From analysis to action: Citizen Science on the River Chess

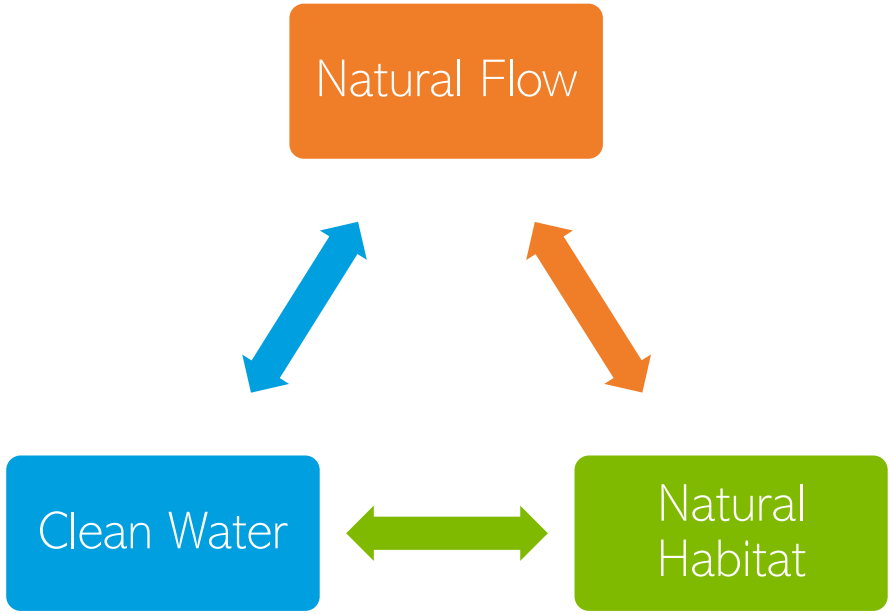
Kate Heppell CCSP/QMUL

Examples in this presentation arise from the River Chess Smarter Water Catchment project, with thanks to the following organisations:

Working in partnership

River Chess Smarter Water Catchment

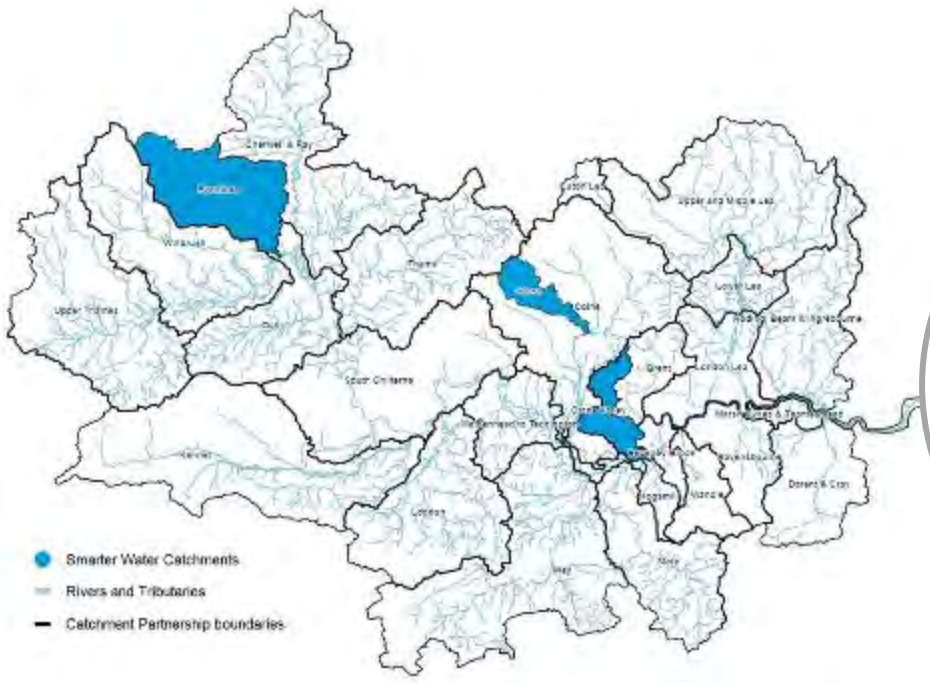
How do we improve the health of Chalk Streams?



