Department for Environment Food & Rural Affairs

Order Form – Contract for Research and Development Goods and/or Services

1. Purchase Order Number	To be provided by contract manager within 10 days
2. Customer	Environment Agency Red Kite House, Howbery Business Park, Wallingford, OX10 8BD
3. Contractor(s)	University of Stirling Stirling FK9 4LA Scotland, UK
4. Co-Funder(s)	N/A
5. Defra Group Members	N/A
6. The Agreement	This Order is part of the Agreement and is subject to the terms and conditions appended at Appendix 1 and shall come into effect on the Start Date. Unless the context otherwise requires, capitalised expressions used in this Order have the same meanings as in the terms and conditions. The following documents are incorporated into the Agreement. If there is any conflict, the following order of precedence applies (in descending order): a) this Order; b) the terms and conditions at Appendix 1; and c) the remaining Appendices (if any) in equal order of precedence.
7. Deliverables	**Goods:** None
	Services: See Appendix 2 – Specification/ Description
8. Milestone Delays (Clause 18.2.10)	N/A

9. Start Date	1st August 2024
10. Expiry Date	28th February 2025
11. Extension Period (Clause 5.2)	1 month
12. Charges	The Charges for the Deliverables shall be as set out in Appendix 3 – Charges. Unless and to the extent otherwise expressly stated in Appendix 3, the Charges are fixed for the duration of the Agreement.
13. Payment including Payment by Co-funder(s)	Payments will be made in pounds (GBP) by BACS transfer using the details provided by the supplier on submission of a compliant invoice. Invoices must be submitted to the Contract Manager upon the corresponding deliverable being received for review and sign off. Any invoices that are submitted that do not meet the following criteria will not be processed: • 1 PDF per invoice (no larger than 4mb in size) – all supporting documentation must be included in that PDF (no additional separate supporting documentation as a separate file). • Multiple invoices can be attached to one email; however, as above we can only accept 1 invoice per PDF (and no additional supporting files). • Invoices must be dated. • Invoices must quote a valid Purchase Order. • Invoices must have a breakdown of what is being billed. • Invoices must include the total before and after VAT. Payment of 50% of the contract value will be made upon completion of Tasks 1-5. Payment of the remaining 50% of the contract value will be made upon completion of all works.
14. Customer's Authorised Representative(s)	For general liaison your contact will continue to be [redacted] or, in their absence, [redacted]

15. Contractor's Authorised Representative	For general liaison your contact will continue to be [redacted] or, in their absence, [redacted]
16. Co-funder's Authorised Representative	For general liaison your contact will continue to be: N/A
17. Optional Intellectual Property Rights ("IPR") Clauses	The Customer has chosen Option B in respect of intellectual property rights provisions for the Agreement as set out in the terms and conditions.
18. Contractor's general liability cap	The liability of the Contractor as set out in Clause 16.2.1 of the terms and conditions. Total liability is no more than 150% the total charges or £5m whichever is the greater.
19. Progress Meetings and Progress Reports	● The Contractor shall attend progress meetings with the Customer every 2 weeks ● The Contractor shall provide the Customer with a progress report within 5 months after the project start date
20. Address for notices	**Customer:** Environment Agency, Red Kite House, Howbery Business Park, Wallingford, OX10 8BD **Attention:** [redacted] **Email:** [redacted] **Co-funder(s):** N/A **Contractor:** University of Stirling, Stirling, FK9 4LA, Scotland, UK **Attention:** [redacted] Email: [redacted]
21. Key Personnel of the Contractor	**Key Personnel Role:** / **Key Personnel Name:** / **Contact Details:** **Contractor's Project Manager** [redacted] [redacted]

