Monitoring Microplastics in our Rivers Through Citizen Science

A Pilot Project in Hampshire's Test & Itchen River Catchments

2020-21

Project Supported by the Nineveh Charitable Trust

Contents

Summary

- Plastic pollution has become an increasingly publicised concern amongst environmental stakeholders and the public.
- The impacts of plastics on the world's oceans are well researched, but their land-based origins and potential impact on freshwater life are less well understood.
- Microplastic (measuring less than 5mm in diameter) pollution is potentially more environmentally damaging than larger pieces of plastic because small pieces of plastic are more likely to be consumed by wildlife and have a greater relative surface area which can absorb and release chemicals.
- Research over the last 12 months has identified microplastic pollution throughout urban and rural freshwater environments in the UK, including the air, soils, riverbed sediments and river water.
- Recognising the need for greater research into the prevalence and distribution of microplastics in UK freshwater environments, Earthwatch saw this information gap as one that could be addressed through citizen science if a suitable sampling and analysis method could be developed
- With the financial support of the Nineveh Charitable Trust, Wessex Rivers Trust worked in partnership with Earthwatch to establish a pilot project aimed at developing and implementing a cost-effective, transferable citizen science-based method for monitoring microplastic pollution in rivers.
- The pilot project tested the microplastic monitoring methodology on four watercourses of varying nature (i.e. different flow, depth and bank type) located throughout the upper and lower reaches of the Test and Itchen River catchments in Hampshire.
- An existing network of conservation volunteers were engaged and actively involved in testing the methodology in the field between autumn 2020 and summer 2021.
- Due to lockdown restrictions throughout much of the winter and spring, monitoring was not carried out as regularly as initially planned.
- The pilot project validated a sampling methodology that enables citizen scientists to capture and record microplastic particles in easily accessible watercourses. The sampling methodology is sufficient to identify presence or absence of microplastic particles, but is not sufficiently precise for the purpose of quantifying microplastic concentrations.
- The proposed monitoring approach shares many similarities to the citizen science-based Anglers Riverfly Monitoring Initiative (ARMI), including similar equipment requirements, highlighting the opportunity to integrate microplastic pollution monitoring with an existing, well-established environmental monitoring programme throughout the country.

1.0 Introduction

1.1 Background

Amongst the many pressures we know to threaten the health of our rivers, plastic pollution is becoming increasingly recognised as one of modern society's biggest scourges on our aquatic environment. Microplastic pollution is potentially more environmentally damaging than larger pieces of plastic because small pieces of plastic are more likely to be eaten by wildlife and have a relative greater surface area on which other persistent chemicals may absorb and from which plasticisers and other additives may be released. Microplastics can enter the environment through breakdown of large plastics, or in their primary form, for example as pre-production pellets (nurdles), biobeads (used in wastewater treatment), or microbeads from cosmetics. Due to the chemical makeup of plastic materials, this mixture of micro-sized particles, leached additives, and subsequent degradation products, put our native wildlife at risk.

To understand the impact of plastic pollution on our freshwater environment, we first need to identify their presence, concentration, type and source. Plastic pollution in our oceans is well-documented, but until recently, much less research has been dedicated to investigating plastics in freshwater systems, the main source of plastics in the ocean. Media reports over the last 12 months have described the sources and potential impact of microplastic pollution on both humans and nature.

With plastic pollution high on the public's agenda and environmental radar, Earthwatch recognised an opportunity to develop a simple but effective approach for citizen scientists to monitor the level of microplastic pollution entering their local river or stream. Utilising their network of conservation volunteers, and the financial support of the Nineveh Charitable Trust, Wessex Rivers Trust partnered with Earthwatch to undertake a 12 month pilot project (2021-22) to test out a new approach to microplastic monitoring in rivers.

1.2 Aims and objectives of the project

The primary aim of the project was to develop and implement a cost-effective, transferable citizen science-based method for monitoring microplastic pollution in rivers. Testing the method in a diverse rural and urban river catchment aimed to aid our understanding of the type, spatial extent, and potential sources of microplastic pollution in our river catchments, helping to inform future studies in the field.

