NATURAL COURSE

OUR WATER. OUR FUTURE

Understanding microplastic contamination in rivers of Greater Manchester 2021-2023

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About Natural Course

78% of water bodies in North West England are failing to meet a good ecological status* and solutions are often found to be too expensive to implement.

Natural Course is a collaboration of organisations in North West England from public, private and third sector who, together, will seek cost-effective solutions to improving water quality across urban and rural landscapes, sharing best practice across the UK and Europe.

*Environment Agency, North West River Basin District 2015

Natural Course will:

- Test and inform best practice in achieving UK and EU legislation in water quality
- Use the North West River Basin District as a flagship project and share best practice with the UK and Europe
- Make better use of resources, share ownership of complex issues and maximise outcomes through a collaborative approach of organisations from public, private and third sector.

Join the conversation @Natural_Course #NaturalCourse

Understanding microplastic contamination in rivers of Greater Manchester 2021 - 2023

Microplastics

Microplastics, as the name implies, are tiny particles of plastic, commonly defined as being less than five millimeters in length.

Some microplastics are intentionally made small for commercial use such as in cosmetics (microbeads) or textiles (microfibers). Other microplastics are the result of larger plastic items breaking down over time, usually because of exposure to environmental factors including the sun's radiation and turbulence in water.

The amount of plastic we use in the U.K and the world has increased dramatically over recent decades. This is largely due to plastics beneficial properties which means it can have many uses and is relatively cheap to produce.

However, the problem with plastics, including microplastics, is that the properties that make it beneficial also mean that it does not readily break down into harmless molecules. Once in the environment, microplastics accumulate and persist. Plastics, including microplastics, can take hundreds to thousands of years to decompose, all whilst causing harm to the environment in which they are.

Because microplastics are not biodegradable, they have been found in a variety of environments, including oceans and freshwater ecosystems. This is even true for Greater Manchester, where research has shown significant microplastic accumulation in the river beds.

Natural Course wanted to understand more about the extent of microplastics in the rivers of Greater Manchester. In 2021, Greater Manchester Combined Authority (GMCA), United Utilities (UU) and the Environment Agency (EA), as part of Natural Course, commissioned a study of microplastic contamination in Greater Manchester rivers to enhance understanding of the problem and assist the development of management strategies.

Environment Agency

United Utilities
Water for the North West

GMCA GREATER MANCHESTER COMBINED AUTHORITY

What we did…

The UK Centre for Ecology and Hydrology (UKCEH) was commissioned to carry out the study. UKCEH developed a sampling plan for the rivers Irk, Roch and Medlock in north east Greater Manchester, that captured differences relating to catchment characteristics (rural vs. urban) and rainfall intensities (steady state vs. heavy rainfall).

Across the three catchments (Irk, Roch and Medlock), sampling sites were identified at:

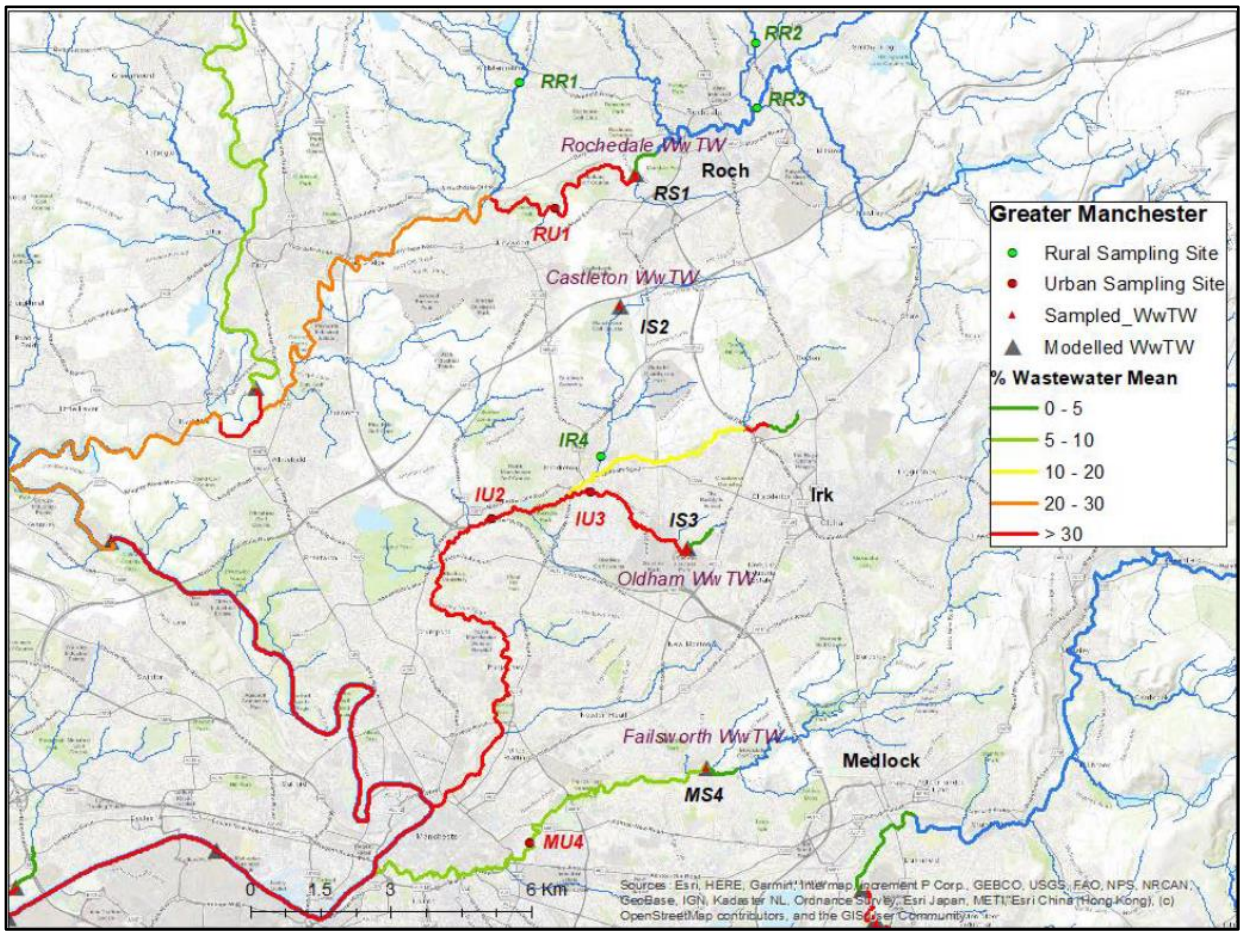
- The outfalls of four Wastewater Treatment Works (WwTWs)
- Four sites upstream of the WwTWs in rural and peri rural areas
- Four sites downstream of the WwTWs in urban areas