Catchment Based Approach

What is the ‘smarter water catchment’ initiative?

A Thames Water pilot project looking at the environment as a system and working in closer partnerships to co-create & co-deliver innovative solutions to our greatest challenges



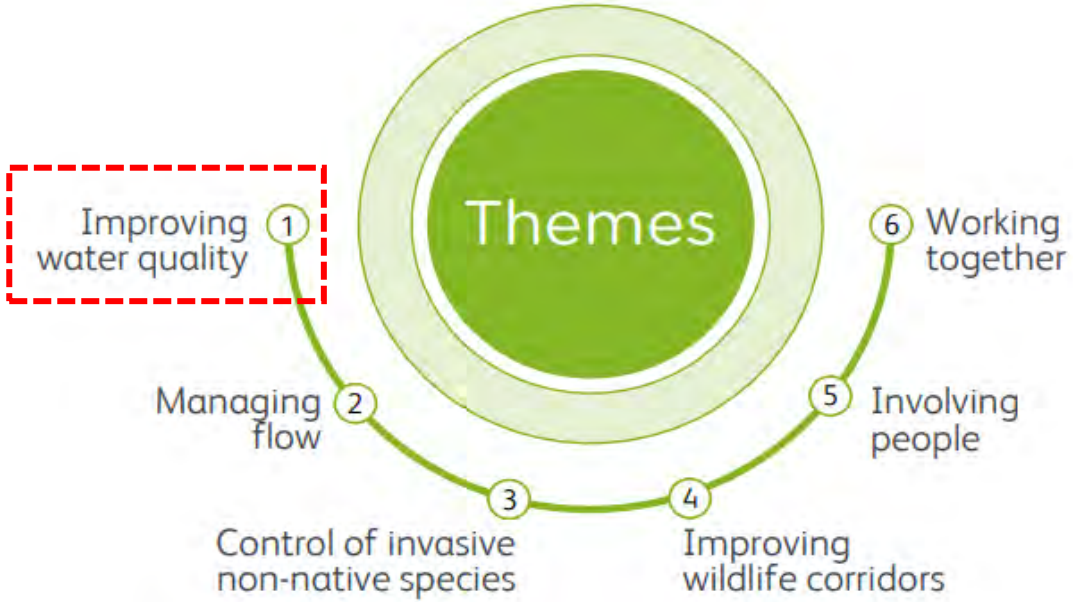
Additional **£9m** investment from 2020-2025 to trial new ways of working to improve the health of our river catchments