2 Methodology

2.1 Survey site locations

Many of the rivers in the Wessex Rivers Trust area are 'chalk streams' – these are a globally rare type of river, famed for their crystal-clear waters which support a wide range of plants and animals (**Figure 2.1**). More than half of the world's chalk streams are found in southern England alone. Yet these fragile, unique rivers are at risk of deterioration. Compared to the plastic pollution research undertaken on in large urban river catchments, little focus has been afforded to the globally rare and incredibly sensitive chalk streams of Southern England.

Figure 2.1 The River Itchen – one of the world's most famous chalk streams.

The Test and Itchen River catchments (**Figure 2.2**) are two of the country's most famous chalk streams, home to Atlantic salmon, brown trout, water vole and otter. Wessex Rivers Trust's network of conservation volunteers kindly offered their support to the project, and were keen to understand whether microplastics are present in their local rivers.

To develop an effective methodology for recording microplastic pollution in rivers, four monitoring locations with active conservation volunteer networks were selected in both the rural headwaters and the urbanised lower reaches of the catchment. These included the Cheriton Stream (located in the rural headwaters of the River Itchen), the River Anton (located in the semi-urban upper Test catchment), the Tadburn Lake (located in the semi-urban lower Test catchment), and the Monk's Brook (located in the urbanised lower Itchen catchment) (see **Figure 2.2** & **2.3**). Training and subsequent surveys were planned for delivery between autumn 2020 and summer 2021, thereby encompassing all four seasons and a range of low to high flow conditions across different potential areas for plastic pollution. The exact survey schedule, including frequency of samples would evolve in relation to the time available from the conservation volunteers.

Figure 2.2 Watercourses selected for the microplastics monitoring pilot project.

Figure 2.3 Sampling sites on the Cheriton Stream (top left), River Anton (top right), Monk's Brook (bottom left) and Tadburn Lake (bottom right).

2.2 Proposed monitoring methodology

Earthwatch developed a low-cost citizen science monitoring method which was to be tested by citizen scientists following training led by Wessex Rivers Trust. The sampling equipment was based on an adapted aquatic macroinvertebrate kick-net (hereon referred to as an 'adapted kick net') which was designed to be held by hand from in-channel or on the river bank. The free-floating net frame was designed to be submerged, facing the flow to collect any microplastics in suspension in the water column (see **Figure 2.4**). The net was held static in position for a set period of time (depending on the flow velocity of the river current), allowing for an approximate sample volume to be calculated accordingly. A 400 µm net mesh was employed to capture any microplastics that could be visible to the naked eye for identification. A range of site-based sampling details were recorded (see **Appendix 1**) to verify the sample.

Figure 2.4 **The adapted aquatic macroinvertebrate kick-net employed during the initial stages of the pilot project on the Cheriton Stream and River Anton (left) and the standard kick-net used during the pilot project on the Monk's Brook and Tadburn Lake (right).**

The adapted kick-net methodology was tested in the field by Wessex Rivers Trust and their conservation volunteers on the Cheriton Stream and River Anton in autumn 2020. Further planned sessions with the conservation volunteer groups on the Tadburn Lake and Monk's Brook were cut short by the onset of the winter 2020 covid-19 lockdown. However, the initial testing of the method highlighted areas which required development, including a simplified sampling net approach suitable for shallower watercourses.

Based on the feedback received from volunteers during the initial tests on the Cheriton Stream and River Anton, the project team simplified the sampling net, employing a standard aquatic macroinvertebrate kick-net (hereon referred to as a 'standard kick-net') (see **Figure 2.4**). The standard 'off the shelf' kick net uses a 1mm diameter mesh, deemed suitable for recording microplastics greater than 1mm (1000 µm) in diameter. The revised sampling methodology was tested on the Monk's Brook and Tadburn Lake. Whilst the Monk's Brook survey was undertaken by Wessex Rivers Trust staff only, sampling on the Tadburn Lake was carried out by the local conservation volunteer group through late spring to early summer.