	Technical advisor (senior lecturer) [redacted] **Post-doctoral researcher** [redacted]
22. Procedures and Policies	For the purposes of the Agreement: The Customer's protection and security requirements are contained in Clause 15. Protection and security of data of the Research and Development Terms and Conditions. The Customer's sustainability policy can be found at: Our energy use - Environment Agency - GOV.UK (www.gov.uk) The Customer's equality and diversity policy can be found at: Equality and diversity - Environment Agency - GOV.UK (www.gov.uk)
23. Commercial Exploitation (Clause 11)	Clause 11 (Commercial Exploitation) shall apply to this Agreement: **Yes:** ☐ **No:** ☒
24. Special Terms	N/A
25. Additional Insurance	N/A
26. Further Data Protection Provisions	The further data protection provisions as contained at Annex 1 of the Terms and Conditions are applicable to this Agreement where indicated below: **Yes:** ☐ **No:** ☒

Signed for and on behalf of the **Customer**	Signed for and on behalf of the **Contractor**
[redacted]	

Appendix 1: R&D Terms and Conditions

The terms and conditions applicable to this requirement can be found on the website below

Research and development terms and conditions - GOV.UK (www.gov.uk)

Appendix 2: Specification/Description

Impact of phosphorus reduction on the ecology of rivers in England

This contract is for the completion of a research project that will assess the impact of phosphorus reduction from sewage treatment works on river ecology. This will include detailed statistical/spatial analysis of EA monitoring data. The supplier will produce deliverables including data outputs files, computer code, a report detailing the findings of the research, and a seminar presenting findings to EA staff. It is important that the EA has a robust understanding of the impacts of mitigation measures on receiving waters, in order to justify future investment, to ensure money is being spent where it is most effective. The EA will also benefit from an improved understanding of the nutrient/ecology relationship and the suitability of existing water quality standards.

1. Project summary

The aim of this project is to evaluate the ecological response in rivers to reductions in phosphorus concentrations resulting from the implementation of phosphorus control measures at sewage treatment works.

This specification sets out the background to the work required and the specified tasks to be undertaken, while recognising that an iterative approach will be required.

2. Project partners

The project partners are the Environment Agency and the University of Stirling

3. Overall strategic objective

The overall objective of the project is to use existing routine monitoring data to assess the impact of phosphorus control at sewage treatment works on the ecology of receiving river waters, primarily through the response of aquatic macrophytes but potentially also diatoms.

This will enable the Environment Agency (and others) to:

- develop a robust understanding, at a national level, of the ecological impacts of mitigation measures for phosphorus on receiving waters,
- provide an assessment of the extent of progress being made and future prospects in addressing the challenges of river eutrophication,
- justify future investment and to ensure money is being spent where it is most effective, and
- improve the understanding of the nutrient/ecology relationship in rivers and the suitability of existing water quality standards.

4. Background

Nutrients, in particular phosphorus (P), are a major cause of failure to achieve Water Framework Directive Regulations (WFD Regs) Good status and/or Favourable Condition in rivers. Environment Act targets to reduce phosphorus loads from sewage treatment works (STWs) and nutrient/sediment loads from agriculture are now central to a major policy drive to make dramatic further progress towards better compliance.

Phosphorus removal from wastewater effluents has been a key intervention measure aimed at reducing eutrophication impacts in freshwaters for two to three decades - initially under the Urban Wastewater Treatment Regulations (UWWTR) (first measures 1998) and subsequently in WFD Regs Programmes of Measures for ecological status and conservation objectives. The water industry has invested £2.1 billion in capital expenditure at sewage treatment works since

1995, with further significant investment planned (£2.4 billion up to 2027). As a result of this investment the phosphorus load from STWs was reduced by 68% between 1995 and 2020.

Since the implementation of the WFD Regs the principal means of assessing and reporting on the state of our rivers has been through periodic publication of WFD ecological status classifications. The classification process involves comparison of current conditions with an unimpacted "reference" condition in each river water body, and the overall aim is to achieve good ecological status. Phosphorus is a key supporting element for ecological status, and site-specific standards have been established. The principal biological elements responding to phosphorus in rivers are macrophytes and phytobenthos (reported as a single combined element for the WFD). Macrophytes include mass-forming filamentous algae such as Cladophora which can be one of the more obvious manifestations of eutrophication.