This was done to gain further insight into the extent of and possible sources of microplastics to different parts of the catchment. The principal function of WwTWs is to treat sewage from domestic and industrial sources by removing nutrients and contaminants. Removing microplastics is not a design requirement of WwTWs. Research carried out by UKWIR (UK Water Industry Research) showed that WwTWs are very effective at removing the majority of microplastics. By sampling upstream and downstream of WwTWs we hoped to understand the contribution of WwTWs and other sources in delivering microplatics to different parts of the catchment in both steady-state and heavy rainfall events.

The samples were passed through filter cartridges which were then analysed in a UKCEH laboratory. Three baseline samples were taken during steady-state river flow conditions in 2022 and samples were taken during three heavy rainfall events in 2022-2023.

Using the WwTW results as inputs, a GIS water quality model was used to predict microplastic concentrations throughout the Roch, Irk and Medlock and other Greater Manchester rivers. This was compared to sampling results, to examine the sources of microplastic delivery into the rivers. A model has been constructed of the loads leaving the WwTWs which could be compared with loads calculated from the storm events being delivered to rivers. This allowed an understanding of the importance of storm events to the microplastic annual budget to be made.

Water sampling kit on the River Irk



Location of the sampling sites in Greater Manchester, overlaid with predicted mean percentage of wastewater.

Results

- In steady-state conditions, WwTWs can account for the majority of downstream microplastics, albeit in a small quantity. This is because when it isn't raining heavily, the main source of water input into rivers is from WwTWs.

- However, rivers without WwTWs and upstream of WwTWs also have microplastics, even at the most rural of locations. This means that other, non-wastewater, sources of microplastics exist.

- Storms increase the concentration of microplastics in rivers and make a significant overall contribution to the annual load of microplastics in rivers.

- Discharges from Combined Sewer Overflows (CSOs) are likely to play a part in the higher concentration of microplastics seen during heavy rainfall events, however, other important urban non-WwTW sources exist and need to be acknowledged.

- During a sampled heavy rainfall event, at a site downstream of Rochdale, a substantial increase in microplastics was measured, yet there was no CSO event at Rochdale on that occasion. This suggests that urban runoff, separate from WwTW discharge, could be responsible for much of the problem of high microplastic levels in heavy rainfall events in

rivers downstream of urban areas. The mobilisation of historic microplastics in riverbed sediment could also have contributed. This suggests a 'deep clean' of hard surfaces within Greater Manchester, to remove plastic debris, could make a difference.