Microplastic samples recorded during surveys were analysed by Earthwatch using Fourier Transform Infrared Spectroscopy (FTIR). FTIR analysis was performed twice on each sample, in the range 650-4000 cm-1, using an Agilent Cary 630 FTIR Spectrometer. The spectra were analysed and compared to available structures of common plastics and other materials. FTIR spectroscopy is an analytical method used for identifying plastics and other materials, based on their molecular structure. As infrared radiation passes through a thin material sample, a part of the radiation is absorbed by the sample and with the rest transmitted to a detector. The amount of radiation absorbed will change at each infrared wavelength according to the molecular structure of the material being analysed. The resulting absorption (or transmission) spectrum can be used to identify the material (plastic) analysed.

3 Results

A total of 12 samples were taken from the four watercourses (see **Table 3.1**). Microplastics were recorded only in the Monk's Brook sampling.

Table 3.1 Microplastic monitoring trial results.

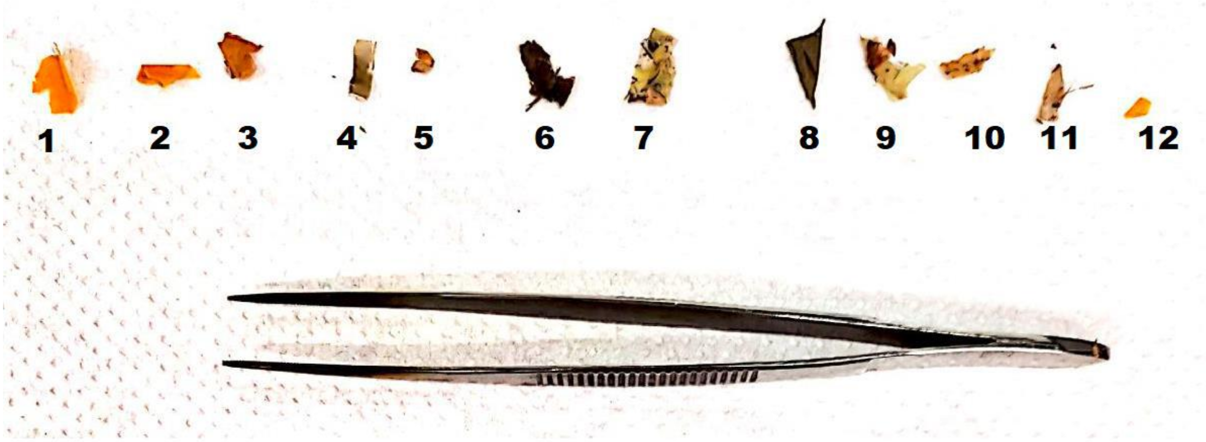
River catchment	Watercourse	Survey period	Sampling method	No. of samples	Volume of water (m^3) per sample	Microplastic Pollution (present/absent)
Test	River Anton	Autumn 2020	Adapted kick-net	2	90	Absent
Test	Tadburn Lake	Spring/Summer 2020	Standard kick-net	7	90	Absent
Itchen	Cheriton Stream	Autumn 2020	Adapted kick-net	2	90	Absent
Itchen	Monk's Brook	Winter 2020/21	Standard kick-net	1	90	Present

The first test of the proposed monitoring methodology was undertaken on the Cheriton Stream and River Anton under normal (approximately Q50) flow conditions. Both surveys identified similar issues with the adapted kick-net design. The free moving net did not remain submerged, or in position when the depth of the watercourse was less than 50cm. With many headwater streams having a depth of less than 50cm, surveyors had to search quite extensively for a pool or depression in the river where the net could be used effectively. However, these areas were not easily accessible for the volunteer. Volunteers also considered the adapted kick-net design to be overly complex and time consuming to construct at home by volunteers. No records of microplastic pollution were recorded on the River Anton and Cheriton Stream.

