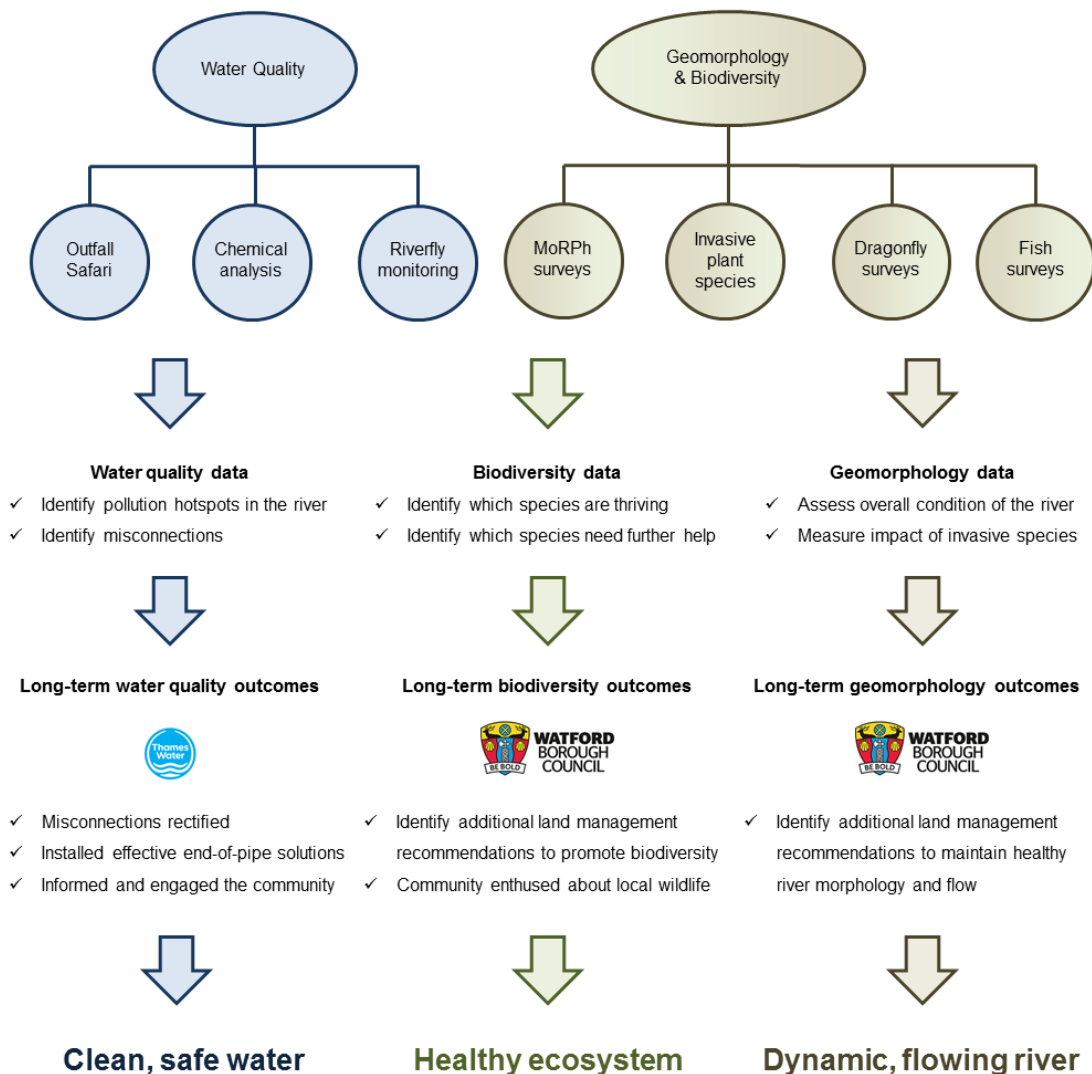


Figure 2 - Overview of all proposed environmental monitoring activities, the data that will be produced and the outcomes

3.3 Project Coordination

We propose that a Project Coordinator would be recruited to manage the environmental monitoring project (see Table 4). The project coordinator would be recruited for 104 days per year, which is approximately 50% of a full-time position. For a full breakdown of project coordinator costs and activities, please see section 5 pages 60-62.

Activity	Task
Promote project and recruit volunteers	Develop promotion and recruitment strategy
	Attend community events to recruit volunteers and promote project
	Register new volunteers and provide administrative support
	Publish promotional material via agreed media channels
	Manage social media interactions and enquiries
	Manage citizen science network and communications
	Coordinate annual citizen science forum
Reporting	Produce annual water quality report
	Produce annual biodiversity and geomorphology reports
	Facilitate quarterly Watford Water Quality Forum meetings
Environmental monitoring support	Organise survey programmes
	Assist project partners with training days as required
	Provide administrative support for volunteers
	Collate, circulate and publish data as required

Table 4 - Responsibilities of the Environmental Monitoring Project Coordinator.

4 Environmental Monitoring Activities

Section 4 outlines the seven proposed environmental monitoring activities that would be conducted as part of the Rediscovering the River Colne Project in Watford.

4.1 Riverfly Monitoring

4.1.1 Introduction

4.1.1.1 Anglers' Riverfly Monitoring Initiative (ARMI)

The Anglers' Riverfly Monitoring Initiative (ARMI) is a citizen science initiative that facilitates regular monitoring of river water quality by trained volunteers, referred to as riverfly monitors. Monitors record the presence of freshwater invertebrate species (see Figure 3) – the results provide an early and reliable indicator of pollution issues.



Figure 3 - Riverflies - adult Mayfly (left) and adult Caddisfly (right). Source: the Riverfly Partnership.

ARMI is used widely in the UK as a 'neighbourhood watch' for rivers and is practiced by anglers, environmentalists and community groups. The initiative helps rivers to be monitored more widely and at greater frequency than is possible by the Environment Agency alone. It has proven effective in identifying pollution incidents and ensuring action is taken. In several cases this has led to prosecution of polluters by the statutory authorities and has prevented similar future incidents.

The ARMI scheme was established in the UK in 2007 and coordinated by the Riverfly Partnership. ARMI is recognised on all Water Framework Directive River Basin Management Plans in England and Wales.

4.1.1.2 Existing riverfly monitoring in Watford

The Chilterns, Hertfordshire & Middlesex Riverfly Hub provides training to anyone wishing to monitor riverflies in Hertfordshire, Middlesex and Chilterns areas. The hub offers an annual programme of training workshops run by its five Riverfly Partnership accredited ARMI instructors.

The Colne Valley Fisheries Consultative (CVFC) is the designated Riverfly Coordinator for the Chilterns, Hertfordshire & Middlesex area, which covers Watford. The CVFC is responsible for:

- Delivering Riverfly Partnership-accredited ARMI training sessions
- Coordinating the existing team of volunteer riverfly monitors in Watford



Figure 4 - Riverfly identification using the ARMI methodology



Figure 5 - Riverfly monitoring in the Colne at Knutsford Playing Fields

4.1.2 Rationale

4.1.2.1 Existing monitoring effort

CVFC coordinates monthly riverfly monitoring at the following sites:

1. Bushey Mill Lane Bridge
2. Knutsford Playing Fields
3. Link Road Bridge
4. Radlett Road Playing Field
5. Lower High Street Bridge

4.1.2.2 Challenges

To date, riverfly scores indicate that water quality in the River Colne is at its poorest condition as it flows through Watford, falling to its lowest between Radlett Road Playing Fields and Lower High Street Bridge (see Figure 5). The riverfly monitoring effort in Watford faces the following challenges:

- The pool of trained riverfly monitors in Watford is small (only 5 monitors)
 - In the event monitors are not available to survey (e.g. due to illness) data is not collected as cover is not available
- No riverfly data is collected in southern Watford – the most southerly point is Lower High Street Bridge

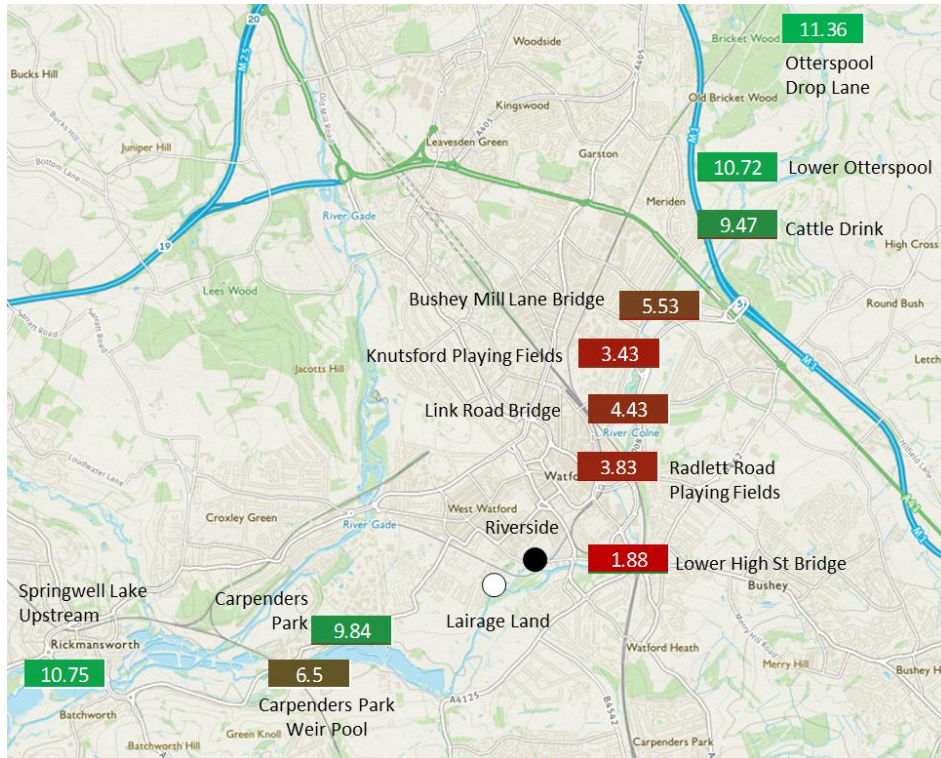


Figure 6 - Riverfly monitoring sites in Watford area. Numbers and colours denote riverfly score at each site from red (poor) to green (high) (December 2019). New monitoring sites proposed: Riverside (black) and Lairage Land (white)

4.1.3 Aims and objectives

We propose to extend the riverfly monitoring initiative in Watford to survey more sites and include more volunteers. Specifically, our objectives are to:

- Survey two additional sites in Watford:
 1. Riverside
 2. Lairage Land
- Recruit a new team of riverfly monitors to assist and extend the existing volunteer effort
- Produce data to feed into the annual water quality report

4.1.4 Methodology

4.1.4.1 Sample collection

The sampling method is a three-minute kick/sweep sample using a standard kick sample net followed by a one-minute manual search (see Figure 7).

