LUND TRUST SUMMER INTERN REPORT 2022 – ENDING UK RIVER POLLUTION

Table of Contents

Introduction

This report explores projects that aim to end the UK river pollution crisis. To begin with, this report outlines the nature of river pollution in the UK. Through an analysis of seven projects that have tackled poor river health in different ways, this report considers the characteristics of those projects in terms of Lund Trust's aims, focusing on greening lives, funding transformative work and community engagement. I define 'characteristics' as the key elements that emerge across the river pollution projects, through the language they use and the approaches they take. The final aim, around community engagement, is one I propose, which will be justified later in the report. The report begins with a breakdown of the methodology behind my research project, followed by a summary of the context of river pollution in the UK. From there, the report explores the characteristics that emerged across the seven case studies. Following an exploration and my development of Lund Trust's aims, the report then discusses how the emergent characteristics – approach, scale, leadership, and community – from the case studies align with the aims of Lund Trust. To conclude, this report suggests that the best type of project for Lund Trust to fund is one that actively engages a diversity of community members, to be both ecologically and socially transformative at multiple scales.

In order to reach a conclusion around the types of projects that Lund Trust should fund, this report aims to answer the following research questions:

1. **What approaches to mitigating and ending river pollution have been used in the UK and what are their characteristics?**
2. **How do these characteristics align with Lund Trust's aims?**
3. **What types of projects should Lund Trust fund?**

Methodology

I initially focused on understanding the context of river pollution in the UK. I conducted online research into the environmental and funding situation around the issue. I was then able to use this contextual knowledge to assess the effectiveness of projects.

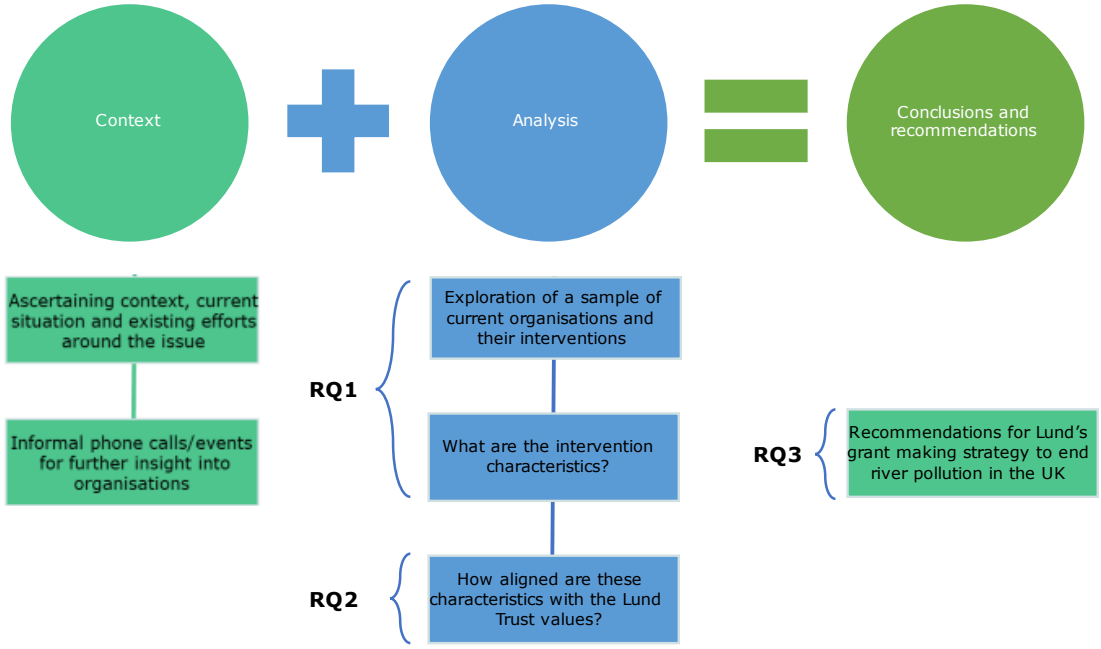
I analysed a sample of past and current projects around river pollution, generating case studies for each project from the available online data/information. I found desk-based research to be the most appropriate way of accessing this information, using online resources and databases. As an informal, yet helpful addition to my research, I also organised meetings with project managers and others involved in river health, to provide me with a stronger understanding of how these projects aim to end river pollution in the UK. At the same time, I reviewed Lund Trust's aims, developing them and contextualising them to river pollution.

Having formulated the case studies, I worked through each one to ascertain the key elements of the project. This allowed me to identify characteristics that were different

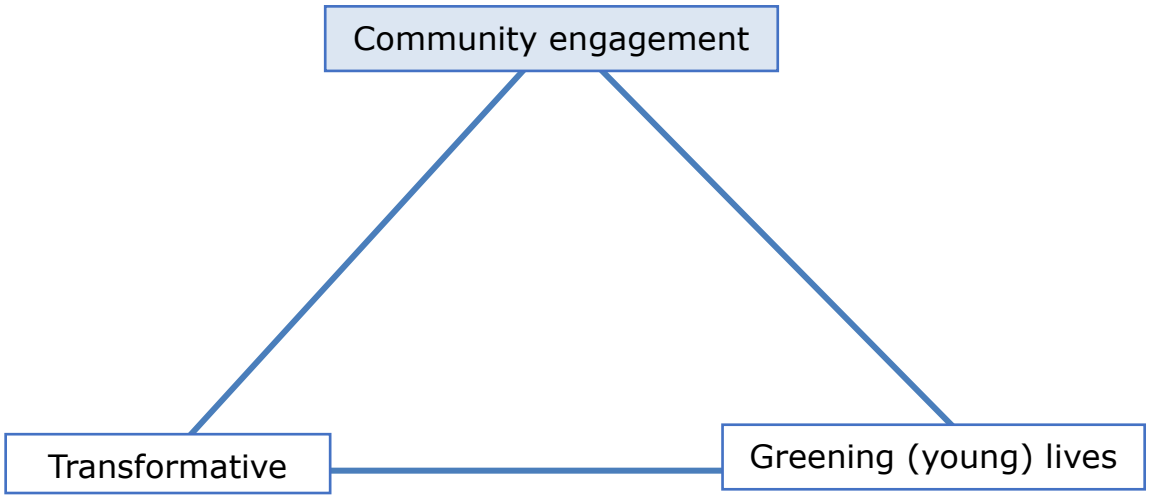
or similar across the range of projects. From there, I was able to establish four key characteristics across my sample, and subsequently categories within each characteristic. For example, within the characteristic of 'community' I was able to make distinctions between 'active' and 'passive' as categories. I then mapped out how these profiles aligned with my developed definitions of Lund Trust's aims. This process allowed me to recognise the extent to which the characteristics across the projects were compatible with the aims of Lund Trust. In addition to this, I also considered the practicalities of funding from Lund Trust's perspective in my analysis.

Several factors influenced my selection of the seven case studies that became the basis of my investigation. The limited number of river pollution projects in the UK meant that I was restricted to a narrow range of potential case studies. Four out of the seven projects were sourced from an online UK Projects Map, designed by the River Restoration Centre (RRC, 2014). These four projects were all funded by the Catchment Restoration Fund between 2012-15; a specific three-year period where government grants were issued to river projects. To ensure that my case studies covered a diverse range of projects, I also looked at projects not funded under this scheme, including projects that adopted different approaches to the ones under this scheme. It is also important to note that despite recognising their role in polluting and also protecting rivers, I deliberately chose not to include projects undertaken solely by water companies, as it is unlikely that Lund Trust would fund a private water company in this way. Through a deliberate selection of very different projects, I was able to better recognise which type of project would be more aligned with the aims of the Lund Trust.

The figure below shows how the context and analysis in my research methodology complement each other.



Central to this research project is a focus on assessing how different projects fit with Lund Trust's aims. In section 2.1 of this report, I consider Lund Trust's aims in detail, including providing a recommendation of a new aim, 'community engagement', based on my research. The figure below summarises the (now) three key aims of Lund Trust – 'transformative' work, greening (young) lives and community engagement.



Context

Why is there such an urgent need to address UK river pollution now and what is being done about it?

Government officials have declared that English rivers are currently experiencing a 'chemical cocktail', made up of sewage, agricultural and road pollution. As a result, 38% of checks for fish health indicated poor health levels in 2021, due to pollution-induced diseases (Trent, 2021). Not only are these species integral to flood prevention, they also provide a livelihood to many British people; £1.7 billion is generated annually through UK freshwater fisheries (Angling Trust, 2021). This example indicates the impact of pollution not only for fish populations, but for wildlife and society more widely.