Volunteers identified an opportunity to integrate microplastic monitoring alongside the well-established national Angler's Riverfly Monitoring Initiative (ARMI)[1]. Based on the feedback received from volunteers, the project team decided to test an unaltered version of a standard aquatic macroinvertebrate kick net – the same setup used by ARMI samplers. This revised approach was tested on the Monk's Brook and Tadburn Lake under both normal and elevated flow conditions in winter and spring/summer of 2021 respectively. The Monk's Brook survey, estimated to have sampled approximately $90m^3$ of water in 20 minutes, recorded a total of 12 suspected microplastic fragments which were sent for further FTIR analysis. Approximately 75% of the fragments sent for analysis were confirmed as plastic. All of the pieces were secondary microplastics (i.e. broken down from larger plastic items), and all were angular fragments. No spheres or fibres were collected. Six of the pieces (Samples 1, 4, 7, 9, 10 and 11) had polyethylene (PE) on one side and cellulose on the other, most likely originating from mixed material packaging (e.g. coffee cups or plastic-lined card/paper food packaging). Two pieces (Samples 2 and 8) contained mostly PE. One piece (Sample 12) contained polypropylene (which has many uses, including food packaging films, food containers, caps and lids, clothing), while the remaining three (samples 3, 5 and 6) were mostly cellulose based (e.g. originating from paper or plants – not plastic). All of the fragments were shades of orange, brown, yellow or red in colour, which could be due to formation of organic biofilm on the microplastic surfaces.

[1] ARMI is a well-established citizen science based approach for monitoring changes in water quality by sampling pollution-sensitive fly life (aquatic macroinvertebrates). There is a network of ARMI sites across the country.

Figure 3.1 Suspected microplastic samples recorded on the Monk's Brook in winter 2020/21. Analysis revealed all but fragment number 3, 5 and 6 to be plastic based.



The local conservation volunteer group on the Tadburn Lake sampled the river in spring and summer 2021 using their own standard kick-nets. Samples were undertaken during both normal and elevated flow conditions. Initially, volunteers found the bankside sample analysis challenging, citing difficulties in identifying potential microplastics using the magnifying glass on the bank side. However, once volunteers had undertaken their first supervised sample, volunteers found the survey methodology clear and easy to use. Like the Cheriton Stream and river Anton, no records of microplastic pollution were recorded on the Tadburn Lake.

4 Discussion

All four conservation volunteer groups who were approached to undertake the project were eager to offer their support and learn how to monitor microplastics in their river, highlighting the public's continued interest in plastic pollution. The volunteers' willingness to participate and the feedback they provided to the project team throughout the pilot proved key, and demonstrates the importance of testing citizen science based approaches with the target audience prior to attempting widespread rollout.

The pilot project showed the initial sampling methodology to be somewhat over-complicated and ineffective in shallow (less than 50cm in depth) watercourses. However, the revised approach which employed a standard aquatic macroinvertebrate kick-sampling net offers citizen scientists with an easy to use and simple method of sampling microplastics in rivers, using equipment that is easy to source "off the shelf". The ARMI, which uses the same sampling net and very similar bankside analysis equipment, is both well-established and widespread throughout the country, highlighting the opportunity for integrating microplastic sampling into the existing ARMI. This hand-held net based approach limits surveys to sites which are either safe to wade into, or have good access to the bankside and water's edge.

Of the four watercourses sampled during the pilot, one recorded evidence of microplastic pollution, the Monk's Brook. The Monk's Brook is a tributary of the lower, urbanised reaches of the River Itchen catchment; a river internationally recognised[2] for its unique chalk stream flora and fauna. Whilst volunteers were not involved in this specific sampling event, microplastics were clearly visible to the naked eye of the Wessex Rivers Trust surveyor, who had no previous experience in microplastic identification. Laboratory analysis confirmed microplastics can be recorded using a standard kick-net, and identified on the river bank using the naked eye and a simply magnifying glass. It also shows the diversity of plastic fragments being transported in our rivers during high flow events in urban areas. Although the revised approach was successful on the Monk's Brook, the lack of microplastics recorded on the three remaining watercourses does not confirm a lack of microplastic pollution. The multi-season survey programme planned across all four watercourses was

[2] The River Itchen Special Area of Conservation (SAC)

disrupted by the covid-19 lockdowns and uncertainty which plagued much of 2020 and early 2021. This meant mid to long term planning and face to face volunteer training and engagement could not be carried out by the project team and the conservation volunteer groups during much of winter 2020 and spring 2021.