1. Identify the different habitats within the sampling area, for example, fast moving riffles, shallow still water, slow water and weed
2. Split the total active sampling time of three minutes proportionally according to the relative areas of the habitats identified. For example, if riffles occupy 50% of the site, they will be sampled for 90 seconds
3. Sample the habitats working across the river and progressively upstream. Rest the net on the riverbed and vigorously disturb the area immediately upstream using your foot (the 'kick

sample'). The invertebrates are carried into the net by the current. For weed areas 'sweep' the net upstream through the weed bed

4. The complete sample may be taken at once, or the sample may be decanted from the net into a bucket containing river water



Figure 7 - Riverfly survey: (A) sample collection, (B) washing and sample sorting (C) species identification

4.1.4.2 Washing the sample

To ease the counting process, it is important to remove as much of the unwanted debris as possible without losing any of the required invertebrates.

1. Tip the whole sample into the large bucket of river water. Strain the water back through the net whilst agitating the stones and gravel to dislodge the invertebrates
2. Refill the bucket with fresh river water and repeat until all of the invertebrates are dislodged and are now in the net
3. Check the debris for any remaining invertebrates
4. Return the remaining sample from the net into the bucket, half filled with clean water, for sorting

4.1.4.3 Sorting the sample

1. Take small 'sub-samples' from the bucket and place into a shallow white tray half-filled with clean water
2. Using a large pipette transfer the targeted invertebrates described overleaf into a segmented tray ready for counting (see Figure 8). Sorting the sample and estimating the numbers of the target groups becomes quicker with experience.

4.1.4.4 Species identification

The presence and abundance of each species is used to generate a score, which is reflective of the water quality at the time of sample. The presence of the 8 target groups will vary in abundance throughout the year (Table 5). Not all groups will be present at all sites.

Target group	Species or common name
Caddisflies	Cased caddis
	Caseless caddis
Up-winged flies	Mayfly (<i>Ephemeroidea</i>)
	Blue-winged olive (<i>Ephemerellidae</i>)
	Flat bodied (<i>Hepdtageniidae</i>)
	Olives (<i>Baetidae</i>)
Stoneflies	-
Freshwater shrimp	<i>Gammarus</i>

Table 5 - The 8 riverfly target groups



Figure 8 - Riverfly species collected in survey. Cased caddisfly (left) and various invertebrates collected in tray ready for counting (right). Source: The Riverfly Partnership and Watford Borough Council, respectively.

4.1.4.5 Reporting to the Environment Agency

The CVFC submit all ARMI scores to the Riverfly Partnership's online data repository. The process for submitting riverfly data is as follows (and is summarised in Figure 9):

1. Volunteers submit their survey results to the CVFC online at www.rflies.uk
2. The Riverfly Coordinator (CVFC) verifies the survey results
3. If monthly ARMI scores for each site:
 - Are equal to or above expected levels - the Riverfly Coordinator submits the data to The Riverfly Partnership
 - Drop below expected levels - a trigger level breach is declared, and the Riverfly Coordinator will be notified by email
 - i. The site will be immediately re-monitored in response to trigger level breach
 - ii. If the second dataset indicates a trigger-level breach, the Riverfly Coordinator notifies the Environment Agency who will take action to investigate the suspected pollution incident

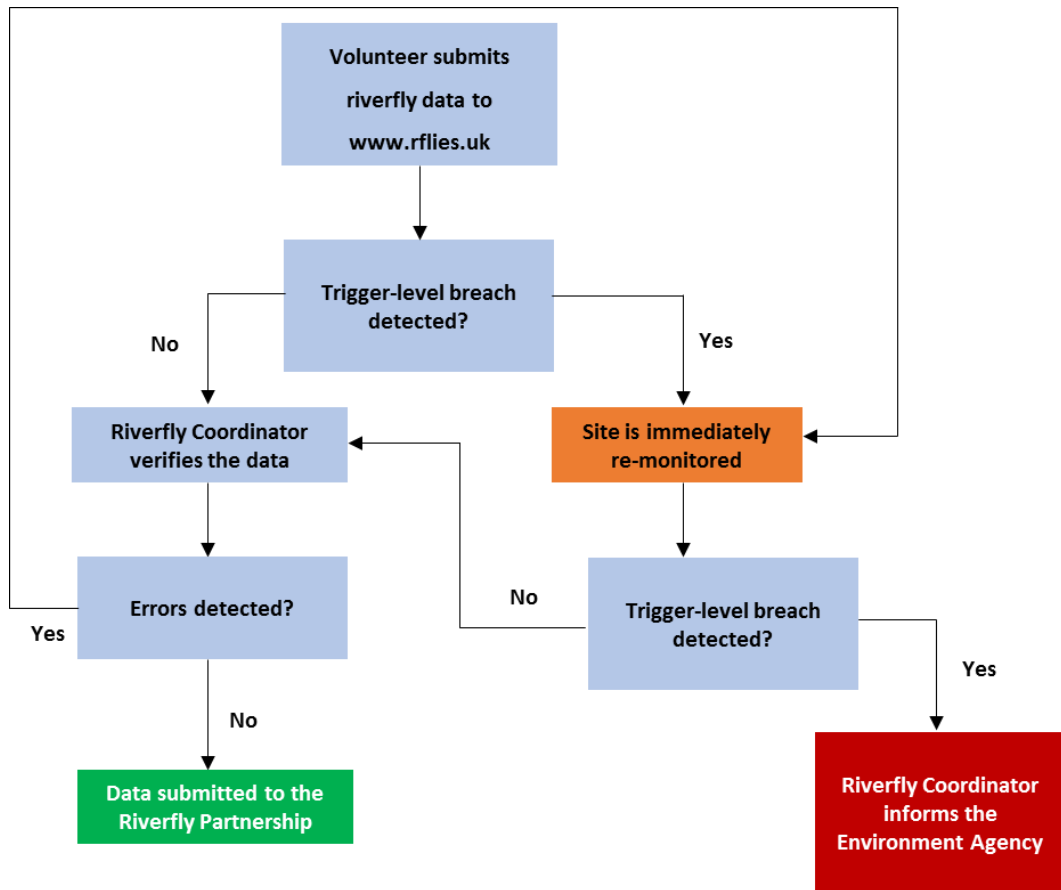


Figure 9 - Riverfly monitoring reporting methodology

4.1.5 Volunteer recruitment

We aim to recruit twenty eight volunteers (two pairs of volunteers per site) to ensure that there are always enough monitors available in the event of volunteer absence (see Table 6). Each pair will monitor the site alternate months and can provide cover if the other pair is unable to survey.

	Per monitoring site	Across all 7 sites
Volunteers needed	4	28

Table 6 - Volunteer target numbers for riverfly monitoring in Watford

4.1.6 Training requirements

The riverfly monitoring course content is set by the Riverfly Partnership and is standard throughout the UK (see Table 7).

Requirements	Per training session
Training duration	1 day
Training frequency	Once annually
Maximum volunteers trained per session	14
Qualified ARMI tutors required per session	2 (the lead tutor is the CVFC Chilterns, Herts and Middlesex Riverfly Coordinator)
Venue requirements	<ul style="list-style-type: none"> Capacity for 16 adults Proximity to river with sufficient numbers of riverflies for demonstrations

Table 7 - ARMI training requirements

4.1.7 Tools and equipment

Equipment (waders and standard ARMI kit) will be supplied to each pair of volunteers on loan. All equipment must be returned when they stop volunteering. If equipment is not returned, volunteers must pay to replace the equipment.

4.1.8 Reporting method

Volunteer riverfly monitors will submit data online through the Chilterns, Herts and Middlesex Riverfly Hub website (www.rflies.uk). Upon verification by the Riverfly Coordinator, the results are published online where they are available for public download. If the data cannot be verified, the Riverfly Coordinator will respond accordingly (see section 4.1.4.5).

4.1.9 Timescale and coordination

The riverfly monitoring programme will be delivered by the Project Coordinator and CVFC Riverfly Coordinator. The roles and responsibilities of each delivery partner are summarised in Table 8.

Activity	Project Coordinator	Riverfly Coordinator	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Volunteer training	Register new volunteers	Develop course content	1-2 times per year													
	Liaise with volunteers and CVFC	Deliver training														
	Organise logistics e.g. book venue	Process volunteer accreditation														
Facilitate monitoring sessions	Remote support for volunteers and CVFC	Supervise new volunteers	Monthly/ ongoing													
	Cover volunteers with insurance	Provide advice and guidance Ensure each site has been monitored at the agreed time														→
Processing data	Remote support for volunteers and CVFC	Collect data from volunteer monitors	Monthly													
		Verify data each month														→
Generating report on findings	Write annual report	Export annual data and send to Project Coordinator	Each December													
	Present report at WWQF	Assist Project Coordinator with production of annual report														

Table 8 - Roles and responsibilities of Project Coordinator and CVFC Riverfly Coordinator in the citizen science riverfly monitoring project

4.1.10 Budget

The riverfly monitoring programme will be delivered by the Project Coordinator and CVFC Riverfly Coordinator. The staff and equipment costs are outlined below in Table 9.