There are three major sources of river pollution in the UK (Stallard, 2022):

1. **Untreated sewage (wastewater)** – Environment Agency data states that 25% of water pollution in England and Wales comes from the water and sewage industry. In 2019/2020, the Environment Agency analysed 260,000 pollution incidents; the data suggested that 40% of these incidents came about from blockages, with 60% of these blockages caused by wet wipes (ibid.). In 2020, water companies discharged untreated sewage water into rivers 400,000 times in England (Hutber, 2021).
2. **Agricultural practises –** the agricultural sector makes up 76% of land area in England and Wales (UKELA, n.d). Use of fertiliser and pesticides is responsible for 40% of England's river pollution (Stallard, 2022). The cost of resultant contaminated drinking water is thus passed onto consumers, totalling £120 million annually (Pretty et al., 2000).
3. **'Run-off'** – agricultural chemicals running-off into UK rivers result in a reduction in oxygen concentrations, posing a threat to both human life and biodiversity. However particularly in urban areas, run-off also takes the form of other pollutants, such as oil – this accounts for 18% of UK river pollution (Stallard, 2022).

Whilst these three sources are the greatest concerns now, the rise of microplastic and pharmaceutical pollution poses a future threat to UK rivers (D'Souza et al., 2020).

River pollution is not being adequately addressed in the UK, due to significant changes in funding. In 2018, the UK government published a 25-year Environmental Plan, consisting of a new Environmental Bill for England (approved in 2021) that would strengthen regulation for environmental sustainability. However, despite experts declaring an urgent need to address river health in the UK, government funding to the Environment Agency (responsible for environmental protection nationally) has declined by 70% over the last decade (Schuster, 2021). In addition to this, there has been an 88% fall in prosecutions of river polluters in the last decade (ibid.). It therefore becomes evident that government efforts to end river pollution are deteriorating.

Whilst the UK government has some programmes in place for addressing river pollution, these are limited in their scope. Until the UK left the EU, the Water Environment Grant was one of the main schemes to fund the improvement of water quality in rural England (Department for Food and Rural Affairs, 2020). This grant was funded by the EU, under the Rural Development Programme, operating between 2018 and 2021.

However even with past schemes, such as the Water Environment Grant, there were barriers to applying. For example, the second criterion required project proposals to 'benefit the rural environment' (ibid.). Whilst the scheme specified that the project may be in an urban area, providing that it 'benefits a rural area' as well, this still excluded those projects that had an entirely urban focus. The Water Environment Grant also paid in arrears, posing a challenge to small organisations that could not cover high upfront capital costs. The UK's withdrawal from the EU means that some of these funding programmes no longer exist.

Currently, the Department for Environment, Food and Rural Affairs (DEFRA) has few grants designed to fund solutions to river pollution in the UK. For example, the UK government has had a 'Catchment Sensitive Farming' programme in place across the last 15 years, designed to incentivise farmers to adopt practises that reduce water and air pollution from their land (Department for Environment, Food and Rural Affairs, 2021). Although this programme contributes towards tackling the significant issue of agricultural river pollution, it only addresses one of several UK river pollution sources. In this way, the UK government has limited resources in place for ending this major ecological problem.

Water companies also run and support projects to end river pollution. Their role is large-scale, yet still largely insufficient. Water companies commit significant funds as part of their WINEP plans (Water Industry National Environment Programmes), as well as being required to set out how they are going to implement them. The WINEP requirements are developed by the UK government (Department for Environment, Food and Rural Services, 2022). For example, Anglian Water has committed £800 million directly to environmental enhancements as part of its WINEP plan between 2020 and 2025. Simultaneously, water companies are also highly responsible for the river pollution crisis. Since 2015, the Environment Agency has issued £138 million of fines against water companies (Environment Agency, 2022). In this way, water companies emerge both as river polluters, as well as agents of ending river pollution in the UK.

The role of philanthropy in ending river pollution in the UK has been demonstrated by the efforts of other independent trusts. The Esmée Fairburn Foundation, for example, co-designed a £1.8 million social investment programme in partnership with The Rivers Trust in 2019 (Esmée Fairburn Foundation, 2022). This programme operated through loans, rather than grants, helping small projects to tackle high upfront capital costs,

The next section of this report will review seven projects that have aimed to end river pollution in the UK, outlining the key elements of each project in the form of a case study, followed by an exploration of the emergent characteristics across the projects.

Section 1: What approaches to mitigating and ending river pollution have been used in the UK and what are their characteristics?

Case studies

As outlined in the methodology, I aimed to select a diverse range of projects as case studies. Ranging from high-value technologies to low-cost citizen-led campaigns, I recognised the importance in exploring very different attempts to end river pollution in the UK. Subsequently, this section summarises each of the seven case studies that I analysed, outlining their background, key interventions and community engagement strategies.

Case study 1: InNoPlastic

Location: Pilot schemes across Caribbean and English coastlines.

Issue: Addressing high levels of plastic pollution in the sea, on a global scale.

Organisations involved: EU-funded project, run by 17 partners across 10 countries. Rivers Trust UK contributed as an advisor to this project.

Intervention: Exploration and trialling of innovative marine technologies that can replace existing plastic-removal technologies. These developments were trialled across a series of testing sites internationally. The project was designed to bring together technical and social change through piloting an incentive-based initiative to encourage the public to participate in plastic clean-ups on the coast. Attempts are also being made to explore how this plastic waste can be reused as part of a circular value chain.

How the community was engaged: A 'social engagement strategy' was designed to engage the community. 3D technologies and virtual reality equipment were used to raise environmental awareness through workshops and in schools. An app was designed to bring together a wealth of citizen science data.

Funding: EU-funded project, granted €5,997,296.

Source: Home | In-No-Plastic (innoplastic.eu).

Case study 2: Oxford Rivers Project

Location: A small Oxford catchment area of the River Thames – Port Meadow.

Issue: Addressing sewage wastewater pollution in a local river.

Organisations involved: Partnership between Oxford City Council, Rivers Trust, Thames Water, Thames21 and #endsewagepollution mid-Thames campaign group - named the Oxford Rivers Project

Intervention: Citizen complaints against untreated sewage water discharges into the River Thames led to 5,000 residents signing a petition in 2020, calling for a **'designated bathing water status'** area in Oxford. Concerns came from high bacterial content within the water posing threats to wild swimmers, as well as **algal blooms** that threatened both recreational use of the water, as well as aquatic life. The campaign also demanded that the water was regularly tested for bacteria and that raw sewage spills were announced. As a result, a stretch of the river in the 'Port Meadow' region of Oxford received the designated bathing water status in 2022, after a 2-year ongoing effort. The CEO of Thames Water also committed an investment of £26 million into a major expansion of the Witney sewage treatment works, operating in Oxford.

How the community was engaged: UK's largest citizen science project for analysing river bacteria levels. Throughout 2021, citizens monitored and recorded bacteria levels within the Oxford catchment area. This data was used as part of the campaign.

Funding: Jointly funded by Oxford City Council, the Rivers Trust and Thames Water. Amount unknown.

Source: Oxford Rivers Project - Thames21

*** Designated bathing water status =** 'a coastal or inland water that attracts many bathers in relation to any infrastructures or facilities that are provided, or other measures that are taken, to promote bathing at the site' (Gov.uk, 2021).

* **Algal blooms =** a rapid growth of algae within freshwater or marine systems, caused by high concentrations of nutrients entering the water system. These algal blooms result in a significant decline in oxygen concentrations, threatening entire aquatic ecosystems (Smayda, 1997).

Case study 3: Wild Wiske Revival: North Yorkshire Project

Location: River Wiske, North Yorkshire

Issue: **Sediment pollution** and **agricultural run-off**

Organisations involved: Led by Yorkshire Wildlife Trust, in partnership with the Environment Agency. Funded by the Water Environment Grant, under the EU.

Intervention: New wetland habitat was created, as well as a restored riverbank as the enhancements for this river quality project in a North Yorkshire River. Focused on the river restoration of the River Wiske, which has been heavily modified in the past, through river straightening and widening. Agricultural practises and poor land management led to sediment/nutrient and chemical run-off into the river, smothering the riverbed and negatively impacting fish stocks. 6300 metres of fencing was installed, preventing sediment run-off into the river. 1500 trees planted, as well as a 300m **hedgerow** to reduce run-off from land into the river.

How the community was engaged: Working closely with 5 local landowners to provide tailored advice on pest management, to reduce algal blooms and chemical run-off.

Funding: £230,000 granted over 2019-22 by the **Water Environment Grant**, which is funded by the EU.

Source: North Yorkshire project brings water quality boost to River Wiske - GOV.UK (www.gov.uk)

* **Agricultural run-off** = occurs when chemicals and nutrients used in farming practises are carried into the river by rainwater, leading to algal blooms and subsequent oxygen depletion in river systems. This is harmful for both the ecosystem, as well as human use of the river.

* **Sediment run-off** = occurs when erosion (wearing away) of land washes away into rivers, entering storm drains and consequently worsening the quality of drinking water, as well as wildlife. When sediment enters the river in this way, it reduces the amount of light that penetrates the water, limiting the growth of vegetation and disrupting food chains (Zhao et al., 2022).

* **Hedgerow =** hedges, as well as trees, walls fences or other structures that are designed (in river pollution contexts) to act as a physical barrier against nutrients and chemicals from entering rivers, through increasing soil absorption of the run-off.