With the exception of the Cheriton Stream site, all survey sites were located downstream of storm overflows[3] or surface water drains. The Monk's Brook survey and one of the Tadburn Lake surveys was undertaken during a period of elevated flows when storm overflows and surface water drains typically discharge into the river. Previous studies have highlighted the high likelihood of microplastic pollution entering rivers via storm overflows and surface water drains, with the results from the Monk's Brook survey emphasising the risk posed by these (untreated) drainage systems on the health of the aquatic environment. The heavily urbanised Monk's Brook is crossed by both the M3 and M27 motorways, with the survey site located less than 1 km downstream of the M3 crossing of the brook. An oil-based slick, rich in suspended sediment was observed during the sampling event, discharging from a culverted drain into the brook less than 250 metres upstream of the sampling point. Health and safety is a key aspect for consideration during any citizen science-based project. Sampling during elevated flow conditions presents a higher level risk to the safety of the sampler, especially during the colder months of the year. This may somewhat limit the application of this method during certain periods when microplastics are actively discharging into the river via these storm overflows and surface water drain pathways.

Identification of microplastic particles proved to be the main limitation of this methodology, with only angular fragments in the upper size ranges being successfully picked out of the net samples. Considering the sites being studied, it is not unlikely that tyre and road wear particles and microfibres are present in the rivers, but they were not collected. Considering their dimension (< 1 µm), the difficulty of separation from riverine organic matter, particularly as bright colours are often masked by organic growth, we can assume these particles are unlikely to be collected using this sampling method. They may be captured by the net, but are not being found during the sorting process.

This highlights a difficulty in sampling of microplastics in rivers, but not so much in other environments where citizen scientists successfully sample microplastics, such as beaches, where organic matter does not usually affect particle appearance to such an extent. Approaches to remove organic matter during the sorting process were not pursued as it was not possible to identify a safe and practical way to perform this cleaning process on the riverbank with volunteers. For this reason, we can assume that for the number of microplastic particles successfully identified is an underestimate of those present in the river. Further research is required to ascertain what proportion of the microplastics present in the river are actually sampled, to extrapolate the results and make accurate estimations of concentration levels.

5 Conclusion

Although covid-19 restrictions limited participation, we developed and tested our microplastic sampling approach on all four watercourses selected for the pilot in the Test and Itchen catchments, during all four seasons. The microplastics sampling methodology tested during the pilot demonstrated the ability to capture and positively identify presence of microplastics using existing, accessible riverine sampling equipment, but not to quantify the concentration. Likely sources of microplastics and potential pollution pathways were identified on the Monk's Brook, an urbanised tributary of the lower River Itchen near Southampton, Hampshire.

The pilot emphasised the need to test citizen science projects with the target audience prior to wider roll-out, with feedback playing a key role in shaping proposed approaches. Integrating microplastics monitoring to the

[3] Combined sewer overflows, or storm overflows, are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies.

existing Anglers Riverfly Monitoring Initiative (ARMI) network could help us improve our understanding of microplastic pollution in our rivers.

Appendix 1

Wessex River Trust Microplastic Sampling Pilot Survey

IMPORTANT - Before you begin your sample collection, complete the supplementary data questions on the data form. It is just as important that we have this data even if no microplastic particles are found.

Equipment required (ensure where possible that items are made from non-plastic materials)

- Sampling net
- Sample tray
- Tweezers
- Metal household sieve
- Magnifying glass
- Squeezy bottle (to wash the net out into the sample tray)
- Spotter's guide to aid ID of plastic pieces
- Printed datasheet (at the end of this document)
- Pen / pencil
- Envelope (one per sample)
- Timing device
- Smartphone or other device with GPS capability
- Camera / Smartphone with camera

Please try to avoid wearing fleece or other polyester clothing whilst sampling, as fibres from your clothing may contaminate the sample

Method for sample collection:

1. Identify a location where you can safely suspend and hold the net in place by hand for a 20-30 minute period
2. Submerge the entire net into the water. It is important that the whole net is under the water surface for the entire sampling time, so we can more accurately estimate the volume of water that has been sampled
    - If you are unable to sample from the bankside, you may need to enter the watercourse to sample flowing water
    - Do not enter the watercourse unless you deem safe to do so. Do not enter the watercourse if you are unable to see the bottom, or the river is particularly turbid. Ensure you have a strong foothold and can exit the water easily if required
    - If you are entering the watercourse to sample, try to position yourself in a way that does not disturb the bed of the river whilst sampling
3. Hold the net pole as vertical as possible in the water. Maintain the same depth position as much as possible throughout. For a still or slow flow we recommend a minimum of 30 minutes of sampling. For steady or fast we recommend a minimum of 20 minutes. <u>Record the exact time the net is submerged and the exact time it is removed from the water – it is important we know the exact length of time the net was in the water for</u>