Activity	Project Coordinator Staff Time			CVFC Riverfly Coordinator			Equipment and materials				Expenses			
	Actions	Days	Cost	Actions	Days	Cost	Item	Units	Cost	Total	Item	Units	Cost	Total
Volunteer training	Liaise with volunteers and CVFC	2	£500.00	Prepare course content and materials	1	£75.00	Venue hire	2	£300.00	£600.00	Riverfly tutor travel to venue and collect equipment	2	20	£40.00
	Organise logistics	1	£250.00	Deliver training days	4	£300.00	Volunteer accreditation	28	£35.00	£980.00				
	Register new volunteers	2	£500.00	Post-course admin e.g. answer questions, process volunteer accreditations	1	£75.00	Participant packs	28	£7.00	£196.00				
							Consumables (refreshments etc)	1	£45.00	£45.00				
Monitoring Sessions	Remote support for volunteers and CVFC	6	£1,500.00	Onsite support for volunteers	14	£1,050.00	Waders	28	£100.00	£2,800.00	Project coordinator travel	12	5	£60.00
							RMI Kit (1 per pair) + £8 delivery cost	14	£97.00	£1,366.00	CVFC Coordinator travel	24	20	£480.00
													Volunteer travel	12
							Provision of replacement/spare riverfly kits already supplied by CVFC to volunteers who will fulfil role in Watford	8	£97.00	£776.00				
Data Analysis	Collation and analysis of data for annual report	3	£750.00	Verify monthly data	1	£75.00								
				Submit to national database	1	£75.00								
Totals		14	£3,500.00		22	£1,650.00				£6,763.00				£2,260.00
Grand Total			£14,173											
Project Coordinator day rate			£250.00											
CVFC day rate			£75.00											

Table 9 - Budget for riverfly monitoring project

4.2 Outfall Safari

4.2.1 Introduction

Surface water outfalls are the discharge points for surface water from the surrounding urban area into the river. Outfalls can be a source of chronic pollution in urban rivers when wastewater makes its way into the surface water system through misconnected foul water outlets and other problems within the surface water drainage network.

Photographic evidence of sewage rag, litter and discoloured water recorded on the CVFC pollution reporting app shows that several outfalls along the Watford Colne pollute the river, compromising the biodiversity and amenity value of waterways (see Figures 10 - 12).



Figure 10 - Polluting outfall in Watford. Discoloured water flows from the outfall. Sewage rag and litter collects behind temporary blocks installed by Thames Water.

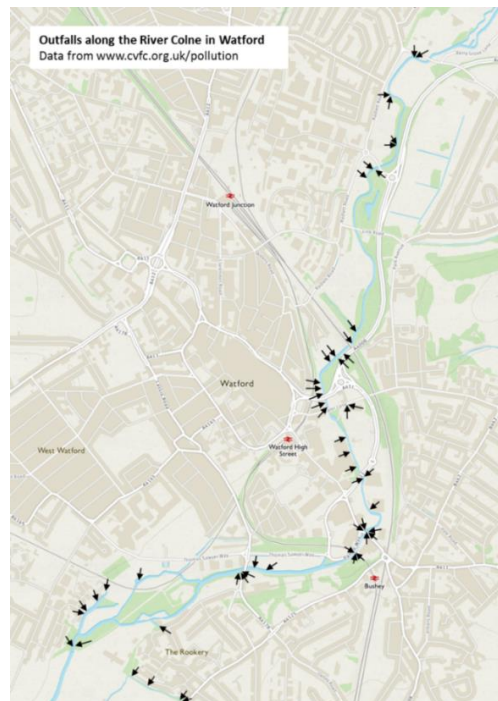


Figure 11 - Polluting outfalls mapped along the Colne in Watford. Data from CVFC app.

We propose to comprehensively map and assess all polluting outfalls along the River Colne in Watford using the Outfall Safari methodology. The Outfall Safari is a citizen science method developed by the Zoological Society of London (ZSL) in partnership with Thames Water and the Environment Agency to locate, assess the impact of, and report polluted surface water outfalls in rivers. The Outfall Safari is a partnership project that involves:

- The regulator i.e. Environment Agency
- The water company i.e. Thames Water
- The Catchment Partnership i.e. the Colne Catchment Action Network
- A host environmental non-environmental organisation i.e. Groundwork South
- Volunteer citizen scientists (only in year 4 after the completion of the first Outfall Safari by trained staff members)

4.2.2 Rationale

4.2.2.1 Existing monitoring effort

At present, a small circle of volunteers and local community groups use one or more of the following methods to report pollution incidents in the river in Watford:

1. Report directly to Thames Water's incident hotline
2. Report directly to the Environment Agency's incident hotline
3. Record on the Colne Valley Fisheries Consultative app - www.cvfc.org.uk/pollution

4.2.2.2 Challenges

Despite considerable volunteer efforts, outfalls in Watford are not well-documented due to the following challenges:

- The volunteer base is small therefore many outfalls into the Watford Colne are not monitored regularly and pollution incidents pass without being recorded
- Reporting pollution incidents can be arduous and confusing for members of the public as there are three reporting channels
- Issues surrounding water pollution are not well publicised or understood by members of the public



Figure 12 - Sewage rag caught on River Colne outfall in Watford

4.2.3 Aims and objectives

This project aims to launch the Outfall Safari in Watford to comprehensively record all polluting outfalls in the Watford Colne for the first time. The specific objectives of the Outfall Safari are:

1. To record and map the dry weather condition of surface water outfalls in rivers
2. To assess and rank the impact of the outfalls and report those that are polluting to the regulator (i.e. EA) and water company (i.e. Thames Water)
3. To build evidence on the scale of the polluted surface water outfalls problem and drive an increase in investment to resolve it
4. To engage communities with their local rivers and inspire change

4.2.3.1 Outcomes

The survey data will form part of a suite of evidence to demonstrate whether undertaking the environmental monitoring activities, alongside other improvement works identified by the project, results in tangible improvements to water quality throughout Watford. Specifically, the Outfall Safari methodology outcomes are:

1. Identification of pollution ‘hot spots’ to enable Thames Water to prioritise their outfalls to be targeted in interventions e.g.:
 - Misconnections tracing
 - Developing better end-of-pipe solutions e.g. grilles/structures to capture sewage
 - Allocating polluting outfalls to the ‘surface water outfall programme’ (SWOP)
2. Inform wider catchment management decisions
3. Raise awareness surrounding misconnections

4.2.4 Methodology

4.2.4.1 Health and safety

The Outfall Safari will be conducted predominately from the bankside. In difficult-to-access areas, in-channel work may be required (see Figure 13). Only suitably trained personnel (not volunteers) covered by their organisation’s public liability insurance will take part in the first Outfall Safari.

Volunteers will be invited to take part in bankside assessments in subsequent Outfall Safaris (every 4 years) once the high-risk areas have been investigated and mapped by the project team.



Figure 13 – Bankside assessment (A) and, in-channel assessment (B). Source: A Guide to Running an Outfall Safari January 2019, ZSL and The Rivers Trust.

4.2.4.2 Identify safe stretches of river

The River Colne will be divided into five sections to survey. Any areas deemed to be inaccessible or unsafe will be excluded. To ensure safe working in and around the river, a minimum of two surveyors will be required to survey each stretch of river at one time (see Table 11).

Areas to survey	Surveyors per survey area	Total surveyors per Outfall Safari
5	2	10

Table 10 - Surveyor numbers for Outfall Safari



Figure 14 - Discoloured water flowing from Oxhey Park outfall. Source: CCP CIC

4.2.4.3 Scoring System

In dry weather only, trained surveyors will survey the river with a mobile app that allows them to geolocate, photograph and assess outfalls for evidence of pollution. The Environment Agency has developed a method for converting the assessment data to a numeric impact score for each outfall between 0 -20 (see Table 11 and Figure 15). The higher the score, the greater the visible impact of the outfall.

Table 11 - Outfall Safari scoring guidance

Question	Guidance	
GPS location	Record using mobile app	
Description of nearest landmark	Occasionally there can be issues with the accuracy of GPS – the more location detail that is provided, the easier it is for follow up action to be taken	
Which bank is the outfall on	This should be left or right as the surveyor stands looking downstream	
Question	Options	EA score
Ranking the flow coming out of the outfall	<ul style="list-style-type: none"> • No flow • Trickle • Low flow • Moderate flow • High flow 	N/A
Ranking the visual impact of the outfall	No visible effect	0
	Within 2 m of outfall	2
	Impact 2 m – 10 m of outfall	4
	Impact 10 m – 30 m of outfall	6
	Impact greater than 30 m from outfall	10
Ranking the aesthetics of the outfall	No odour or visible aesthetics	0
	Faint smell, slight discolouration	2
	Mild smell, mild discolouration, small coverage of grey fungus	4
	Strong smell, strong discolouration, large coverage of grey fungus and/or litter	6
	Gross smell, gross sewage	10

4.2.4.4 Reporting procedure for impact scores of ten or more

The Outfall Safari methodology specifies that outfalls that score 10 or higher require urgent attention and should be reported immediately to Thames Water.