* **Water Environment Grant =** a scheme under the Rural Development Programme for England (RDPE) that funded improvements to the water environment. This grant was a multi-million-pound fund, administered by Natural England and the Environment Agency, on behalf of the UK Department for Environment, Food and Rural Affairs. The scheme only operated between 2018 and 2021 (Gov.uk, 2020).

Case study 4: Wandle River Restoration Project

Location: River Wandle – Carshalton water body (catchment)

Issue: Sediment pollution from urbanisation around river. Intensive historical use, as well as human engineering of straightening and widening, led to deterioration of water quality and subsequent biodiversity issues. High levels of road run-off occur due to urbanisation around the river catchment area.

Organisations involved: Environment Agency, London Borough of Sutton, London Borough of Merton, Wild Trout Trust, Thames Water, Queen Marys University London, Kings College London, Friends of Ravensbury Park and Residents Association of Mill Pond Practise.

Intervention: River Wandle is an important urban chalk river to South London. As a result, there were high concentrations of sediment and contaminant pollution, such as hydrocarbon and heavy metal. In response, the project improved river connectivity through the removal of three **weirs**, reduced road run-off through complex river technologies, restored natural river processes through reshaping of the river and worked with the community.

How the community was engaged: public consultations, informative posters and letter drops in the areas surrounding the works, as well as engaging volunteers to help undertake practical elements where possible.

Funding: £454,353 provided by the Catchment Restoration Fund, granted by UK Department for Environment, Food and Rural Affairs, across 2012-15.

Source: Wandle River Restoration Project | The RRC

*** Weirs =** small dam built across a river, to control the upstream water levels.

Case study 5: River Thame Catchment Conservation Project

Location: A tributary of the River Thame (tributary of River Thames)

Issue: Point-source agricultural and road run-off leading to poor water quality. River Thame and its tributaries are low lying, facing high point source pollution from agricultural and road run-off. The region was also significantly drained, despite being a naturally wet landscape and catchment area. As a result, the majority of the River Thame and its tributaries failed to meet 'Good Status' under the Water Framework Directive.

Organisations involved: Led by Pond Conservation and River Thame Conservation Trust, in partnership with the Environment Agency.

Intervention: In response, small wetlands were created on streams to hold back nutrient and sediment pollution, prior to entering the river. Field drains were also installed in order to allow water to pass from field to waterbody effectively, coupled with wetland drain interceptors basins installed at all feasible locations. 5km of woody debris was inserted in streams across 4 pilot areas, to improve wildlife.

How the community was engaged: Workshop programmes, training courses and farm visits provided to local community to raise awareness of water quality issues, as well as working alongside landowners and farmers to build practical solutions to agricultural run-off.

Funding: £180,746 over 2012-15, funded by the Catchment Restoration Fund.

Source: River Thame Catchment Project - Freshwater Habitats

Case study 6: Improving Water Quality in Loweswater

Location: Loweswater Lake – smaller lake in Lake District.

Issue: High concentrations of nutrients, such as phosphorous, were recorded in the Loweswater Lake, due to pesticide/fertiliser run-off from agricultural practises, as well as septic lank leaks. This led to algal blooms, creating dangerous bacteria for human and wildlife health. The water quality was not meeting the standards for the Water Framework Directive.

Organisations involved: National Trust, Environment Agency, Natural England, United Utilities, Centre for Ecology and Hydrology, University College London and Cumbria Wildlife Trust.

Intervention: West Cumbria Rivers Trust led this project and made 5 key interventions. Through adjusted land management and working with farmers, phosphorous inputs were reduced, minimising fertiliser run-off into the lake. Lake sediment was sampled to estimate the impact of phosphorous on river processes. Phytoplankton populations were reduced through **ultrasonic techniques**, as well as through technologies that dissolved oxygen levels at depth, minimising phosphorous concentrations from lake sediments. Lake quality was then monitored against historic levels regularly, sampled by the Environment Agency and through volunteering.

How the community was engaged: Strong history of community engagement within the Loweswater region, continued through community meetings, regular project updates, engagement with farmers, volunteering opportunities and engagement with local schools.

Funding: £316,950, entirely funded through the Catchment Restoration Fund across 2012-15.

Source: Loweswater: a UK Lake Restoration case study | UK Centre for Ecology & Hydrology (ceh.ac.uk)

*** septic tank** = an underground chamber through which domestic wastewater for basic sewage treatment flows (Tilley et al., 2014).

* **Water Framework Directive** = a legal act, set out by the European Union in 2000, requiring EU member states to achieve 'good' qualitative and quantitative status for all water bodies by 2015. For the purpose of this research report, the main criteria that is being discussed under this Directive, is around 'chemical' quality, which determines whether or not the water body has a 'good ecological status'.

*** ultrasonic techniques** = the use of waves or vibrations that are of a frequency above human audibility of around 20,000 hertz, that are found to inactivate and reduce phytoplankton growth (Honda et al., 2021).

Case study 7: Thames River Watch

Location: River Thames Catchment Area (London)

Issue: Plastic pollution

Organisations involved: Joint project between Tideway, who are building the new combined sewer for the Thames Tideway Tunnel and Thames 21.

Intervention: an 8-year partnership to address plastic pollution in the River Thames. Creating a bank of data that highlights the issue of litter pollution in the Thames. Programme established in 2014, to create a citizen scientist network, integral to understanding the health of the Thames. Using this data to inform public policy and lobby the government to make significant change. Zac Efron (Hollywood celebrity) collaborated with Thames21 for a visit to the plastic litter hotspot in Rainham, as part of his Netflix documentary. Citizens used 1m2 quadrats on the foreshore to count litter within, measuring the issue and rate of change to support new policy proposals. 7400 visits took place, collecting 9200 wet-wipes and 130,000 plastic bottles. Significant publicity was generated on major news channels and Michael Gove (Minister of Environment) used the evidence generated in Parliament.

How the community was engaged: the project was almost completely led by citizens and the local community, generating citizen science. Worked with ethnic minorities as part of next stage.

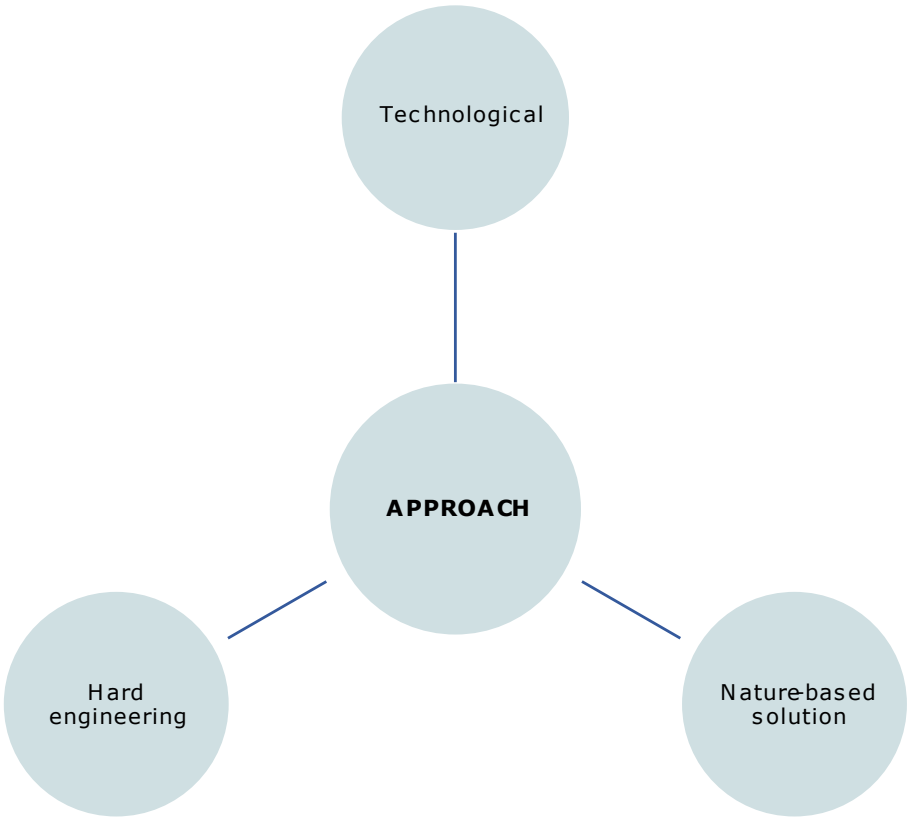
Funding: Joint funded from Thames Water and Tideway programme until 2024. Amount unknown.

Source: Thames River Watch: protecting the Thames - Thames21

Characteristics

This section brings together the case studies by exploring the key characteristics that I drew from my research: approach, leadership, scale and community. Having researched each case study in detail, these were the clearest and most comparable elements of the projects that emerged. To reach these characteristics and the categories beneath them, I filled out a table with information on the seven case studies, from online resources, and used qualitative methods, identifying key words and phrases across the table. Under each characteristic, I have determined categories that describe how the characteristic plays out in different ways, across the range of projects.

APPROACH



Across the case studies, there was a range of approaches and different points of intervention. These points of intervention include pre-pollution measures; pollution prevention at the source; prevention of pollution from entering the river; and post-pollution measures, which involve treating the river.