Processing the sample

1. Turn the net inside out into the sample tray, and rinse the net using a squeezy bottle filled water from the river, collected at the sample point. Rinse all visible particles from the net into the tray
   Note: use a clean bottle for each site or rinse bottle with deionised water between sites, to prevent contamination

2. Large fragments or anything caught in the net can be removed with tweezers
3. Any particles (whether organic, plastic or other) greater than 5mm should be removed from the sample (make a note on the data sheet comments if any large plastic pieces were captured, identifying what it is if it is obvious)
4. Remove any large, obvious pieces of organic matter using tweezers, checking to make sure no microplastic particles are being removed with it
5. With the sample still in the sample tray, observe by eye, or using a magnifying glass, to look for pieces of microplastic. Particularly look at particles floating on the surface, and for anything that is brightly coloured (see Spotter's Guide to help with identification)
6. Pick out all the microplastic samples you find and transfer them to a piece of paper. Gridded paper is ideal for estimating size, if available. If you are not certain whether something is plastic or not, collect and record it anyway
7. Once you have collected all the plastic particles you can find from the wet sample, slowly pour the sample through a household sieve, being careful to ensure that all the water passes through the sieve and does not spill over the edge
8. Search through the particles in the sieve to see if you can find are any further potential plastic pieces that had been missed
9. Record all suspected microplastic particles on the datasheet. Use the Spotter's Guide for help on identifying plastic pieces. If in doubt, include it in the sample.
10. For all particles less than 5mm in the sample, categorise according to size, shape and colour. Try to identify the source of the particle, if at all possible (e.g. bottle, bag, fishing line, glitter)
11. Take a photo of the particles, next to the labelled envelope (for sample ID purposes)
12. Fold up the paper and transfer to a paper envelope. Seal the envelope ensuring there are no gaps for pieces to escape.
13. Label the envelope with the site name, date, time, sample collector's name and sample number (if more than one collected)

THANK YOU FOR TAKING PART IN OUR PILOT SURVEY!

Data recording sheet

Recorder details

Observer name ____

Institution/group (if relevant) ________________________________

Section 1a) Survey details

Type of waterway

☐ Stream (<2m) ☐ River (>2m) ☐ Estuary ☐ Canal

☐ Other (please specify) _______________

Name of waterway __________________

Location of survey site

Post code (or grid reference) __________________

Date of survey ______________________

Site arrival time _____________________

What are the overall weather conditions on arrival?

Wind: ☐ High ☐ Low ☐ None

Cloud cover: ☐ High ☐ Low ☐ None

Section 1b) Supplementary data

Water flow rate ☐ Still (not moving) ☐ Slow (slower than walking speed)

☐ Steady (walking speed) ☐ Fast (faster than walking speed)

Water level ☐ High (signs of submerged bank vegetation or flooding) ☐ Average

☐ Low (a watermark/line is visible on the bank)

Waterway width (meters)

☐ <1m ☐ 1-2m ☐ 3-5m ☐ 6-10m ☐ 11-15m ☐ 16-25m ☐ >25m

Ground surface type (of the river banks at the site)

☐ Grass ☐ Gravel/stones ☐ Mud/bare ground ☐ Rock ☐ Other (please specify)

Are there any obstructions to water flow within the observation track? ☐ Yes ☐ No