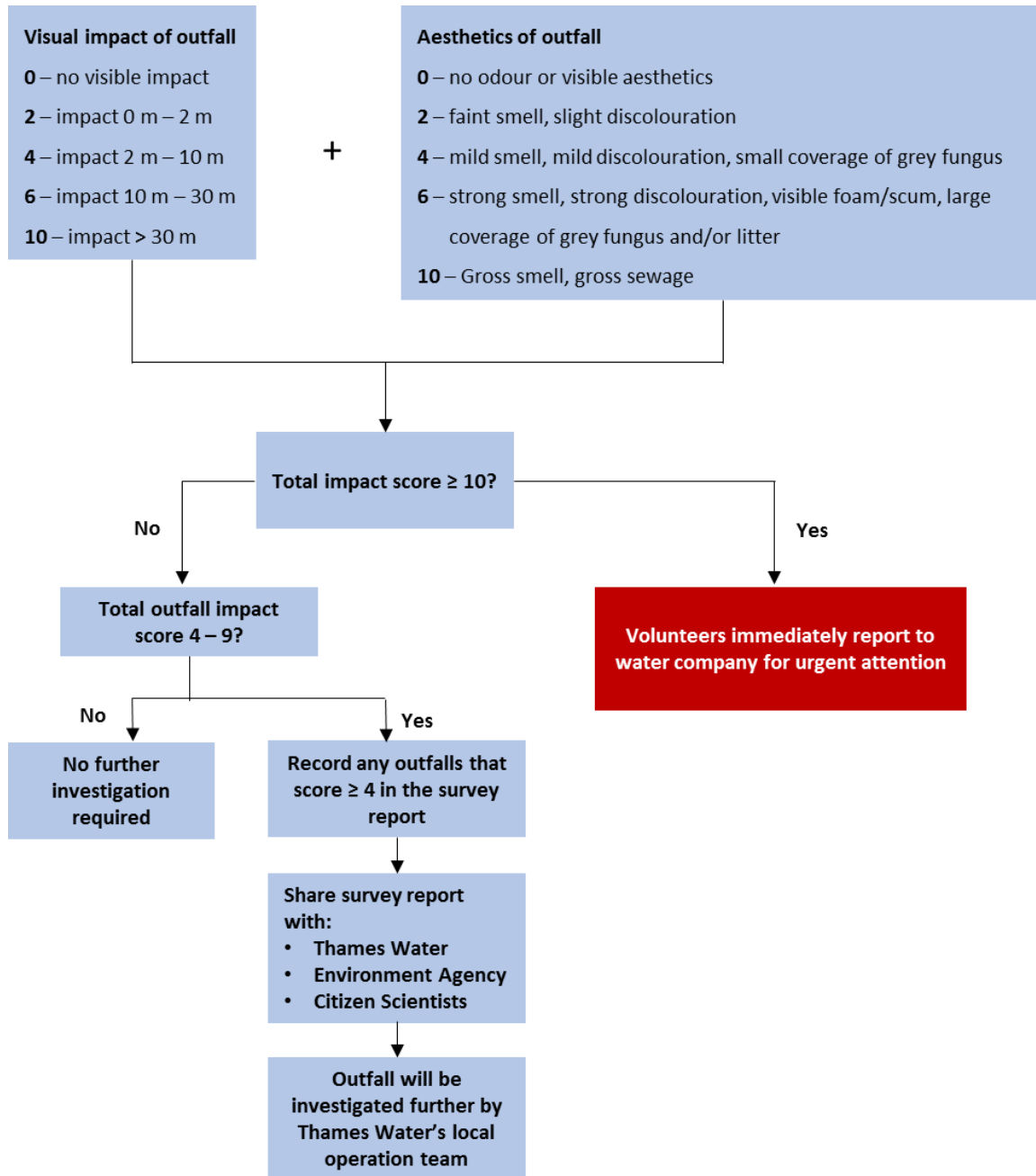


Figure 15 - Outfall Safari scoring protocol

4.2.5 Volunteer recruitment

The first Outfall Safari will be conducted in-house by the Project Coordinator and 3-4 other project partners. The second Outfall Safari four years later will be rolled out to volunteers for health and safety reasons (see section 4.2.4.1).

4.2.6 Tools and equipment

Surveyors will record all outfall data using the Epicollect app downloaded to smartphones.

The Project Coordinator will ensure surveyors are supplied with the necessary personal protective equipment and sanitary supplies:

- Waders
- Waterproof gloves
- Sanitary kit
- First aid kit
- Ranging pole



Figure 16 - Personal protective equipment is provided to ensure safe working during the Outfall Safari. Source: A Guide to Running an Outfall Safari January 2019, ZSL and The Rivers Trust.

4.2.7 Reporting method

All data will be recorded on the Epicollect app managed by the Project Coordinator. After completion of the survey the data will be processed as follows:

1. The Project Coordinator will download and send the outfall data to the Colne Valley Fisheries Consultative (CVFC)
2. CVFC will map all outfall locations and their scores/photos onto the section of the CVFC app
3. The Project Coordinator will input the data into a report to be presented at the Watford Water Quality Forum

4.2.8 Timescale and coordination

The Outfall Safari will be conducted by the Project Coordinator and project partners Community Connections Project CIC (CCP CIC) and the Colne Valley Fisheries Consultative (CVFC). The roles and responsibilities of each delivery partner is summarised in Table 12.

The Outfall Safari will be repeated in March every 4 years because:

- The extent to which outfalls are concealed by riparian vegetation is minimal in March
- 4 years is time interval Thames Water recommend to allow time for positive changes (e.g. resolving misconnections) to be made and take effect

Activity	Project Coordinator	CCP CIC & CVFC	TW & EA	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Facilitate monitoring sessions	Conduct survey, provide administrative support for surveyors	Conduct survey	Provide advice and guidance	March												
Processing data	Manage data collection software	-	Provide advice and guidance	After survey - April												
	Verify and export data															
Generate report	Generate summary report	Participate in WWQF	Participate in WWQF	After survey - April												
	Present results to WWQF															

Table 12 - Role of Project Coordinator, CCP CIC, CVFC, Thames Water (TW) and the Environment Agency (EA) in delivery of the Watford Colne Outfall Safari

4.2.9 Budget

The Outfall Safari will be conducted by the Project Coordinator, CCP CIC and CVFC. The staff and equipment costs are outlined below in Table 13.

Activity	Project Coordinator			CCP CIC			CVFC			Equipment and materials				Expenses				
	Action	Days	Cost	Action	Days	Cost	Action	Days	Cost	Item	Units	Cost	Total	Item	Units	Cost	Total	
Monitoring Sessions	Organise survey programme	5	£1,250.00							PPE	6	£100	£600.00	Project coordinator travel	3	10	£30.00	
	Conduct survey	3	£750.00	Conduct survey	3	£750.00	Conduct survey	3	£225.00					CC CIC travel	3	10	£30.00	
														CVFC travel	3	10	£30.00	
Data Analysis	Manage data collection software	2	£500.00															
	Verify, export and map data	3	£750.00															
Totals		13	£3,250.00		3	£750.00		3	£225.00				£600.00				£90.00	
Grand Total	£4,915.00																	

Project Coordinator day rate	£250.00
CCP CIC day rate	£250.00
CVFC day rate	£75.00

Table 13 - Staff and equipment costs for the Outfall Safari

4.3 Water Chemical Analysis

4.3.1 Introduction

Chemical analysis of river water samples can identify changes in water quality not detectable by eye. Chemical testing is sensitive and yields reliable and replicable water quality measurements. This quantitative technique serves as a useful complement to riverfly monitoring and qualitative Outfall Safari surveys.

4.3.2 Rationale

4.3.2.1 Existing monitoring effort

Since March 2018 the Environment Agency has undertaken monthly water chemical testing at Bushey Mill Lane (upstream of Watford) and Hampermill, Oxhey (downstream of Watford) (see Figure 17).

The results show that ammonia, found in human effluent, is more concentrated at the site downstream of Watford.

Concentrations of phosphate, a component of fertilisers and agricultural run-off, are variable at both monitoring sites with no clear trend (Figure 18 and Table 14).

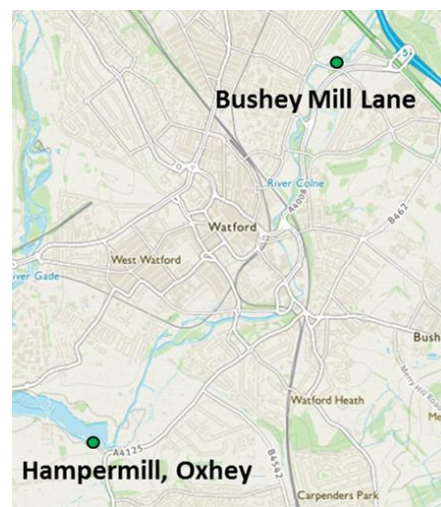


Figure 17 - Environment Agency chemical monitoring locations Bushey Mill Lane (upstream) and Hampermill, Oxhey (downstream)

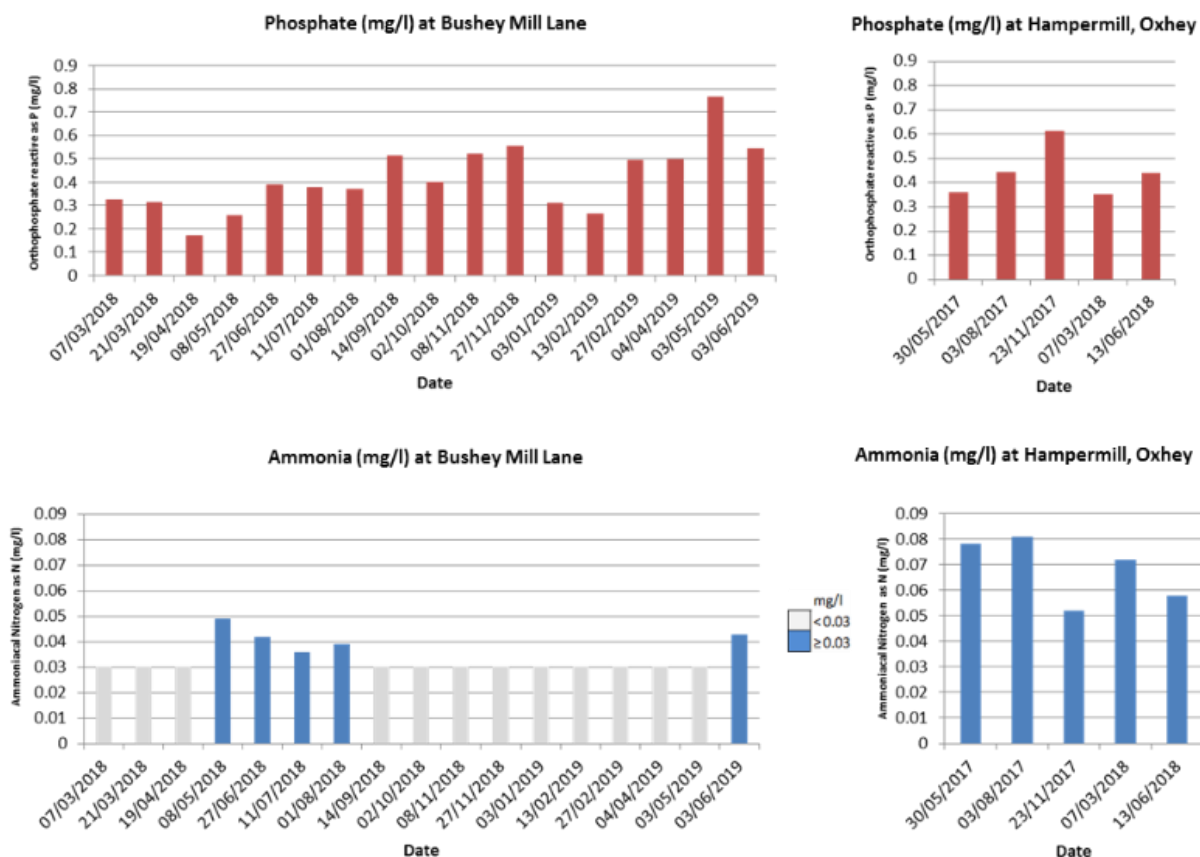


Figure 18 – Ammonia (red) and phosphate (blue) concentrations at Bushey Mill Lane (left) and Hampermill, Oxhey (right) (mg/l)