Technologies: pollution treatment, monitoring and prevention

This section considers four projects where technology was central to their approach: InNoPlastic, Loweswater, the Oxford Rivers Project and Thames River Watch. It considers the different ways the projects used technology, from large-scale removal of pollution to small-scale monitoring, other aspects of their approach that supported their use of technology, and their point of intervention, from prevention to treatment.

InNoPlastic used large-scale technologies to address marine plastic pollution and to end river pollution. Through a focus on plastic removal in this innovative way, InNoPlastic prioritised the treatment of marine environments, as opposed to the prevention of plastic pollution. Here, the point of intervention is post-pollution, rather than prevention.

Two other projects used technology as the basis of their intervention. The Loweswater project can be characterised as small-scale technological in its approach. Using ultrasonic and oxygen-dissolving technologies, it tackled dangerous concentrations of phosphorous in a lake. High phosphorous concentrations, from agricultural run-off, are hazardous to both human health and the ecosystem. The project used simple monitoring and testing technologies to ensure good water quality, post-intervention. Like InNoPlastic, the Loweswater project used technology, albeit on a smaller scale, to treat pollution. However, alongside this technology, the Loweswater project also used a preventative approach, working with farmers to improve land management at the source of the pollution.

In a different manner, monitoring technologies were used as the predominant, rather than supporting intervention of the Oxford Rivers Project. Whilst the Loweswater project used monitoring devices to track the progress and maintenance of their measures, the Oxford Rivers Project used them to generate data and evidence that was then presented to the Oxford City Council as part of a campaign to secure designated bathing water status. Using technology to produce evidence was also at the centre of Thames River Watch's work. Whilst not a direct intervention to clean the river of plastic pollution, this project also used simple equipment, in this case a quadrat, to analyse the types of plastic litter that entered the Thames River. It used this approach to generate data and evidence that was circulated to the media and presented to the government. The aim of both of these projects was clear – they were not designed to directly intervene against pollution, but to produce evidence that would reduce or prevent pollution by gaining protected status, thus mandating the monitoring of water quality and forcing polluters to play their part.

Across the project sample, technology was adopted not only for different purposes - from a supporting role in projects to their primary solution - but also at different points of intervention, from tackling pollution at its source to post-pollution clean-up.

Hard engineering and nature-based solutions

Within the projects' approaches, a distinction can be made between 'nature-based' and 'hard engineering' approaches. Hard engineering approaches involve the installation of artificial structures, such as barriers, as part of river pollution management (Brierley and Fryirs, 2022). In contrast, nature-based solutions involve working with nature to address ecological and social issues, such as creating or restoring wetlands as a natural river filter. (Lovell and Taylor, 2013).

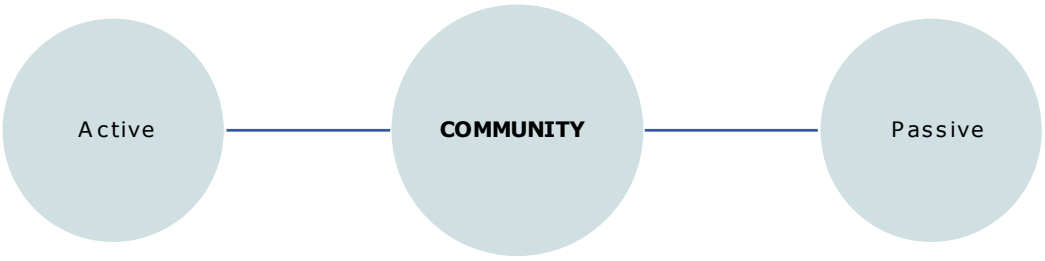
The Wandle River Restoration Project was centred around hard engineering, making significant alterations to the river to encourage natural processes and thus restore good river quality. For example, to correct previous straightening of the river, the river was reshaped in a more natural way. Through a correction of previous human engineering to the river, this measure arguably also contributed to a better human-river relationship, by using carefully planned modifications to restore stability to the river system (Zingraff-Ahmed et al., 2021). Other measures, such as installing engineering solutions that intercepted road run-off, contributed to the preventative nature of this project, where pollution was not alleviated, but prevented from entering the river.

In contrast to this hard engineering approach, the River Thame Catchment Conservation Project operated through a predominantly nature-based solution. Through the implementation of wetlands, the project generated a natural filter for pollution from agricultural and road run-off. It strengthened in-stream habitats by inserting 5km of woody debris in streams across 4 pilot areas. Whilst not directly relevant to river pollution, this aspect was designed to improve biodiversity, another key river issue. These solutions draw on a prevention approach, acting as a barrier between the pollutant and the river, or filtering pollution from the water, rather than prevention at the source.

The Wild Wiske Revival project brought together both hard-engineering and nature-based infrastructure. In an effort to prevent pollution from reaching the river, the project placed fences and trees as barriers against run-off, particularly against agricultural run-off and sediment erosion. This separation between human-led processes and the natural environment of the river can be seen as a necessary measure to allow the river to recover, restoring a mutual human-river relationship of care and enjoyment, for the future.

The approaches across the project sample thus span a range of approaches, both in the nature of the intervention – being technological, hard engineering or nature-based – and the point at which the project intervenes in ending river pollution.

COMMUNITY



Using the available descriptions of each project's community approach, I was able to characterise each style and degree of community engagement. The way in which I discuss community engagement is concerned with the role given to the communities by the project leaders, rather than the approach taken by the project itself. I have categorised each project's community approach as active or passive and define these terms alongside examples from the case studies below.

Active

Some projects enabled the community to have an active role in the planned interventions, characterised by local people playing an integral part in the entire process of the project, rather than just being informed or consulted. Active community roles are deemed effective in public projects, as they enable the community to feel more involved, seen as a prerequisite for a project to achieve its aims (Eden and Tunstall, 2006). For example, the Wandle River Restoration Project used public consultations and volunteering opportunities that were available to local people. The act of consulting and giving some or all decision-making power to a community regarding a project that will affect their locality, demonstrates an active inclusion of their concerns and desires.

The Loweswater project worked directly with farmers to build solutions that supported both their livelihood needs and ecological improvements. In addition to farmer engagement, the Loweswater project also regularly updated the wider community, and worked with local people through consultations and meetings, where local people's concerns and desired solutions were heard and implemented as much as possible; an active style of community engagement.

Both Thames River Watch and the Oxford Rivers Project demonstrated active relationships with the local community to a greater degree, where communities were responsible for leading the projects. The Oxford Rivers Project places a community at the centre of its attempt to end river pollution, establishing itself as the largest citizen-science project for analysing river bacteria nationally. The community used the evidence that they collected to apply to Oxford City Council for 'designated bathing water status', demonstrating a direct relationship between the community's aims and actions and the outcome. Another key factor here was the human-river relationship that motivated the movement. The collective action was predominantly

motivated by sewage pollution threatening their enjoyment of the river. Norton's (1984) 'convergence theory' highlights that the greatest motivation for environmental protection comes from human benefit from nature. Demonstrating this relationship, the Oxford Rivers Project was a successful attempt to enforce the protection of the local river against pollution so that the community could continue to make recreational use of it.

Similarly, Thames River Watch was also community-led. People within the local catchment area came together to produce necessary evidence to campaign for change at policy level. In this way, the project emerged as evidence-led, carried out by citizen scientists. Since beginning the project in 2014, the project has worked with more than 2,000 young people, through volunteering and education programmes. As part of the next stage of the project – Thames River Watch For All – that launched in 2021, the project entered a three-year phase that aims to engage a pool of volunteers that is more ethnically diverse and inclusive of those on low incomes.

The Wild Wiske Revival project engaged the community in a high intensity way. Online case study resources for this project mention that its leaders, the Yorkshire Wildlife Trust working in partnership with the Environment Agency, provided five local landowners with tailored advice on pest management, to reduce algal blooms and chemical run-off. Working with a small number of landowners, yet at an intense level of engagement, demonstrates a different approach to active community engagement.

It becomes evident that an 'active' style of community engagement encompassed variable practices across the respective projects, which centred citizen voices and actions to different extents.

Passive

Some projects displayed passive styles of community engagement. This style involves informing or consulting the community, rather than making them part of decision-making processes.