<u>If yes, answer the following questions thinking about the biggest obstruction you see</u>:

a) Type of obstruction

☐ Sand or mud bank / island ☐ Aquatic plants ☐ Terrestrial plants/trees

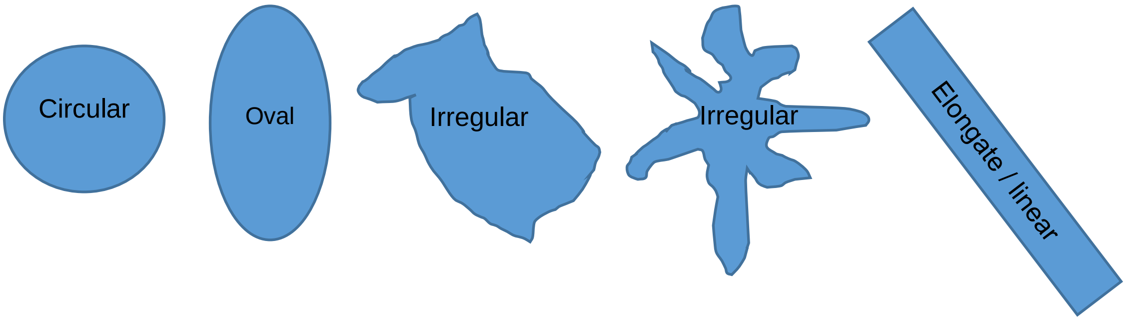
☐ Man-made structure ☐ Other (please specify) _______________

b) Obstruction width ☐ <1m ☐ 1-2m ☐ 3-5m ☐ 6-10m ☐ >10m

c) Obstruction length ☐ <1m ☐ 1-2m ☐ 3-5m ☐ 6-10m ☐ >10m

d) Obstruction shape

e) ☐ Approximately circular or square ☐ Oval or rectangular ☐ Elongate or linear e.g. a wall or weir ☐ Irregular ☐ Other (please specify) ____________



f) Obstruction position in river ☐ Left-hand side ☐ Middle of river ☐ Right-hand side

g) How does the obstruction affect river flow?

☐ Diverts flow (e.g. splits the river flow in two, or changes river direction)
☐ Slows flow minimally ☐ Slows flow substantially ☐ Restricts river width and speeds

Put any additional information on the obstruction and how the flow is affected here

Section 2) Environmental variables

Which of the following sources of plastic pollution can you see? (Select all that apply)

☐ Fly tipping ☐ Sewer overflow ☐ Litter bin ☐ Picnic area

☐ Recreational activity (please specify) _______________

☐ Industrial discharge ☐ Residential discharge ☐ Urban/road discharge

☐ None ☐ Other (please specify) ______________

What is the land use in the immediate surroundings?

☐ Urban residential ☐ Industrial ☐ Urban park ☐ Agricultural ☐ Forest

☐ Grassland/shrub ☐ Other (please specify) _________________

Can you see evidence of the following water uses? (Select all that apply)

☐ Fishing ☐ Swimming ☐ Boating ☐ Irrigation ☐ Public water supply

☐ None ☐ Other (please specify) ______________

What is the bank vegetation? (Select all that apply)

☐ Trees/shrubs ☐ Grass ☐ No vegetation cover

☐ Other (please specify) _______________

What aquatic life is there evidence of? (Select all that apply)

☐ Plants/algae below the surface ☐ Plants emerging from the water ☐ Floating plants/algae

☐ Fish ☐ Frogs/toads ☐ Aquatic birds ☐ None

☐ Other (please specify) ________________

Any other comments on the survey site

Is there anything else you want to tell us about your survey site?

Microplastic particle count

Survey start time (time net submerged) ______________________

Survey end time (time net removed from water) ______________________

Key to Microplastic Categories for recording form

Shape
• Ball, round or spherical
• Cylindrical
• Cube
• Disc/flat circular
• Other flat regular shape e.g. square, rectangle, triangle
• Irregular fragment/piece
• Long/elongated

Colour
• white
• clear/opaque
• black
• yellow
• orange
• green
• grey
• blue
• purple
• red
• brown
• other

Size (estimate)
• <1mm
• 1-2mm
• 2-3mm
• 3-4mm
• 4-5mm

Record each particle one by one on this table:

Particle type	Shape	Colour	Size	Estimated type of plastic (e.g. bag, food wrapper, fishing line) or unknown	Number of pieces with these characteristics
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					

Any comments on the sample

Is there anything else you want to tell us about your sample? E.g. any macro (>5mm) pieces captured