Chemical	Common name	Abbr.	Indicative of	Common sources	Concentration (mg/l)					
					Bushey Mill Lane - <i>upstream</i>			Hampermill, Oxhey - <i>downstream</i>		
					Min	Max	Mean	Min	Max	Mean
Ammoniacal nitrogen	Ammonia	A	Nutrient pollution	Effluent, sewage	< 0.03	0.05	0.01	0.05	0.08	0.07
Reactive phosphorous	Phosphate	P	Organic pollution	Agricultural run-off, fertilisers	0.17	0.77	0.43	0.35	0.61	0.44

Table 14 - Concentrations of ammonia (A) and phosphate (P) at Environment Agency monitoring sites upstream and downstream of Watford (mg/l)

The Environment Agency also deploy sondes temporarily to investigate water quality levels in response to pollution incidents. Since February 2019, three sondes have been monitoring the Colne by an outfall near Water Lane.

4.3.2.2 Challenges

While some chemical monitoring takes place upstream and downstream of Watford, the baseline water chemistry of River Colne as it flows through Watford is poorly understood.

4.3.3 Aims and objectives

The aim of this project is to track water quality in the Colne as it flows through Watford. The specific objectives are to:

- Establish a volunteer-led water sampling programme in partnership with Thames Water
- Quantify levels of ammonia and phosphate at six new monitoring sites in Watford

The outcomes of this project will be to:

- Determine the baseline levels of ammonia and phosphate of the Colne through Watford
- Track the ecological status of the Colne in Watford in line with the ammonia and phosphate thresholds outlined in the Water Framework Directive
- Identify areas of poor water quality on the Colne
- Produce evidence to demonstrate whether any interventions, remedial works and habitat improvements results in tangible improvements to water quality throughout Watford



Figure 19 - The River Colne flowing through Knutsford Playing Fields

4.3.4 Methodology

4.3.4.1 Sample locations

We propose to measure water quality upstream of, within and downstream of Watford (Figure 20).



Figure 20 - Proposed water chemical testing sites

4.3.4.2 Record flow rate

All water samples are collected at any point over a sampling weekend (once each month).

Trained citizen scientists record surface flow velocity during sample collecting to enable chemical loadings to be calculated from the chemical concentration data.

Step 1 – Set up gauging station to calculate A (river cross sectional area)

- A reach of 3 – 5 m in length is identified with relatively linear features. Posts are installed to demarcate the reach
- A representative transect is taken from bank to bank within the reach, measuring depth every 0.5 m
- A depth gauge is installed into the bank on the transect
- A river cross sectional area (A) reading is taken by citizen scientists upon each site visit

Step 2 - Calculate V (surface flow velocity)

- A piece of floating material is used to measure flow rate (ms^{-1}) between two markers

Step 3 – Calculate Q (flow rate)

$$Q(\text{m}^3 \text{ s}^{-1}) = 0.8 \times V (\text{ms}^{-1}) \times A (\text{m}^2)$$

4.3.4.3 Collect and store water sample

Citizen scientists collect a water sample and store it in a cool bag and cooling kit at $+5 \pm 3$ °C.

4.3.4.4 Sample distribution

On the Sunday evening of the sampling weekend, one volunteer collects all six samples. New sampling bottles are dropped off as full bottles are collected.

Samples are stored overnight at $+5 \pm 3$ °C and delivered by a volunteer to Maple Lodge Water Treatment Works where they are labelled and transferred to a fridge.

4.3.4.5 Laboratory analysis

A refrigerated courier van collects the samples from Thames Water on Monday morning and delivers them to the Thames Water UKAS accredited laboratory in Reading.

4.3.4.6 Circulate results

Thames Water issue a concentration data report to the Project Coordinator within two weeks of sample receipt. The report outlines AN and P loading using flow rate data calculated by citizen scientists (see section 4.3.4.2.).

4.3.5 Volunteer recruitment

The project will recruit a new citizen science team consisting of twelve local volunteers (see Table 15). Community Connections Project CIC will also collect samples and coordinate the volunteers. Where possible, sites that overlap with riverfly monitoring sites were selected so that riverfly monitoring and chemical sampling could be undertaken simultaneously by a single pair of volunteers.

Site name	Riverfly site	Volunteers required
Cattle Drink	Yes – existing	2
Knutsford Playing Fields	Yes – existing	2
Radlett Road	No	2
Dalton Road	No	2
Lairage Land	Yes - new	2
Carpenders Park	Yes - existing	2
	Total	12

Table 15 - Volunteer target for water chemical monitoring

4.3.6 Training requirements

Training for citizen scientists will be delivered by Thames Water, supported by the Environment Agency, and will involve some classroom and field elements (see Table 16).

Course content	
Water quality and identifying pollution types	
Consistent water sample collection	
Sample transfer and storage	
Consistent measurement of flow	
Recording and communication site measurements	
Health & safety	
Logistics	Per training session
Duration	1 day
Training frequency	Once annually
Volunteers trained per session	12
Delivery partners	Thames Water
	Environment Agency
Venue cost	None - training venue is provided by Thames Water

Table 16 - Training requirements for water chemical monitors

4.3.7 Tools and equipment

Thames Water will provide all equipment required to:

- Collect, store and transport water samples (e.g. vials)
- Record flow (e.g. standard gauging board and flow velocity measurement system)

4.3.8 Reporting method

Thames Water will generate the data in their laboratories each month. The data will be shared with the Project Coordinator each month, who will:

- Upload water quality data to the CVFC app:
 - Available for download by citizen scientists and members of the public
- Share the data with project partners:
 - At Watford Water Quality Forum (every 3 months)
 - In the annual water quality report (annually)
- Share the data with volunteers:
 - Circulate by email each month (volunteers will present the findings at the annual citizen science conference)

The Environment Agency water quality data for Bushey Mill Lane and Hampermill is available for public download at: <https://environment.data.gov.uk/water-quality/view/explore>

4.3.9 Timescale and coordination

Citizen scientists will collect all 6 water samples over one sampling weekend each month and deliver them to Maple Lodge Water Treatment Works the following Monday. The programme will be delivered by the Project Coordinator, Community Connections Project CIC (CCP CIC) and Thames Water. The roles and responsibilities of each delivery partner is summarised in Table 17.

Activity	Project Coordinator	CCP CIC	Thames Water	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Volunteer training	Liase with volunteer surveyors	Attend training	Supply venue	Once annually (exact month TBC)												
	Liase with Thames Water to coordinate logistics	-	Develop course content													
			Deliver training													
Facilitate monitoring sessions	Remote administrative support for volunteers	Collect samples and lead volunteers	Advice and guidance	Monthly												
			Provide equipment													
Processing data	Review data from TW and liase with CVFC to upload to website	-	Send data to Project Coordinator	Monthly												
Generate report	Input chemical analysis data into annual water quality report in December	-	Participate in WWQF	Report produced Annually (December)												
	Present data to WWQF															

Table 17 - Role of Project Coordinator CCP CIC and Thames Water in the water chemical testing programme

4.3.10 Budget

The staff and equipment costs for the water chemical testing programme are outlined below in Table 18.

Activity	Project Coordinator			Thames Water			CCP CIC			Equipment and materials				Expenses				
	Action	Days	Cost	Actions	Days	Cost	Action	Days	Cost	Item	Units	Cost	Total	Item	Units	Cost	Total	
Volunteer training	Facilitate annual training session	1	£250.00	Train volunteers in methodology	1	£0				Venue hire	1	£0	£0.00					
	Promote event to volunteers	1	£250.00															
	Register new volunteers	1	£250.00															
Monitoring Sessions	Remote support for volunteers and partners	6	£1,500.00	Remote support for volunteers and partners	5	£0	Collect samples and transport to Thames Water	12	£3,000.00	PPE	6	£100	£600.00	Project coordinator travel	12	5	£60.00	
													CC CIC travel	12	10	£120.00		
																	Volunteer travel	12
Data Analysis	Collation and analysis of data for annual report	3	£750.00	Analyse Data	1													
				Liaise with project coordinator	1													
Totals		12	£3,000.00		8	£0			£3,000.00				£600.00				£1,860.00	
Grand Total	£8,460.00																	

Project Coordinator day rate	£250.00
CCP CIC day rate	£250.00

Table 18 - Staff and equipment costs for the water chemical testing programme

4.4 Geomorphological surveys

4.4.1 Introduction

Geomorphological surveys measure habitat diversity, physical habitat and the hydromorphological functioning of a river and its margins.

The Modular River Physical Survey (MoRPh) is a geomorphological survey developed for Citizen Scientists. The survey supports the Catchment Based Approach and river stewardship for Catchment Partnerships and is now being more widely adopted for river assessment and monitoring. The methodology is recognised by statutory bodies such as the Environment Agency and is the preferred citizen science method of undertaking hydromorphological surveys on rivers nationally.



Figure 21 - Habitat variability along the River Colne in Watford.

4.4.2 Rationale

4.4.2.1 Existing survey efforts

The MultiMoRPh survey methodology was used by the Rediscovering the River Colne project team to assess the baseline condition of the river at all 7 proposed river improvement sites in Watford in 2019.

Repeat MultiMoRPh surveys are required to monitor any changes to the river channel over time after the completion of the practical habitat improvements undertaken in workstream 1 of the Rediscovering the River Colne project.

4.4.2.2 Challenges

A team of local people need to be trained in the MoRPh methodology in order to track the ecological and geomorphological condition of the river over time.