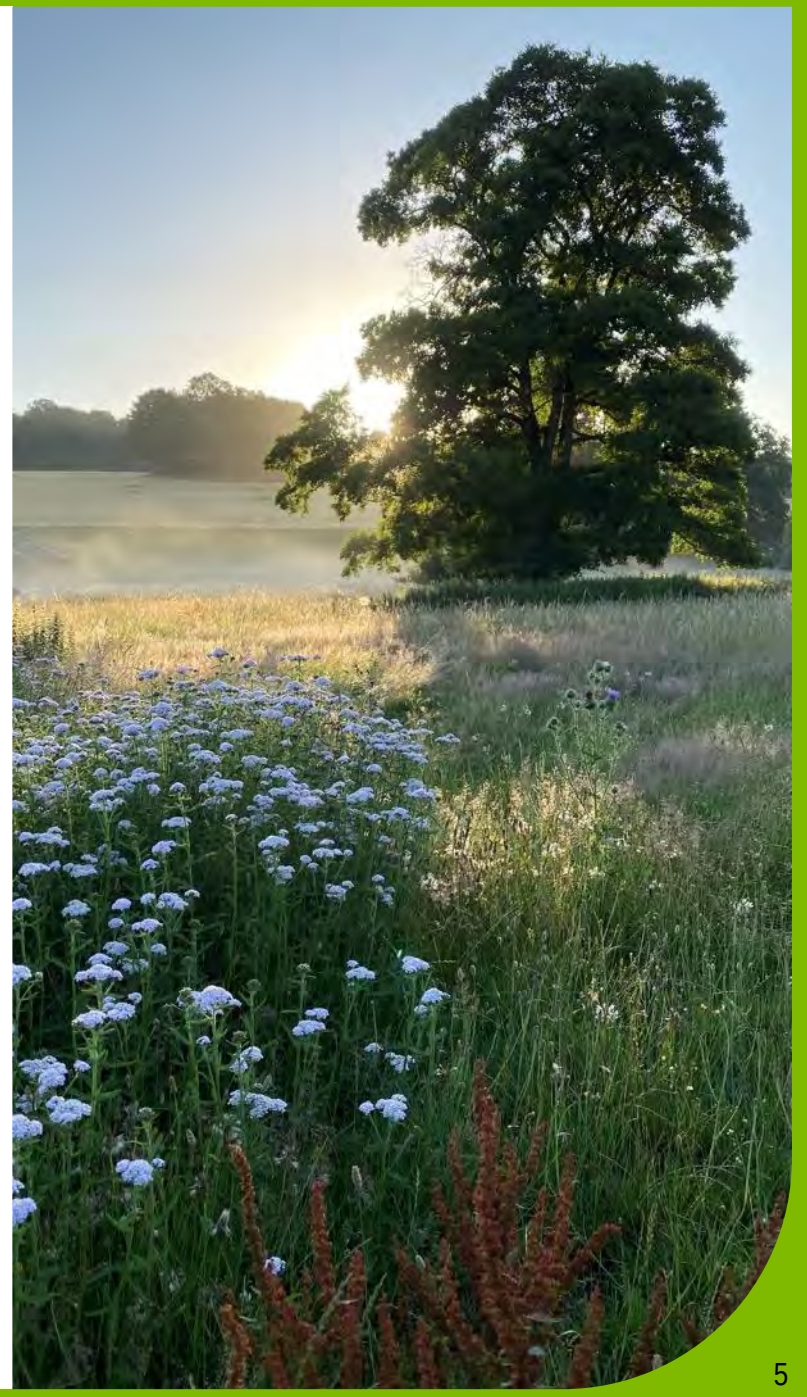
- Develop deeper understanding of the challenges
- Determine requirements to facilitate co-delivery
- Explore co-funding opportunities
- Set a precedent for future ways of working across the water industry
- Inform better decision making & future investment

What does this mean in practice?

The partners have co-created a shared 10-year plan which aims to restore the health of the River Chess