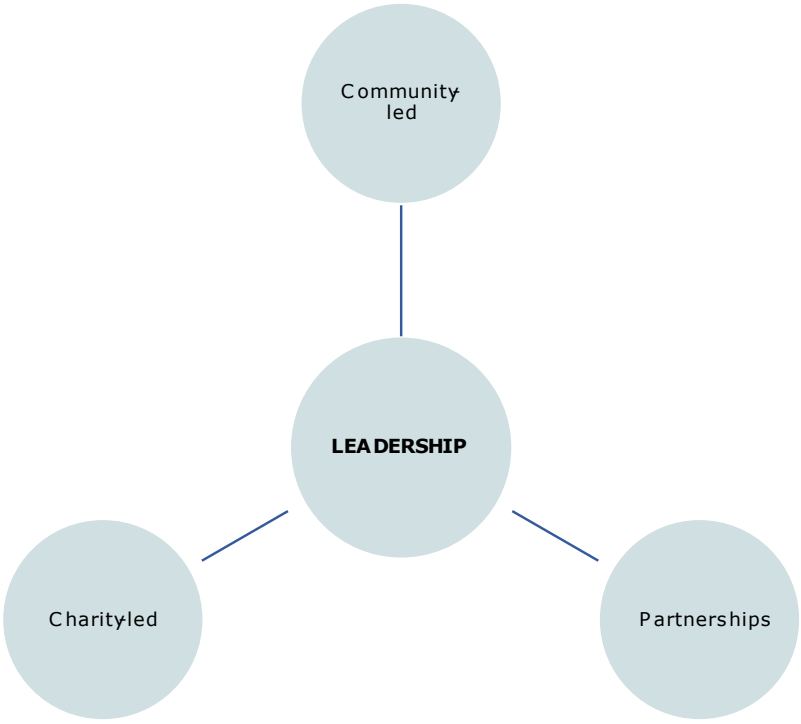
Two projects took this approach. InNoPlastic aimed to use technology in an innovative manner, to allow the community to better understand plastic pollution. This occurred through virtual experiences, as well as designing an 'accessible' application that collected citizen science monitoring data, provided by InNoPlastic's partner Empower. Brečka et al., (2022) recognise the importance of finding new ways to implement technology within environmental education, specifically promoting the use of 'virtual reality' and 'mobile applications'. The technological basis of InNoPlastic's community outreach emerges in line with a new way of fostering an environmentally conscious society. However, this multi-dimensional approach to community engagement focuses on innovative experience and education, which is arguably passive in its approach; the community engagement is one-directional, from project coordinators to the local community. Though the project found innovative ways to educate local people about environmental issues and collect

citizen-science data, the community does not appear to have been part of decision-making processes, and so has been given a passive role.

The River Thame Catchment Conservation Project also adopted a passive style of community engagement, by designing training courses and workshops to raise awareness of environmental issues. The way in which local people were involved appears more informative, rather than collaborative.

In an effort to end river pollution in the UK, some projects approached the idea of community engagement from a position that placed greater agency with the project leaders, rather than the community. The emergent power asymmetries between local people and the project leaders in those cases is characteristic of passive engagement.

LEADERSHIP



From looking into each of the seven case study projects, there was a diversity in how the projects were led and organised. The leadership styles across the projects can be categorised into charity-led, community-led and partnerships. It is important to note that whilst both charity-led and community-led projects still engaged in partnerships with certain organisations, the central role of the community and charity in their respective projects justifies these separate categories.

Community-led

Some projects were established due to community concerns, placing the community at the forefront of the project execution, though supported by charities and other organisations.

The Oxford Rivers Project was a citizen-led project, where the community was directly responsible for generating evidence that would be integral to establishing designated bathing water status. Hence, the citizens were at the centre of the project leadership. However, it is also important to recognise that the project operated in partnership with charities, the council and other campaign groups. This partnership did not take away from the central leadership position of the citizens, but instead strengthened and supported the efforts of local people by providing expertise, resources and funding.

In a similar way, Thames River Watch was led by people living in the Thames catchment area. As highlighted in the section about community, above, this project brought together a range of community members, including young people and minority volunteers, to produce the evidence to campaign for policy change. However, to further support the community members involved in the project, Thames River Watch partnered with the Thames Tideway Scheme and Thames21, a London-based river charity. This partnership with Thames Tideway Scheme, again, did not shift the leadership away from the community, but instead made the project possible through being the main source of funding, alongside Thames Water. Supporting citizens with resources and expertise, Thames21 further empowered the citizen-led nature of the project. Tideway partnered with this project as part of their Corporate Social Responsibility, whilst carrying out a £4.3 billion update of the London sewage network. Its funding facilitated the actions of the citizens.

Projects that adopted a community-led style of leadership allowed local people to be leaders of work aimed at ending the pollution of their rivers, but in each case the communities were supported by various organisations for funding, resources and other logistical purposes.

Partnerships

I categorised four of the projects as 'partnerships', although the nature of these partnerships varied.

InNoPlastic is a 'global' partnership. Run by 17 partners across 10 countries, the project partners consisted of research organisations, government bodies, industry end users, non-governmental organisations, and businesses. The leadership of this project was not only globally diverse, but also drew on a broad range of expertise.

The Wandle River Restoration project and the Loweswater project are both more diverse partnerships. They do not fit a neat category like 'global' or 'charity' above. The partnership style of the Wandle River Restoration Project, for example, brought together charities, universities (such as the geography department at King's College London), water companies and other local community groups. This contributed to a catchment-based approach, as it allowed multiple local agents of environmental change to come together (Collins, 2020). This diverse partnership also brings together a wide range of expertise, drawing on geographical and scientific academic insight, as well as local charity and community concerns.

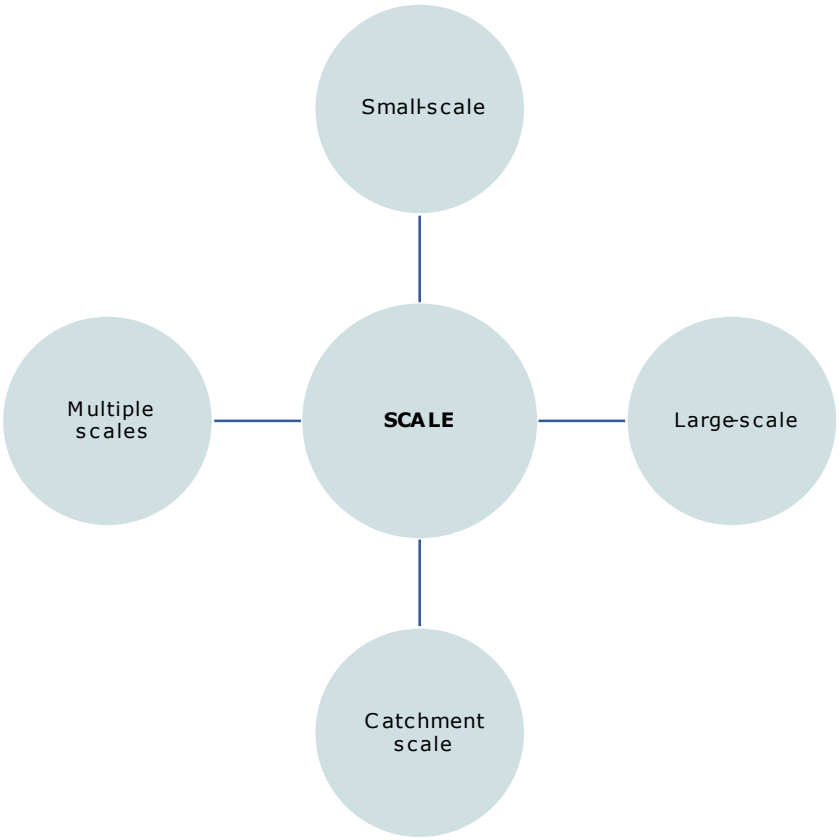
Charity-led

The Wild Wiske Revival project was led almost entirely by one charity. Led by the Yorkshire Wildlife Trust, a local charity, this project is characterised by local insight, its work carried out by people that understand the value in their local river. Bringing together local people that are concerned about their surrounding nature, in partnership with the Environment Agency who provide operational and logistical advice, the organisational composition of this project is one that focuses on and supports local efforts.

The River Thame Catchment Conservation Project can be characterised also as charity-led, where multiple charities were responsible for leadership. Here, the

project brought together local rivers trusts with the Environment Agency. Rivers trusts are local charities, that are members of the Rivers Trust. They bring people, resources and intelligence together to allow rivers to thrive, as well as providing advice and resources for the local communities. In this way, they act as both local pressure groups, as well as local experts (Newson, 2011). Newson (2011) also outlines how these local rivers trusts have no statutory power of their own; their ability to deliver change is based on their financial power through charitable funding, as well as the statutory bodies that they partner with. The River Thame Catchment Conservation Project partnered with the Environment Agency and was funded by the Catchment Restoration Fund.

SCALE



Scale is relevant to several key aspects of the projects. Here, I consider spatial/geographical scale, including catchment-based approaches that offer a different spatial understanding to projects working within regional, city or other boundaries. I also explore the ways in which certain projects impact at multiple scales, such as size of partnerships, amount of funding or number of people impacted. I outline how scale underpins several other characteristics that have been discussed earlier, such as how scale correlates to choice of approach or community engagement strategy.

The case study projects address river pollution at a wide range of geographical scales. These often correspond with the nature of the projects' approaches, leadership and relationship to communities. Some operated at smaller scales. The Oxford Rivers Project, for example, was designed to establish designated bathing water status for a stream of the Thames, within the Oxford catchment area. The project's use of 'simple monitoring technologies', as discussed earlier, complemented the scale of the project. Targeting a small stream of water for the designated bathing water status, with strong local citizen engagement, was clearly effective and well-suited, as it achieved its aim. Similarly, the Loweswater project focused on a small lake. The scale of the project meant that the diverse partnership that led it was able to apply a range of expertise at a highly detailed level.