4.4.3 Aims

The aim of the project is to launch an annual citizen science MoRPh survey programme to monitor the condition of the river after completion of the habitat improvement works. The objectives are to:

- Train new volunteer citizen scientists in the MoRPh survey methodology and support annual surveys at the 7 river improvement sites along the Colne in Watford
- Produce annual reports that detail the ecological and hydromorphological function of the river
- Raise awareness about river ecology and geomorphology within the local community

The outcomes of the surveys will be to:

- Identify which sections of river have improved or declined in condition
- Indicate the extent that the river improvement works were successful
- Identify any new threats or challenges impacting the river’s geomorphology
- Identify additional land management recommendations for landowners and land managers

4.4.4 Methodology

4.4.4.1 On-site measurements

At each of the seven river improvement sites, the rivers will be sampled at ten lengths (modules) by pairs of trained surveyors. Each set of ten modules takes approximately seven hours (i.e. one working day) to survey.

The following parameters are recorded within each of the ten contiguous MoRPh surveys to ascertain scores for each subreach of the river based on a series of sixteen indices (see Table 29).

Characteristics	Parameters
Channel dimensions	<ol style="list-style-type: none"> 1. Left bank height 2. Right bank height 3. Bankfull width 4. Water width 5. Water depth
The left and right bank top (10 m back from the bank edge)	<ol style="list-style-type: none"> 1. Artificial / managed ground cover 2. Natural / lightly managed ground cover 3. Bank top water related features
The left and right bank face (includes margins of the water-filled channel)	<ol style="list-style-type: none"> 1. Bank face profile 2. Bank face materials 3. Bank face channel margin features 4. Bank face / channel margin vegetation
The channel bed	<ol style="list-style-type: none"> 1. Channel bed materials 2. Water surface type 3. Channel bed features 4. Channel bed vegetation

Table 19 - MoRPh survey parameters recorded by citizen scientists

The data from each survey is used to generate scores for 16 indices that illustrate the current condition of the river channel and riparian zone, in addition to scoring the level of human pressure affecting the watercourse. This allows for any subsequent improvement or detriment to the river to be fully monitorable.

Characteristics	Indices	
	Index no	Measurement
Channel	1	Number of present/extensive flow types
	2	Highest energy present/extensive flow type
	3	Number of present/extensive bed material types
	4	Coarsest present/extensive mineral bed material type
	5	Average alluvial bed material size (phi units)
	6	Average alluvial bed material size class
	7	Extent of superficial bed siltation
	8	Channel physical habitat complexity
	9	Number of aquatic vegetation morphotypes
Riparian (Bank Face and Bank Top)	10	Average riparian physical habitat complexity
	11	Maximum riparian physical habitat complexity
	12	Riparian vegetation structural complexity
Human pressures and impacts	13	Degree of human pressure imposed by bank top land cover
	14	Channel reinforcement
	15	Non-native invasive plant species extent
	16	Number of non-native invasive plant species

Table 20 - River condition scores generated by citizen science data



Figure 22 - Different channel dimensions and margin vegetation along the Colne in Watford

4.4.5 Volunteer recruitment

Local people will be encouraged to volunteer as citizen scientists. University students may be interested in conducting surveys, particularly students from Queen Mary University (where the survey was developed).

Number of sites	Survey days per site	Surveyors per site	Total surveyor days
7	1	2	14

Table 21 – Days required to survey all seven river improvement sites

4.4.6 Training requirements

Each volunteer must complete the 'Introduction to MoRPh' training programme offered by Queen Mary University in order to learn how to conduct a MoRPh survey and gain access to the MoRPh database (see Table 22). Up to ten volunteers can be trained in one session.

Requirement	Per training session
Training duration	1 day
Training frequency	Once annually
Volunteers trained per session	Up to 10
Delivery partners	Queen Mary University
Venue requirements	Provided by Queen Mary University in London
Training cost	£600 for up to 10 trainees

Table 22 - Training requirements for MoRPh survey volunteers

4.4.7 Tools and equipment

The following materials are required to complete the survey:

- MoRPh survey sheets and code sheet Waterproof clip board
- Mobile phone with GPS App and camera
- Length measuring device (e.g. expandable metal 5-10 m tape)
- A ranging pole to help your stability and as a measuring device
- Waders, waterproof clothing and safety equipment appropriate to working on riverbanks

4.4.8 Reporting method

The Project Coordinator will export the data annually and produce an annual report which will:

- Be circulated to all relevant stakeholders and riparian landowners and land managers along the river Colne in Watford
- Identify any additional land management recommendations as they arise

4.4.9 Timeline and coordination

The geomorphological surveyors will be coordinated by the Project Coordinator (see Table 23). The surveys will be conducted 1-2 years after river improvement works have taken place in order to allow time for any changes to take effect. The surveys will be repeated annually to record changes that occur over time. The survey will take place in June as this is the month where key botanical species, notably invasive species, are most visible.

Activity	Project Coordinator	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Volunteer training	Liaise with volunteer surveyors	Once annually in May												
	Liaise with MoRPh trainers to organise training													
Facilitate monitoring sessions	Remote administrative support for volunteers	Throughout June												
Processing data	Remote administrative support for volunteers	June - July												
Generate report	Generate geomorphology report	July - August												
	Circulate report to relevant partners													

Table 23 - Project Coordinator roles and responsibilities for MoRPh surveys

4.4.10 Budget

The staff and equipment costs for the MoRPh survey programme are outlined below in Table 24.

Activity	Project Coordinator			Training Costs			Staff and Volunteer Expenses		
	Action	Days	Cost	Action	Cost	Total	Action	Cost	Total
Volunteer training	Facilitate annual training session	2	£500.00	Training Course for 10 volunteers	£600	£600.00	Travel expenses for 10 volunteers	£200	£200.00
	Register new volunteers	1	£250.00				Travel expenses for project coordinator	£20	£20.00
Monitoring Sessions	Coordinate annual survey programme	5	£1,250.00	PPE for 10 volunteers	£100	£1,000	Travel expenses for 10 volunteers	£200	£200.00
	Onsite support for volunteers	5	£1,250.00				Travel expenses for project coordinator	£20	£20.00
Data Analysis	Provide remote support for volunteers using Cartographer	3	£750.00						
	Export annual data for production of report	1	£250.00						
Reporting	Produce annual MoRPh report	1	£250.00						
Totals		18	£4,500.00			£1,600.00			£440.00
Grand Total			£6,540.00						

Project Coordinator day rate	£250.00
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Table 24 - Staff, training and equipment costs for MoRPh surveys

4.5 Non-native invasive plant species

4.5.1 Introduction

The colonisation of riparian habitats by non-native invasive plant species has a range of negative impacts on the River Colne including:

1. Reduction in biodiversity of flora and fauna
2. Disrupted geomorphology
3. Risk to public health (i.e. Giant Hogweed)

The Colne in Watford suffers from the invasion of three non-native plant species (see Table 25 and Figure 23).

Common name	Scientific name	Impact
Himalayan Balsam	<i>Impatiens glandulifera</i>	Can promote bank erosion through dieback and subsequent destruction of bankside structure
		Dense stands can impede water flow at times of high rainfall, thereby increasing the likelihood of flooding
		Reduces biodiversity as it shades out and crowds out native plants
Giant Hogweed	<i>Heracleum mantegazzianum</i>	May form dense stands reducing riparian species diversity
		Produces phytotoxic sap which burns human skin exposed to UV radiation i.e. sunlight
Japanese Knotweed	<i>Fallopia japonica</i>	Alteration in habitat structure and biological communities is known to impact directly on salmonid fisheries
		Its presence poses great management and access concerns if left uncontrolled (The Living River Project - The River Avon System Non-native Invasive Plant Strategy).

Table 25 - Impact of the invasion of Himalayan Balsam, Giant Hogweed and Japanese Knotweed on riparian habitats



Figure 23 - Invasive plant species in British rivers. Left: Himalayan Balsam. Centre: Giant Hogweed. Right: Japanese Knotweed. Photos from Non-Native Species Secretariat (<http://www.nonnativespecies.org>)

4.5.2 Rationale

4.5.2.1 Existing monitoring effort

The CVFC mobile app is used to record the presence of invasive plant species across the Colne catchment and, with the support of the Environment Agency, will soon be rolled out for use in other catchments (<http://cvfc.org.uk/nnis/>).

4.5.2.2 Challenges

Community groups Green Gym and Community Connections Project CIC currently conduct some removal of these plants (see Figure 24) and record their presence on their facebook page, however no group is strategically mapping and assessing the severity of invasive species in Watford.



Figure 24 - Control of invasive plant species in the Watford Colne by Community Connections Project CIC

4.5.3 Aims and objectives

We propose to establish a new robust citizen science invasive plant species monitoring programme for the River Colne in Watford. The objectives are to:

- Recruit a new team of volunteer citizen scientists and train them in invasive plant species identification
- Map the locations and assess the severity of all invasive plant populations along the Colne in Watford before and after river improvement works

Outcomes:

- Gain a comprehensive understanding of the baseline burden of invasive plants in Watford for the first time
- Additional land management recommendations may be identified for:
 - Riparian land managers
 - Riparian landowners
 - Community interest groups (e.g. Green Gym)
- Raise awareness within the local community about the impact of invasive species

4.5.4 Methodology

Eight sites along the Colne in Watford will be surveyed for invasive species throughout June (Table 26 and Figure 25).