The biological response to nutrients in rivers is complex, and for any specific location may be impacted by factors such as reductions in flow due to abstraction or low river flows, or modifications to channel morphology. Evaluating the impact of specific measures requires a deep understanding of the underlying relationships and responses.

Work undertaken for the Environment Agency by external contractors in 2009 (unpublished) looked for evidence of improvement in the status of river ecology resulting from P reduction but did not find any significant impact. This could have been because insufficient time had passed since the introduction of P controls to allow a recovery in the ecology, but equally the reduction in concentration may have been insufficient to promote a response. The use of WFD classification as a measure of improvement may also fail to indicate small and subtle changes in the ecology prior to more substantive shifts in the plant community.

The phosphorus reduction programme has significantly expanded since the original work was completed, more data and new data analysis techniques are now available. This project aims to evaluate the available data and determine whether an impact from the large scale investment programme at STWs can now be detected. Despite major reductions in P loadings from STWs and river P concentrations over recent decades, only 45% of river water bodies in England currently comply with the WFD Regs P standards for good ecological status. It will l be important to give careful consideration to the selection of sites for inclusion in this review. The focus could be on those sites with long-term data on P and macrophytes/diatoms in places where P has been reduced sufficiently to expect an improvement in the biology. River stretches with STWs where P reduction to meet a fair share of GES or favourable condition is in place may be better candidates than those where only the uniform emission limit values associated with UWWT Regs are employed. Therefore an understanding of where and when P was reduced to levels likely to improve the biology could be a factor in the selection of sites for inclusion in this review. However, an iterative approach to the data analysis will be required, and alternative methods including a wider data set, for example including rivers where no phosphorus reduction has been implemented, could be considered.

5. Specific objectives

The project has the following objectives:

- To evaluate the quantity and quality of available monitoring and other supporting data, to select the most appropriate data sets.
- To explore the available data and select appropriate analytical techniques to determine whether river macrophyte (and/or diatom) communities have improved (or changed) as a result of reductions in P concentration, and which aspects of the communities have shown a response.
- To use the data to provide a statistically robust analysis of any observed changes and identify explanatory variables.
- To provide a report interpreting the outcomes of the data analysis and a consideration of the implications for future monitoring and management of phosphorus inputs to rivers.
- If appropriate, to publish the results in a peer reviewed journal.

6. Programme of work and parties' responsibilities

6.1 Parties' responsibilities

The Environment Agency will oversee this project and will meet regularly with the University of Stirling to ensure milestones are met and results and recommendations are available in line with agreed timelines. The University of Stirling are responsible for the delivery of the programme of work Tasks 4 – 7, as described in 6.2 below, with input from EA national experts where appropriate.

6.2 Programme of work

The best approach to the data analysis can only be determined after an initial evaluation of the available data - for example, it may be most appropriate to focus on the in-river P concentrations and associated plant data, rather than the effects of specific STWs. The complex nature of P removal over space and time, and the fact that monitoring locations are not necessarily sited near to STWs, means that monitoring sites may be influenced by more than one STW, with changes in P permits being implemented at different times.

We assume that measured reductions in in-river P concentrations over time are largely a result of P removal at STWs and that the impact of reducing other P sources (such as diffuse agricultural pollution) is relatively small, but a consideration of rivers without substantial P reduction in place would indicate any other underlying trend.

An iterative approach to the data analysis is therefore required and the outline of tasks below takes this into account by not being prescriptive about analytical approaches at the outset.

6.2.1 Task 1 – Data collation and assessment

Collate and assess the data available from Environment Agency routine monitoring programmes, including those in place prior to the introduction of WFD Regs monitoring. Data on water quality from the WIMS archive and macrophytes and diatoms from the BIOSYS archive will be required.