Other projects operated on larger scales, such as the Wild Wiske Revival project in North Yorkshire. There, river pollution was addressed along a 46.9km long river. The approach of the project was selected accordingly, such as focusing on the implementation of large-scale fences and afforestation efforts designed to act as barriers against run-off along the length of the river.

InNoPlastic is the largest-scale project due to the international geography that it covered through its different pilot locations and the global partnership that came together to develop its technologies. It had a correspondingly large budget, relative to the other case studies. Ongoing research and development conducted by the project, and its cross-border network of coordinators, characterises it as uniquely vast for a project focused on river pollution.

Taking a different approach to spatiality, the Wandle River Restoration Project chose to operate at catchment scale. The close community engagement within this project compliments the catchment scale approach, as a major risk with catchment-scale river management has been the lack of regard for local-scale issues (Blomqvist and Schlager, 2005). Bringing together community engagement with catchment-scale river pollution management thus aligns with local issues, whilst also operating within regional and national contexts (Hillman et al., 2008). Regarded as the natural scale of the environment, this catchment approach recognises the river-land relationship that cannot be ignored in river management (Sekharan et al., 2022). In such a way, spatial scale emerges not entirely as the size of the project region, but also the way in which space is understood by authorities and communities; it must be considered in both ecological and social terms.

Though aimed at ending river pollution at the scale of a major river – the River Thames – the Thames River Watch project had an influence at multiple scales. Through the generation of evidence and data, the project aimed to have impact at the scale of the river catchment itself, as well as at a national policy level via evidence-led lobbying, and at the individual scale of the citizen, who leads the project. The project gained publicity locally, nationally and internationally. Through an investment in communications, Thames River Watch managed to gain significant coverage on major news channels, such as ITV News, the Guardian and the Daily Mail. In an effort to further build momentum around the project, a collaboration with Zac Efron led to the project also featuring in a Netflix-produced documentary. Though the project focused on one catchment area and the communities that led its evidence-gathering and campaigning work, it aimed to impact policy at a larger scale, supported by its larger scale communications work. Through this, it becomes clear that different elements of a project may work at different scales to address the project's immediate aims and have influence beyond them.

It is evident that the various scales at which the different projects operated cannot be separated from the other characteristics that define them, such as the relationship between geographical scale and the scale of the technology or intervention deployed. Not only do these scales overlap in some cases, but it is also evident that some projects operated at different scales for different components of their intervention.

The breakdown of characteristics and categories within this section will be further analysed in the next section, specifically in the context of the aims of the Lund Trust. Using the characteristics of leadership, community, scale and approach, I will explore how these characteristics best fit the aims of greening lives, generating transformative change and engaging the community.

Section 2.1. Lund Trust's aims: development of definitions

Having explored the key characteristics that emerged across the seven projects, this section will explore how those characteristics align with Lund Trust's aims. To begin with, I will outline the aims of the trust, considering the meaning of both 'transformative' and 'greening young lives', as well as proposing an additional aim of 'community engagement'. From there, I will explore the best styles of leadership, approach, scale and community for Lund Trust, bringing together these characteristics and aims. I will use this analysis to recommend the most appropriate strategies for the Trust to help end river pollution in the UK.

Lund Trust's aims

As noted at the beginning of this report, 'Lund Trust aims to support transformative work that greens people's lives, particularly young people's lives.' Here, I will explore those aims, interpret their meaning, and recommend definitions, including one for an additional aim around community engagement, that can help Lund Trust as it considers how it might support work that helps end river pollution in the UK.

Transformative

Lund Trust defines transformative in simple terms; it seeks to fund change and those working for change, rather than maintenance, without deploying bold new approaches or innovation for the sake of it. Here, I consider the wider use of the term transformation in relation to the environment, and how funding transformative work as an aim might be understood in relation to the goal of ending river pollution.

In the environmental arena, transformation is often associated with a shift towards sustainability (Geels, 2002). More recently however, environmental practise is increasingly acknowledging the need for transformation to address the inseparability of social and ecological systems (Andrachuk and Armitage, 2015). I will explore 'transformative' as both social and environmental, characterised by a positive restructuring or change to both, recognising their highly entangled relationship.

To define environmental transformation, I draw on the emerging literature around 'green transformation' within climate change discourse. Amundsen and Hermansen (2021) argue that transformation is particularly necessary now, due to the ineffectiveness of incremental responses to the climate crisis. Based on this, I argue that environmental transformation is characterised by aiming to achieve significant measurable change through planned intervention.

It is also important to consider the temporal aspect of 'environmental transformation'. Transformative work must ensure that natural systems are 'safeguarded', enhancing their ability to deliver 'societal wellbeing for future generations' (Blythe et al., p.5). Environmental transformation in the context of river pollution is therefore also centred around sustainability, in terms of long-term resource availability, ensuring that a river can provide adequate ecosystem services. As well as having social benefits, environmental transformation also relies

on social reception; the long-term success of environmental projects is increasingly associated with how it is perceived by the local community (de Lange, 2021).

I define 'social transformation' in two ways. Firstly, without an active focus on 'social transformation', there is a risk that 'transformative' approaches fall short, by making generalisations about their target population (O'Keefe et al., 1976). Several transformation narratives regarding solutions to global environmental issues fail to address the asymmetries that exist between different groups of people, such as around their access to resources or contribution to decision-making (Corson and Macdonald, 2012). So, a lack of attention towards social differentiation within project planning would assume that all transformation will have universal benefits. An environmentally 'transformative' approach to river pollution should benefit all people, not just a certain demographic. Furthermore, a socially transformative project could also be one that positively impacts the attitudes of local people towards rivers. For example, engaging local volunteers from minority backgrounds to carry out river pollution projects could tackle cultural imbalances around attitudes towards the environment (Randle and Dolnicar, 2009).

Bringing these ideas together, I define 'transformative work', in relation to river pollution, as work that creates both environmental and social change, which are inseparable. For the former, the work should be planned to achieve significant, measurable change that has longevity. For the latter, it must benefit all people and not assume the environmental change has universal benefit.

Greening (Young) Lives

Lund Trust defines 'greening people's lives' as centred on green spaces. This consists of better connections to green spaces, more sustainable living and working, or taking actions that contribute to a better-quality environment. The Trust's focus on young people here aims to ensure that young people are considered and consulted in the process of greening a space, as well as supporting organisations that are run by young people. Within my research, I extended this definition to also explore the extent to which different projects recognised the diversity within the term 'lives'. Research around participation in collaborative river management programmes demonstrated that it is often male, middle-aged, and educated citizens that are most represented and accommodated for within such programmes (Koehler and Koontz, 2008). This emphasises the importance of ensuring that clean rivers green 'all' lives, rather than reinforcing or producing socio-environmental inequalities.

This report will look at how cleaner rivers benefit the community, as well as questioning who in the community benefits, as it considers how Lund Trust can support river pollution projects that 'green people's lives'. It will also interrogate the nature of the human-environment relationship that is being fostered through river pollution projects, favouring those where a mutually beneficial relationship is established. This report will also assume that all attempts to end river pollution in the UK will green young lives, as the sustainability that this promotes will benefit future generations, there is greater benefit to those where young people are directly engaged, benefited, or consulted.

Community Engagement

Though not included explicitly in Lund Trust's current aims, I propose, when Lund Trust thinks about its approach to river pollution, an additional aim of promoting community engagement. This additional aim is centred around the relationship between people and rivers. As outlined in the definition of both 'transformative' and 'greening people's lives', ending river pollution in the UK not only benefits the environment, but also shapes a better connection between the environment and the local community (European Environment Agency, 2016). However, the success of river restoration attempts is increasingly dependent on public participation (Heldt et al., 2016). Hennecke and Kronenberg (2014) reiterate this integral relationship, promoting active public involvement at early stages of river restoration planning as a way of reaching publicly accepted solutions.

Because of the relationship between river and community, I argue that community engagement is vital, considering the nature of the river as an 'emotional space', that is a place that can foster a sense of familiarity and cultural identity (Lindemann, 2011). As a result, it is important that river pollution projects deliver not only technically, but also through their ability to address the expectations of local groups and individuals. However, rather than homogenising the idea of 'community engagement' as a key aim for the Lund Trust, we should recognise the degree to which community participation can range (Arnstein, 1969). For example, one side of this range would involve information campaigns, where engagement is unidirectional from the project managers to the community. On the other end of this range, greater levels of citizen empowerment can emerge through consensus conferences, for example, where the community is active in decision-making, rather than just 'informed' or 'consulted' (Nielson et al., 2006). Community engagement, as an aim, thus ensures that river pollution projects are inclusive of all and involve local people in a way that allows them to be agents of change.