Figure 25 - Invasive plant species survey sites: 7 river improvement sites plus the town centre

Site no.	Site name	Site information
1	Knutsford Playing Fields	River improvement site
2	Timberlake Allotments	River improvement site
3	Radlett Road Playing Fields	River improvement site
4	Waterfields Recreation Ground	River improvement site
5	Town Centre	Few ecological records exist as access is limited
6	Oxhey Park	River improvement site
7	Riverside Recreation Ground	River improvement site
8	Lairage Land	River improvement site

Table 26 - Invasive plant species survey sites in Watford

Surveyors will walk the length of the survey area, recording details about invasive species as they are observed. Citizen scientists will record invasive species by:

- Inputting data directly into the CVFC app using their smartphones (see Table 27)
- Recording on paper - any surveyors that do not have access to a smartphone can opt to record data onto a paper map and pass on to the Project Coordinator to upload onto the CVFC app

Question	Response
Location	Grid reference is automatically generated using the app's geolocation feature
Invasive species type	Surveyors select from the list: <ul style="list-style-type: none"> • Giant Hogweed • Himalayan Balsam Japanese Knotweed
Catchment	Volunteers select 'Colne' catchment
Water type	Surveyors select 'River Cone'
Set marker	Surveyor selects if invasive species is on left or right bank (as you look downstream)
Severity	Volunteers will record area covered by invasive species: <ul style="list-style-type: none"> • Minor (<10 m³) • Moderate (10 – 50) • Bad (50 – 100 m³) • Severe (100 -150 m³) • Very severe (>150 m³)
Submitted by	Surveyor enters their full name
Phone number	Surveyor enters phone number in case a follow-up call is required to verify details
Organisation	Surveyor enters organisation e.g. Watford Colne Citizen Scientist
Description	Surveyor provides details about the incident e.g.
Photo	Survey uploads photograph of invasive species

Table 27 - Invasive species assessment form on CVFC app

4.5.5 Volunteer recruitment

To gain full visibility of riparian vegetation, volunteers will sometimes be required to wade in-channel, therefore citizen scientists will survey in pairs to ensure safe working by the river. Eight volunteer pairs will be required to cover all sites (see Table 28).

Surveyors per site	Total sites	Total surveyors required
2	8	16

Table 28 - Volunteer target for invasive plant species surveys

The Project Coordinator will develop a monitoring programme and will recruit volunteer surveyors from the local community. Community Connections Project CIC will receive the monitoring programme and liaise with volunteers to conduct monitoring sessions accordingly.

4.5.6 Training requirements

Citizen scientists will receive one day of invasive species training delivered by the Project Coordinator, CVFC and Community Connections Project CIC (see Table 29). Surveyors will be trained in:

- An introduction to invasive species ecology
- Invasive species identification
- Reporting invasive species using the CVFC app
- Methods of control – best practice

Requirement	Per session
Training duration	1 day
Training frequency	Once annually in May
Volunteers trained per session	16
Delivery partners	Project Coordinator - Groundwork South
	Community Connections Project CIC
	CVFC
Venue requirements	Classroom with access to river for site visit

Table 29 - Training requirements for invasive species citizen scientists

4.5.7 Tools and equipment

Surveyors will use smartphones to record data. Personal protective equipment will be supplied to enable surveyors to walk in-channel:

- Waders
- Waterproof gloves
- Sanitary kit
- First aid kit
- Ranging pole

4.5.8 Reporting method

Upon completion of the survey, CVFC will collate all data and send to the Project Coordinator and Community Connections Project CIC. The project coordinator will produce a report which:

- Details the locations and prevalence of each invasive species at each survey site
- Identifies land management recommendations for control of invasive species

The project coordinator will also update the [Herts Environmental Records Centre](#) annually with the most recent invasive species records.

Community Connections Project CIC will:

- Undertake all control works as part of their existing contract with Watford Borough Council

Note that timing is crucial for removal of Himalayan Balsam - this plant must be removed before it sets seed mid/end-July.

4.5.9 Timescale and coordination

The surveyors will be coordinated by the Project Coordinator and Community Connections Project CIC (see Table 30). The surveys will take place in June as this is the month where invasive plant species are most visible.

Activity	Project Coordinator	CCP CIC	CVFC	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Volunteer training	Liaise with volunteer surveyors	Assist with delivery of training session	-	Once annually in May												
	Organise training e.g. book venue, develop course content		-													
Facilitate monitoring sessions	Remote administrative support for volunteers	Facilitate annual survey sessions	-	Throughout June												
Processing data	Remote administrative support for volunteers		Technical support with app as required	June - July												
Generate report	Generate invasive plant report	Collate data and produce management recommendations	Export data from CVFC app for Project Coordinator	Deadline 30 th June												
	Circulate report to relevant partners															
Invasive species removal	-	Facilitate annual removal session as part of existing agreement with WBC	-	July - August												

Table 30 - Roles and responsibilities of Project Coordinator, Community Connections Project and CVFC in the invasive plant species project

4.5.10 Budget

The staff and equipment costs for the invasive plant species programme are outlined below in Table 31.

Activity	Project Coordinator Staff Time			Community Connections Projects			Equipment and materials				Expenses			
	Actions	Days	Cost	Actions	Days	Cost	Item	Units	Cost	Total	Item	Units	Cost	Total
Volunteer training	Prepare course content and materials	2	£500.00	Assist with delivery of training session	1	£250.00	Venue hire	1	£300	£300.00	Project coordinator travel	1	5	£5.00
	Facilitate training session	1	£250.00				Printed materials	1	£20	£20.00	CCP CIC travel	1	5	£5.00
	Register new volunteers	1	£250.00											
Monitoring Sessions	Produce Monitoring Programme	1	£250.00	Facilitate annual survey sessions	7	£1,750.00					CCP CIC travel	7	5	£35.00
	Promote survey sessions to trained volunteers	1	£250.00										Volunteer travel	20
Data Analysis				Collate data and produce management recommendations	1	£250.00								
Reporting				Produce annual invasive species report with management recommendations	2	£500.00								
NNIS Removal Sessions	Promote removal sessions to all volunteers	1	£250.00	Facilitate annual removal session as part of existing agreement with WBC (costs are covered existing agreement with WBC)	14	£0.00								
Totals		7	£1,750.00			£2,750.00				£320.00				£145.00
Grand Total			£4,965.00											

Project Coordinator day rate	£250.00
CCP CIC day rate	£250.00

Table 31 - Staff and equipment costs for the invasive plant species monitoring programme

4.6 Dragonfly and damselfly monitoring

4.6.1 Introduction

The presence of dragonflies and damselflies, collectively known as Odonata, is an important indicator of ecological balance (see Figure 26). These insects lay their eggs in or near freshwater, therefore their presence in an area is a good indicator of water quality. They thrive in sites that contain diversity of microhabitats and are highly vulnerable to pollution and human perturbation, therefore are also a good indicator of habitat quality.



Figure 26 - Dragonfly (left) and damselfly (right) captured by Hertfordshire Natural History Society

4.6.2 Rationale

4.6.2.1 Existing volunteer effort

Volunteers associated with the Middlesex Wildlife Trust (HMWT) and Hertfordshire Natural History Society (HNHS) have recorded 24 species of dragonflies and damselflies in Hertfordshire to date.

4.6.2.2 Challenges

Few dragonfly and damselfly records are held for Watford, therefore the diversity and abundance of these species along this section of the River Colne is poorly understood.

4.6.3 Aims and Objectives

This project aims to produce the first comprehensive survey of dragonflies and damselflies along the River Colne in Watford. The objectives of the project are:

- To train and support local volunteers in Odonata identification and survey techniques
- To measure the diversity and distribution of Odonata along the River Colne and associated wetland habitats in Watford

The outcomes of the project are:

- To produce information about water quality and habitat to guide prioritisation for future enhancements
- To produce baseline biodiversity data that will inform for future monitoring activities
- To contribute to the Hertfordshire dragonfly atlas

4.6.4 Methodology

Surveyors will follow the methodology provided through the Hertfordshire Dragonfly Atlas Survey. At the time of writing the methodology has not been finalised – information below is adapted from the London Wildlife Trust Dragonfly Atlas.

4.6.4.1 Survey period

Surveys will take place between June and July.

4.6.4.2 Survey conditions

Surveyors will record dragonflies and damselflies;

- Between 10:00 – 16:00 (when these invertebrates are most active)
- During sunny weather with cloud cover less than 60% and no rain
- When wind is low (<18 mph)
- When the temperature is between 17°C - 30°C

4.6.4.3 Habitat selection

Surveyors will count dragonflies and damselflies:

- Along the full length of River Colne in Watford from Knutsford Playing Fields (North) to Lairage Land (South)
- In all adjacent water bodies (e.g. brooks, backwaters)
- In all other areas that might provide habitat e.g. riverside paths

The surveyors will record observations about the site e.g. disturbance, water level and pollution.

4.6.4.4 Counting dragonflies and damselflies

Surveyors will record the:

- Number of dragonflies and damselflies seen
- Species of dragonflies and damselflies seen
- Activity of each dragonfly and damselfly e.g. flight, resting, mating, egg-laying
- Life-stage of each dragonfly and damselfly

4.6.5 Volunteer recruitment

Surveyors will work in pairs to cover seven project areas (Table 32). Volunteers will be sought via the partners' networks and Hertfordshire Natural History Society.

Minimum surveyors per site	Number of sites	Total number of surveyors
2	7	14

Table 32 - Volunteer target for dragonfly and damselfly surveys

4.6.6 Training requirements

Hertfordshire and Middlesex Wildlife Trust will run a training course for all new volunteers which will include a classroom talk followed by field work.

4.6.7 Tools and equipment

Volunteers will be supplied with binoculars, a map, notebook and a survey sheet.

4.6.8 Reporting method

Herts and Middlesex Wildlife Trust will produce an annual report which:

- Outlines the distribution of each species
- Identifies any land management recommendations or river improvements

Herts and Middlesex Wildlife Trust will pass the results of surveys to the Hertfordshire Dragonfly Recorder, who will submit the data to:

- Hertfordshire Environmental Records Centre
- Hertfordshire Dragonfly Atlas

4.6.9 Timescale and coordination

The surveyors will be trained and coordinated by the Herts and Middlesex Wildlife Trust (HMWT), with support from the Project Coordinator (see Table 33).

Activity	Project Coordinator	HMWT	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Volunteer training	Register new volunteers	Deliver training	Once annually												
Facilitate monitoring sessions	Remote support for volunteers and HMWT	Onsite supervision and guidance	June - July												
Processing data	-	Collect and analyse data	October												
Generate report	-	Generate annual report	November												

Table 33 - Roles and responsibilities of the Project Coordinator and HMWT for dragonfly and damselfly monitoring

4.6.10 Budget

The staff and equipment costs for the dragonfly and damselfly monitoring project are outlined below in Table 34.