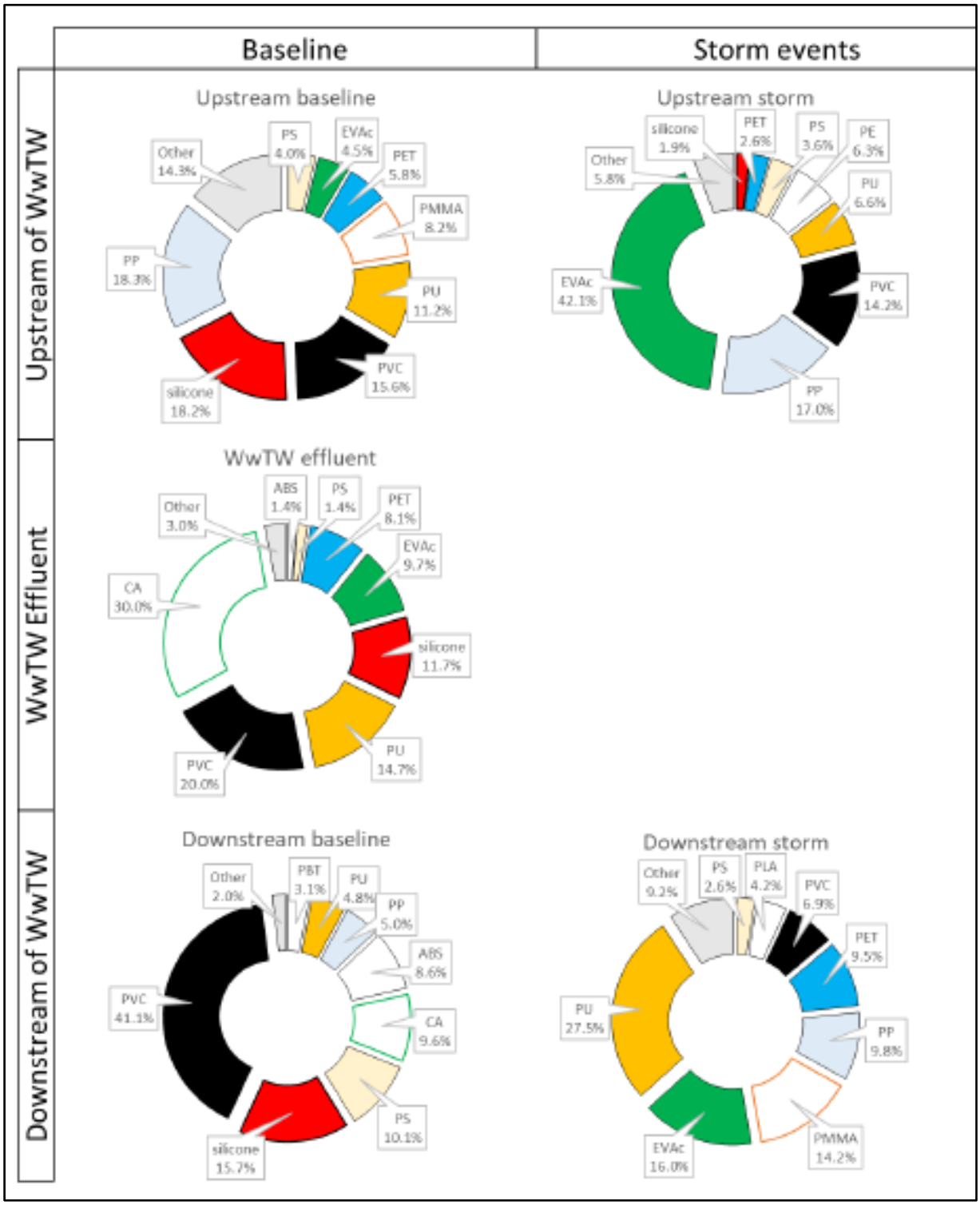
- In upstream locations, whilst proportions differ, the types are microplastic found in both baseline and storm events are similar.

- Heavy rainfall events appear to be flushing out a wide range of plastics, rather than just polyethylene which is typical of plastic bags, instead seeing a range of hard and spongy plastics.

What microplastic polymers did we find…

In upstream locations, whilst proportions differ, the types are microplastic found in both steady flow and heavy rainfall events are similar.

Heavy rainfall events appear to be flushing out a wide range of plastics rather than just PE which is typical of plastic bags with polyurethane (PU) being its biggest component.



- PMMA: polymethyl methacrylate as could be found in perspex
- EVAc: ethylene-vinylacetate copolymers as could be found in flip flops & yoga blocks
- PET: polyethylene terephthalate as found in drink packaging and polyester yarn
- PU: polyurethane as could be found in a kitchen sponge
- PLA: polylactic acid can be found in tableware, laptops and diapers!
- PVC: polyvinyl chloride as found in washing up bowls
- PS: polystyrene as found in plastic cutlery

Next Steps…

This study has added to the ongoing topic of microplastics in rivers. The findings from this study are being disseminated amongst Natural Course beneficiaries and other key stakeholders.

The results from this study have shown that there is not a single source or pathway of microplastics to rivers and therefore there is not a single solution. The Environment Agency, United Utilities and Greater Manchester Authority all have a role to play in reducing the volume of microplastics in rivers in Greater Manchester. Each organisation acknowledges this and are keen to work with other organisations to reduce this type of contamination.

It is anticipated that this study will provide guidance, both academic and practical for future studies relating to microplastics.

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In partnership with

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