Party/parties responsible for delivery – Environment Agency, in consultation with University of Stirling

6.2.2 Task 2 – Site identification

Review the monitoring data to identify sites with appropriate time series, and spatial associations between water quality and biological data.

Party/parties responsible for delivery – Environment Agency, in consultation with University of Stirling)

6.2.3 Task 3 – Collate permitting information

Collate information on STW permitting to identify locations where P reduction has been implemented, when the treatment was introduced and its drivers/objectives.

Party/parties responsible for delivery – Environment Agency

6.2.4 Task 4 – Evaluate diatom data

Consider the utility of available diatom data - diatom monitoring over the last decade was largely confined to moderate and low alkalinity rivers, meaning its spatial coverage is skewed. In addition, the sample analysis method was changed to DNA metabarcoding after 2016 and these data are not directly comparable with the preceding light microscopy method.

Party/parties responsible for delivery – Environment Agency and University of Stirling

6.2.5 Task 5 – Data analysis

Explore the river P and biology (macrophyte) data through time in relation to reductions in P concentration resulting from P removal at STWs. Consider whether there should be a focus in on sites where P concentrations have reduced and are now low enough to expect plants/algae to have improved, or whether a wider analysis is more appropriate to expose the impacts of multiple stressors and/or other underlying trends.

Party/parties responsible for delivery – University of Stirling

1.2.6 Task 6 – Interpretation of results

Depending on the outcome of Task 5, identify factors affecting the observed trends.

Party/parties responsible for delivery – University of Stirling

1.2.7 Task 7 – Final report and presentation of findings

Produce a report documenting the work undertaken, highlighting the key findings and their implications, and providing recommendations for future monitoring and analysis.
Archive data used in the project analysis in a suitable format (to be determined by agreement between parties)
Present the project findings to the Environment Agency via a webinar.

Party/parties responsible for delivery – University of Stirling jointly with Environment Agency

7. Deliverables

Task No.	Deliverable	Responsible party	Date of completion, end: (for example, date or by week 2)
	Start-up meeting	EA	9 August 2024
	Progress meetings	EA/UoS	Fortnightly, August 24 – January 25
1,2 & 3	Initial data extraction/collation – data available	EA	19 August 2024
4	Evaluation and documented decision on use/non-use diatom data	EA/UoS	20 September 2024
	Project Board Meeting	EA/UoS	15 November 2024
5	Progress report – data analysis	UoS	29 November 2024
6	Draft final report – data analysis & evaluation	UoS	10 January 2025
	Project Board Meeting	EA/UoS	31 January 2025
	Webinar on project findings to EA	UoS	28th February 2025

8. Target audience

The findings of the project are primarily required by the Environment Agency's Environment & Business Directorate, specifically the Water Quality Planning team, to inform its understanding of progress and future decisions regarding the need for investment in phosphorus reduction technologies. Depending on

the outcomes, the results will be of interest to teams involved in River Basin Planning and developing Programmes of Measures, Ecology technical staff and Agriculture teams working on diffuse nutrient inputs. Defra Water Quality will also have an interest as regards Environment Act targets and the Environmental Improvement Plan 2023.

Externally, there will be interest and scrutiny from Water Companies, and from other organisations involved in river management and restoration, including Natural England and the Rivers Trusts.

Implications of the findings for current phosphorus standards will be considered by the WFD UKTAG and specifically its Freshwater Task Team, bringing the research to the attention of all UK environmental regulators and statutory conservation bodies.

The wider scientific community will be informed through the publication of results in a peer-reviewed journal and/or presentations at relevant conferences, if this is deemed appropriate.

Appendix 3: Charges

It is foreseen that £48,010.00 revenue costs will be for UoS staff time.
Breakdown as follows:

- [redacted]
- [redacted]
- [redacted]

Appendix 4: Processing Personal Data

N/A