Assessing community engagement

The three community engagement strategies

	Transactional engagement	Transitional engagement	Transformational engagement
Corporate stance	Community investment/ information "Giving back"	Community involvement "Building bridges"	Community integration "Changing society"
Illustrative tactics	Charitable donations Building local infrastructure Employee volunteering Information sessions	Stakeholder dialogues Public consultations Town hall meetings Cause-related marketing	Joint project management Joint decision-making Co-ownership
Communication	One-way: firm-to-community	Two-way: more firm-to-community than community-to-firm	Two-way: Community-to-firm as much as firm-to-community
Number of community partners	Many	Many	Few
Frequency of interaction	Occasional	Repeated	Frequent
Nature of trust	Limited	Evolutionary	Relational
Learning	Transferred from firm	Most transferred from firm, some transferred to firm	Jointly generated
Control over process	Firm	Firm	Shared
Benefits and outcomes	Distinct	Distinct	Joint
Illustrative studies	Brammer and Millington (2005) Gabriel (2006) Stern (2001)	Foo (2007) Maranville (1989) O'Regan and Oster (2000)	Parker and Selsky (2004) Tracey et al. (2005) Westley and Vredenburg (1991)

Figure 1: Bowen et al., (2010) criteria for each of the three engagement strategies under the continuum.

When exploring how the characteristics of the projects show community engagement, I will draw on Bowen et al.'s, (2010) 'continuum of community engagement' (see Figure 1). The continuum defines increasing levels of engagement, from one-way information sharing to two-way dialogue and collaboration, ending with community leadership (ibid.). I will be drawing on the three main categories across this continuum – transactional, transitional and transformational engagement – to explore the styles of community engagement that emerged from my case studies

As the continuum progresses from transactional to transformational engagement, the direction of community engagement shifts from being one-way to 'joint learning' between the project managers and the local people (Hart and Sharma, 2004). The idea of 'sensemaking' is central to transformational engagement, characterised by a collaborative process of creating shared understandings within project management (Ancona, 2011). Sensemaking thus alludes to the central importance of all those concerned in river pollution projects, including the community. Those styles of public participation that sit between citizen-empowered 'transformational' engagement and passive 'transactional engagement' are categorised as 'transitional engagement', where the 'voice' of the project remains mostly in the hands of the project managers, but is partly with the community. In line with the Trust's aims of making transformative change and greening lives, I argue that community engagement, and specifically transformative engagement, should also be part of the Trust's aims when it looks at how it might support work to end river pollution in the UK.

Conclusion of definitions

Setting out these definitions is integral to the rest of the research project, as it provides a framework for me to assess how the characteristics of each case study align with the aims of the Lund Trust. These definitions allow me to assess the compatibility of different approaches to ending river pollution with the Trust. I also note that the definitions of each aim above are not designed to exist in isolation, but to work together. For example, a project that has transformative potential through large-scale wetland implementation might not be as transformative in the long run if it does not engage with the community to understand their needs. Hence, when using these definitions to assess the compatibility of each project with the Lund Trust's aims, I will use the definitions holistically.

Section 2.2. How do the case study characteristics align with Lund Trust's aims?

Bringing together my definition of Lund Trust's aims with my exploration of the key characteristics and categories that emerged across the case studies, this section outlines how these two factors interrelate. Through this process, I will ascertain the most relevant styles of leadership, community, approach and scale to Lund Trust, when it considers grants that will end river pollution in the UK.

What is the best style of leadership for Lund Trust?

There is no single style of leadership that Lund Trust should look for when seeking projects that end river pollution in the UK, but, to make transformative change for all that engages the community in an active way, and thus greens lives through their involvement in their local green spaces, community needs to be central in a project's leadership. Whilst most effectively achieved through citizen-led projects, this can also come from ensuring that the community has a central voice from early stages of the project process, within partnership styles of leadership (Hennecke and Kronenberg, 2014).

The complexity of the river pollution crisis in the UK demands a diversity of expertise, funding and people; a synthesis that partnerships between communities and organisations can successfully achieve. But to achieve transformational change, both social and ecological, leadership needs to contain an element of community. The fruitful results of the Oxford Rivers Project, for example, demonstrated how citizen-led campaigns can be strong, impactful and produce legally enforced outcomes. The transformational nature of this project was characterised not only through changing the river, by securing designated bathing water status, but also through the transformation of the community, who became agents of change. The project has helped start two other attempts to apply for designated bathing water status elsewhere in the UK. Here, not only does community leadership emerge as transformative, but that transformation drives and inspires wider change. Though community-led, the project partnered with relevant organizations and authorities such as Thames21 and Oxford City Council, which strengthened the voices of the local people by providing them with resources and expertise.

The central position of the community is also best aligned with Lund Trust because this leadership style also contributes to the greening of people's lives in a very direct manner. By allowing local people to be the forefront of change in green spaces that they value, they are more involved in their own greening, further enforcing the success of their interventions (de Lange, 2021).

When judging potential projects for suitability, Lund Trust should thus ensure that the community has a central role in leadership, though this need not mean exclusively working with projects where the community are the sole leaders. An emphasis on community can still exist within other styles of leadership, such as within diverse partnerships, as seen with the Wandle River Restoration project. Community groups came together with experts, such as university departments and charities. Such partnerships help ensure the transformative and greening success of a project,

as they introduce subject-specific and organisational expertise that might not exist in the community, and often also a legal structure and mechanism to raise funds.

When ascertaining the categories that existed within the 'leadership' characteristic, I described projects that were charity-led, community-led or partnerships. Though community-led projects can provide the clearest examples of effective work that fits Lund Trusts aims, as defined here, Lund Trust may find that there are effective projects that fall within any of the three leadership categories. The key elements, as described above, are that a project should demonstrate a transformative approach to community engagement, through ensuring that the community has an active and central role throughout the project, as well as sufficient partnerships working to provide an appropriate range of expertise and support. These elements may be present, or indeed absent, in projects whether they are led by a community, charity or other organization or coalition.

What is the best style of approach for Lund Trust?

Across the case studies that I analysed for this project, there was an array of approaches, with varying points of intervention. I argue that nature-based solutions are the most effective approach for meeting the aims of the Trust, as well as for ending river pollution. However, I also recognise the importance of simple monitoring technologies in ending river pollution.

When comparing approaches, I argue that nature-based solutions are more directly aligned with the Lund Trust's aims, compared to hard engineering or technologies. Nature-based solutions emerged within some case studies in the form of wetlands, such as in the River Thame Catchment Conservation Project. As outlined by Knight (1992), wetlands provide secondary benefits that transcend their primary objective to tackle non-point-source pollution, which comes from rainfall moving over and through the ground, rather than from a singular source, such as industry or sewage (Moss, 2008). Directly relevant to Lund Trust's aim to 'green people's lives', wetlands – particularly in urban settings – provide services to human society, such as recreational and educational use, as well as aesthetics (Nash, 1978). In this way, wetlands green lives by directly introducing new green spaces to the local community. They also green lives by acting as natural filters for polluted water, before it enters river systems, thus ensuring that people can enjoy cleaner nature. Here, the local area becomes transformed through the introduction of new green space, as well as transforming the existing natural entity of the river.

The point of intervention at which wetlands operate sits in the middle of prevention and treatment. Whilst not preventing pollution at the source, wetlands provide a filter for treating polluted water before it enters the river. In conversation with various experts in the river pollution space, they said that point-source prevention is an ideal, yet unlikely strategy. The established practises of agriculture, for example, are difficult to change in the short-term. With the urgency of the river pollution crisis, priority must therefore be given to treating polluted waters, before they reach the river, or once they are in the river. Under this priority, introducing wetlands is a more effective approach than hard-engineering or technologies. It not only is nature-based, and so has an ecologically transformative and greening impact, but it also

operates at a point before pollution enters the river, which I argue is transformative to a greater degree. However, Lund Trust would benefit from seeking projects that bring together a preventative and treatment approach, such as within the Wild Wiske Revival project in North Yorkshire. As well as implementing wetlands to treat polluted water before entering the River Wiske, this project also worked closely with five local landowners to provide tailored advice on pest management, in order to reduce agricultural run-off. This approach is multi-layered and thus contributes to ending river pollution at different degrees of ecological transformation.

I argue that the use of monitoring technologies to generate evidence is also an effective strategy to end river pollution that aligns with Lund Trust's aims. The two case study projects that centred citizen science – the Thames River Watch and Oxford Rivers Project – used simple technologies to collect and analyse pollution data and produce evidence. Whilst the Oxford Rivers Project used this evidence to lobby the local council to grant designated bathing water status to the UK, Thames River Watch generated data that was used at government level to make the case for better river pollution funding. This approach engages the community, who lead the collection of data and the campaign more widely, thus adhering to the 'transformational' community engagement that I propose as an additional aim of the Lund Trust. This has a simultaneous effect of greening the lives of those who are engaged in the collection of data, as they become tightly bound with the river through their engagement. As will be further discussed in the community section, below, this style of approach can also be socially transformative, if it has the potential to transform imbalances in cultural attitudes towards the environment. This was seen through Thames River Watch and its active attempt to recruit volunteers from minority backgrounds. Therefore, citizen science evidence-led approaches also align with the aims of Lund Trust, especially where they work with a diverse range of community members. They enforce both pollution prevention and treatment, using legal protections and lobbying to ensure that rivers are kept at a healthy water quality. The practical difficulty here is regarding funding; through my research, few costs were associated with these evidence-led projects, apart from monitoring technologies. Hence, whilst the nature of the project is highly aligned with Lund Trust's aims, how Lund Trust might encourage and expand such work requires more thought.