Activity	Project Coordinator Staff Time			HMWT			Equipment and materials				Expenses			
	Actions	Days	Cost	Actions	Days	Cost	Item	Units	Cost	Total	Item	Units	Cost	Total
Volunteer training	Register new volunteers	1	£250.00	Prepare course content and materials	2	£500.00	Venue hire	1	£300	£300.00	Project coordinator travel	1	5	£5.00
		1	£250.00	Deliver training day	1	£250.00	Printed materials	1	£40	£40.00	Volunteer travel	14	5	£70.00
				Post-course admin e.g. circulate materials, answer questions	2	£500.00	Refreshments	1	£40	£40.00				
Monitoring Sessions	Remote support for volunteers and HMWT	2	£500.00	Onsite supervision and guidance for new surveyors (0.5 day per survey pair)	7	£1,750.00	ID & recording sheets	7	£10	£70.00	Volunteer travel	14	5	£70.00
							Binoculars	7	£150	£1,050.00	HMWT travel	14	5	£70.00
										Project coordinator travel	12	5	£60.00	
Data Analysis				Collate data and analyse data	3	£750.00								
				Produce annual report	3	£750.00								
Totals		4	£1,000.00			£3,750.00				£1,500.00				£275.00
Grand Total	£6,525.00													

Project Coordinator day rate	£250.00
HMWT officer day rate	£250.00

Table 34 - Staff and equipment costs for dragonfly and damselfly monitoring

4.7 Fish populations

4.7.1 Introduction

Electrofishing is a method used regularly by the Environment Agency to monitor fish populations (see Figure 27).

It is the process of catching fish by creating an electrical field through water. This stimulates the nervous system, causing the fish to swim in a specified direction until immobilised and caught by the surveyor. Fish are not harmed during this process.

The Environment Agency conduct electrofishing as part of their National Monitoring Programme in accordance with the Water Framework Directive sampling programme.



Figure 27 - Environment Agency recording fish caught by electrofishing (source www.gov.uk)

4.7.2 Rationale

To complement the citizen science monitoring activities, the Environment Agency has extended its fish population surveys in Watford from one to three sites from 2020 (see Figure 28):

1. Radlett Road Playing Fields
2. TESCO Extra (new site)
3. Lairage Land (new site)

Volunteer citizen scientists will be invited to observe the surveys and access the results.



Figure 28 - Electrofishing sites in Watford

4.7.3 Aims and objectives

This project aims to increase the fish population survey effort in Watford and to open the surveys up for observation by local people. The objectives are to:

- Obtain baseline data about fish populations in Watford:
 - Species composition
 - Relative abundance
 - Size distribution
 - Biomass
- Introduce Watford residents to local statutory environmental monitoring programmes

The outcomes are:

- To identify any changes in fish populations that occur as a result of habitat improvement works
- To identify any additional habitat improvements required

4.7.4 Methodology

4.7.4.1 Frequency

The survey will be conducted once annually per site before river improvement works take place and then 2-3 times annually upon completion of habitat improvements.

4.7.4.2 Sample collection

Using an electricity generator which is dragged behind on a boat as they walk, Environment Agency staff will temporarily immobilise the surrounding fish.

Electrofishing uses direct current electricity flowing between a submerged cathode and anode. This affects the movement of the fish so that they swim toward the anode, where they can be caught by the team conducting the survey and recorded appropriately.

All sampling follows procedures to protect held fish. Air pumps and water transfers are used as necessary to maintain safe conditions. Large fish are kept separate from smaller prey-size fish to avoid predation during containment.

4.7.4.3 Sample analysis

The Environment Agency currently undertake qualitative sampling which is used to determine species composition, relative abundance, size distribution and biomass. The results of the surveys are used to make management recommendations for specific sites and to evaluate the overall condition of fish populations across the Colne Catchment.

4.7.5 Reporting method

The Environment Agency will analyse all datasets and publish them:

- In an annual report for stakeholders
- In the online open-access National Fish Population Database

4.7.6 Timeline and coordination

Fish population surveys will be conducted by the Environment Agency. The Project Coordinator will advertise the surveys to citizen scientists and circulate the findings to the citizen science network and relevant partners (see Table 35).

Activity	Project Coordinator	Environment Agency	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Facilitate monitoring sessions	Advertise monitoring to public and citizen science network	Deliver monitoring sessions with in-house staff	1-3 times per year												
Processing data	-	Analyse data	1-3 times per year												
Generate report	Circulate report to citizen science network and relevant partners	Generate report and sent to Project Coordinator	1-3 times per year												

Table 35 - Roles and responsibilities of the Project Coordinator and Environment Agency in the fish population surveys

4.7.7 Budget

The Environment Agency will cover all costs for the fish population surveys in Watford. The Project Coordinator can advertise the surveys and circulate the results to citizen scientists for no additional cost (see Table 36).

Activity	Project Coordinator Staff Time			Environment Agency	
	Actions	Days	Cost	Actions	Cost
Monitoring Sessions	Advertise surveys to citizen science network	0.5	£0.00	Conduct surveys	£0.00
Data Analysis	Circulate annual report to citizen scientists and relevant stakeholders	0.5	£0.00	Collate data and analyse data	£0.00
				Produce annual report	£0.00
Totals		1	£0.00		£0.00
Grand Total			£0.00		

Table 36 - Costs for fish surveys in Watford

5 Project Budget

5.1 Project Coordinator

5.1.1 Project Administration

The Project Coordinator will administer the Environmental Monitoring Project as a whole and coordinate all volunteer citizen scientists. Annual Project Coordinator staff costs are summarised in Table 37 based on a rate of £250 per day.

Task	Days per year	Annual cost
Develop promotion and recruitment strategy	3	£750
Attend community events to recruit volunteers and promote project	3	£750
Register new volunteers and provide administrative support	3	£750
Publish promotional material via agreed media channels	3	£750
Manage social media interactions and enquiries	3	£750
Manage citizen science network and communications	3	£750
Coordinate annual citizen science forum	5	£1,250
Total	23	£4,500

Table 37 - Project Coordinator costs for project administration

5.1.2 Watford Water Quality Forum

The Project Coordinator will facilitate the quarterly Watford Water Quality Forum (WWQF) meetings and produce the annual water quality report which details the results of the:

- Riverfly surveys
- Outfall Safari
- Water chemical analyses

The costs for these activities are outlined in Table 38 based on the rate of £250 per day.

Task	Days per year	Annual cost
Facilitate Watford Water Quality Forum meetings	8	£2,000
Produce annual water quality report	10	£2,500
Total	18	£4,500

Table 38 - Project Coordinator staff costs for facilitating the WWQF

5.1.3 Project Coordinator Timeline

The activities of the Project Coordinator throughout the year are summarised in Table 39. In summary, the Project Coordinator will:

- Support citizen scientists and project partners - during each defined survey period
- Manage all project administration and facilitate Watford Water Quality forum – all year round

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Riverfly Monitoring												→
Outfall Safari												
Water Chemical Analysis												→
Geomorphological Surveys												
Invasive Plant Surveys												
Dragonfly Surveys												
Fish Surveys												
Project Administration												→
Watford Water Quality Forum												→

Table 39 - Annual timeline of activities for the Project Coordinator

5.2 Annual cost

5.2.1 Cost of individual monitoring activities

The total annual cost of each environmental monitoring activity is summarised below in Table 40. Please note that not all surveys will be conducted annually (see section 5.1.4.).

	Staff time				Equipment and venue hire for training	Expenses	Total annual cost
	Project Coordinator	CVFC	CCP CIC	HMWT			
Riverfly Monitoring	£3,500	£1,650			£6,763	£2,260	£14,173
Outfall Safari	£3,250	£225	£750		£600	£90	£4,915
Water Chemical Analysis	£3,000		£3,000		£600	£1,860	£8,460
Geomorphological Surveys	£4,500				£1,600	£440	£6,540
Invasive Plant Surveys	£1,750		£2,750		£320	£145	£4,965
Dragonfly and Damselfly Surveys	£1,000			£3,750	£1,500	£275	£6,525
Fish Surveys							£0
Project Administration	£4,500				£0	£0	£4,500
Watford Water Quality Forum	£4,500					£0	£4,500
Total	£26,000	£1,875	£6,500	£3,750	£10,383	£5,070	£53,578

Table 40 - Total annual cost for each environmental monitoring activity outlined in this feasibility study

5.2.2 Cost saving by funding the full programme

Each activity has been costed out in full and could be funded as individual projects. However, the overall cost would be reduced if the project was funded as a whole because equipment could be shared across projects through a central hub. For example, the cost of waders and personal protective equipment costs £5,000 in the budget outlined in 5.2.1. but could be halved to £2,500 if resources were shared. The Project Coordinator could track the project inventory and allocate resources to each project as required.

5.3 Total delivery costs 2020 – 2025

The total cost of all environmental activities for the first 5 years of the Rediscovering the River Colne project are outlined in Table 41.

Most environmental monitoring activities will be repeated each year of the 10-year Rediscovering the River Colne project:

- Riverfly surveys
- Water chemical analysis
- Invasive plant surveys
- Fish surveys
- Project administration
- Facilitation of Watford Water Quality Forum

Some activities will not commence until year 2 of the project:

- Geomorphological surveys will commence after practical river improvements (workstream 1) have been delivered in year 1
- Dragonfly and damselfly surveys will commence in year 2 once the survey methodology has been finalised

The Outfall Safari will be repeated every 4 years:

- This is the recommended survey frequency as it allows sufficient time for Thames Water to make operational changes in response to the Outfall Safari data

	2020/21	2021/22	2022/23	2023/24	2024/25
Riverfly Monitoring	£14,173	£14,173	£14,173	£14,173	£14,173
Outfall Safari	£4,915				£4,915
Water Chemical Analysis	£8,460	£8,460	£8,460	£8,460	£8,460
Geomorphological Surveys		£6,540	£6,540	£6,540	£6,540
Invasive Plant Surveys	£4,965	£4,965	£4,965	£4,965	£4,965
Dragonfly and Damselfly Surveys		£6,525	£6,525	£6,525	£6,525
Fish Surveys	£0	£0	£0	£0	£0
Project Administration	£4,500	£4,500	£4,500	£4,500	£4,500
Watford Water Quality Forum	£4,500	£4,500	£4,500	£4,500	£4,500
Annual Total	£41,513	£49,663	£49,663	£49,663	£54,578

Table 41 - Total delivery costs for the Environmental Monitoring Project from 2020 - 2025