The approaches that best suit Lund Trust's aims are those with the greatest community engagement, the most potential for social and ecological transformation, and that green lives to the greatest degree. In line with these aims, both nature-based solutions and citizen-led monitoring and campaigning projects emerge as the best approaches for the Trust. This is not only due to the potential for community engagement, and thus social transformation, but also due to the ways in which they act to both prevent and treat river pollution at multiple points of intervention, albeit in very different ways. What Lund Trust should take away from both of these approaches is their ability to engage a range of people and to provide multiple ecosystem services.

What is the best style of community for Lund Trust?

In this section, I will explore community engagement in terms of quantity and quality, to ascertain the best 'style' for Lund Trust. Drawing on the categories of 'active' and 'passive' that I established in the characteristics section of this report, I will advocate for active styles of community engagement, in line with the proposed aim of Lund Trust. In terms of quantity, I argue that the transformational community engagement, according to Bowen et al.'s, (2010) criteria, tends to come about from there being a small number of community partners.

Active community engagement aligns best with all three of Lund Trust's aims. This style of community engagement comes from two-way communication between the community and project leaders that allows local people to emerge as agents of change for their local rivers. Projects that 'inform' or 'consult' the community, as seen in InNoPlastic's strategy to 'educate' people on the environment through technology, demonstrate passive community engagement that does not align with Lund Trust's aims. Instead, mobilising local people through supporting their concerns and solutions not only meets the criteria of 'transformational', rather than one-way, performative 'transactional' community engagement (ibid.), but it also allows the community to feel more involved and impactful, with the potential to green attitudes for futures to come. Furthermore, the idea of greening attitudes becomes particularly important in the context of minority populations, as highlighted earlier in this section. The engagement of volunteers from low socio-economic and ethnic minority backgrounds became a key focus of the Thames River Watch this year, as part of its Thames River Watch for All strategy (Tideway, 2022). Greening all lives, rather than parts of a community, by engaging them in river pollution projects and thus being socially transformative across a wider demographic of people emerges as directly aligned with Lund Trust's aims.

Active styles of community engagement also address the importance of human-river relationships, which I outline as an essential consideration under the 'community engagement' aim for Lund Trust. Projects that seek to end river pollution in the UK can shape a better connection between the local community and their river, in a mutual relationship of care and enjoyment. This intimate relationship justifies the community being at the forefront of leading change against river pollution, both in the short-term and in maintaining such improvements.

Bowen et al., (2010) argue that transformational community engagement, which I draw on as part of my definition of the 'community engagement' aim for Lund Trust, consists of few community partners in order to create a shared understanding of the project area in a collaborative manner. Here, engaging 'few community partners' is justified by the complex and intense organisation required in projects (ibid.). In the context of river pollution, I argue that few community partners, such as charities and local rivers trusts, is an effective priority for Lund Trust, as this has administrative benefits. However, I build on this definition of transformational community engagement, by arguing that Lund Trust is best suited to projects that ensure enough community groups are engaged, representative of the respective community demographic, as highlighted in the explanation of 'social transformation' in Section 2.1. The quantity of community engagement that best suits Lund Trust thus builds

upon the 'quality' of community engagement, defined not as a specific number, but by a diverse coverage of a range of people.

Lund Trust should seek active, transformational styles of community engagement in river pollution projects. This would ensure that local people are not engaged performatively and passively. Building on this, Lund Trust would ideally seek to work with minority populations where possible, in order to be socially transformative and green a range of lives. When evaluating how many people are engaged through projects, there is no specific 'quantity' of people that should be engaged from the community. Instead, Lund Trust should ensure that projects are engaging enough people from different backgrounds, representing the demographics of the community in the project region.

What is the best project scale for Lund Trust?

Looking at scale, the case studies geographically spanned small, large and catchment scales, with some working at multiple scales. They also represented different scales of funding and leadership structure. In this section, I will discuss how these different categories of 'scale' fit with Lund Trust's aims, making a case that Lund Trust is best suited to projects that operate and impact at a range of scales, bringing them together to optimise their transformative potential.

Projects that operate and influence at multiple scales are highly suitable for Lund Trust, as they demonstrate transformative potential at a range of levels. This transformation can occur not only if we interpret scale geographically or spatially, but also in terms of the scale at which impact occurs. For example, The Thames River Watch project was designed to transform at the spatial scale of a river, whilst also impacting at the national policy scale through evidence generation, which was collected at a more local scale of the citizen. I argue that this is an example of scale-jumping, where project actors work simultaneously across several scales to produce impacts also at several scales (Setzer, 2017). Volk et al., (2008) reiterated the importance of operating at multiple scales, arguing that bringing together interventions at the meso, micro and macro scale is essential to delivering good water quality under the EU Water Framework Directive. This reinforces the transformative aim of Lund Trust, which recognises the entanglement that exists between social and ecological transformation.

Recognising the suitability of projects that operate and impact at multiple scales for Lund Trust, I argue that catchment-based approaches can meet this 'multiple scale' approach, should they prioritise community engagement. Whilst ecologically transformative in river management due to the recognition of river-land interconnectedness (Fenemor et al., 2011), catchment-based approaches can be less socially transformative or effective. A risk with catchment-based approaches is that they often dismiss the importance of local concerns, due to the multiple localities that exist within the catchment (Blomgyist and Schlager, 2005). However, this makes a greater case for community engagement at more intimate, local scales, to bring together community engagement and catchment-scale approaches. Ensuring that catchment-based river pollution projects are engaging in multiple, local forms of community engagement has the potential to be particularly advantageous. In this

way, catchment-based approaches can be both ecologically and socially transformative around river pollution, whilst also aligning with regional and national environmental governance; the latter being a key advantage of the catchment scale (Hillman et al., 2008).

The best style of project for Lund Trust to work with is one that engages with, operates at and impacts at multiple scales. Both spatially large-scale and small-scale projects are capable of scale-jumping, with the people that they engage and the way they connect, as exemplified by Thames River Watch and its use of communications. From a practicality perspective, large-scale projects that cover extensive geographical scales and deploy large-scale technologies might not be appropriate for Lund Trust, as they are likely to be expensive and require multi-year maintenance; this doesn't align with the brief of this research project. Hence, Lund Trust is suited to projects that demonstrate an ability to create and inspire change beyond the geographical scale that they are designed for. This might range from social transformation at the scale of the individual to working with projects that can network at regional, national or even international levels.

Conclusion

The final section of this report will bring together the discussions of section 2.2, summarising the best style of project that Lund Trust could pursue, in order to end river pollution in the UK. It will also propose some additional questions that Lund Trust could consider when evaluating the suitability of potential projects.

This report addresses Lund Trust's brief to ascertain the most suitable way for the Trust to help end river pollution in the UK. In doing this, I explored and developed the aims of the Trust, outlined characteristics that emerged across seven existing projects to end river pollution in the UK, and considered how the characteristics and aims align. In developing the aims of Lund Trust – transformative work, greening (young) lives and an additional proposed aim of 'community engagement' – I emphasised the importance of social and ecological transformation, active community engagement and greening all lives. Having explored seven river pollution projects in detail, I recognised four key characteristics that emerged across them: leadership, community, scale and approach. Within each characteristic, there were a range of different categories that demonstrated the diversity across the case studies. Bringing together these developed aims with the emergent characteristics, I make the following recommendations for Lund Trust, when choosing projects to work with that are designed to end river pollution in the UK:

I recommend the consideration of the following additional questions, when Lund Trust is judging the suitability of potential projects that seek to end river pollution in the UK:

1. Are projects partnerships, where the community is empowered and supported, rather than undermined?
2. Who in the community is being engaged? Is the demographic of the engaged community representative of the community in the project region?
3. Are young people being directly involved in the project process? If not, are there areas in which young people can have a significant impact?
4. Is the project ensuring that human-led modifications to the river maintain a harmonious human-river relationship, rather than disrupting the natural river course?
5. Will the project require additional funding to maintain the planned interventions, or will it sustain itself?
6. Is the project solely treating the river of pollution, or also preventing pollution at the source/from entering the river?

Recommendations for further research

Moving forward, I recommend further research into the following areas, as part of Lund Trust's strategy to fund projects that are working to end river pollution in the UK:

1. **Cultural imbalances in environmental attitudes** – through researching the way in which environmental perspectives differ between different cultural groups, Lund Trust can better ascertain how it can engage with projects that

can significantly address the imbalances that exist between different community groups regarding environmental management. In doing so, Lund Trust can make its aims more inclusive.

2. **The role of young people in river management** – further research is needed regarding the way in which young people engage with local rivers, as well as how young people can be mobilised as active agents of change in local river pollution management. Investigations regarding the attitudes of young people towards the environment and local blue/green spaces would be useful for this.

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