Six different themes…





River Chess Smarter Water Catchment

Thames Water

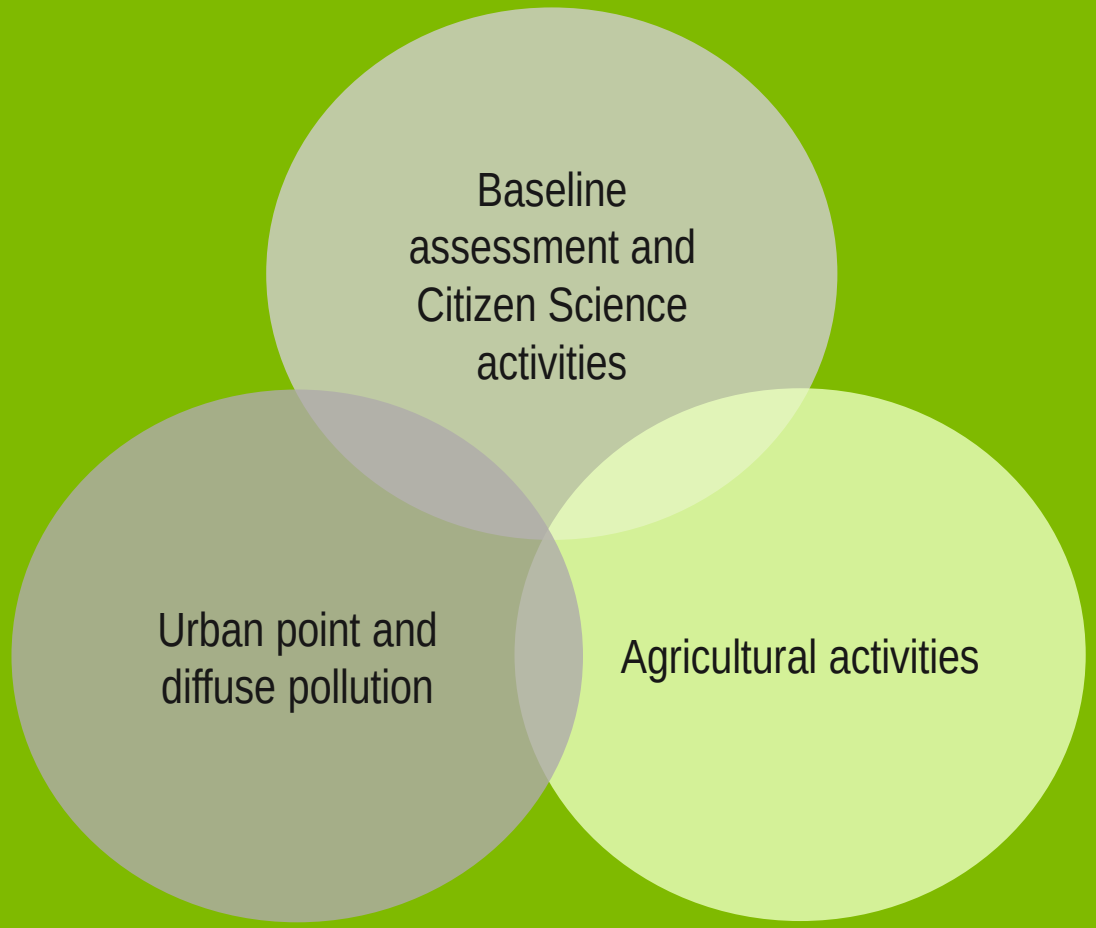
Water quality activities

Over the last year Chilterns Chalk Streams Project has been:-

- Monitoring the River Chess with the ChessWatch initiative
- Carrying out an assessment of monitoring activities and water quality in the River Chess
- Developing plans and delivering new Citizen Science activities in the River Chess

Over the last year Buckinghamshire Council with Jacobs have been:-

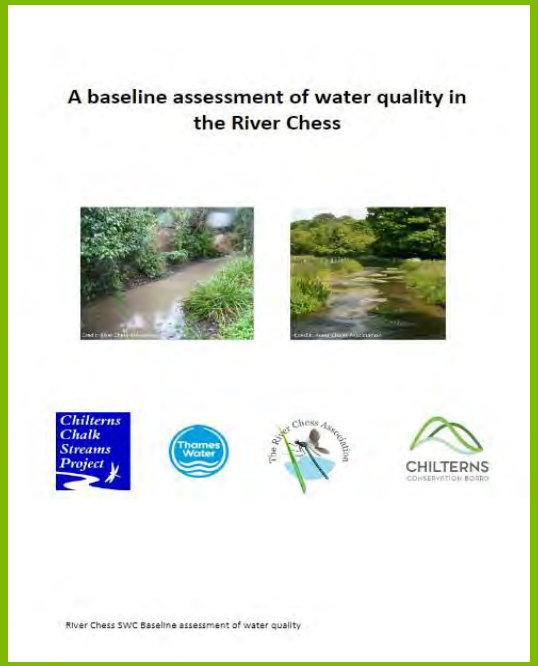
- Collating information and data, and developing an action plan to tackle urban runoff in Chesham



Baseline assessment

Identifying all potential data sources

- Identified all existing monitoring locations and parameters
- Considered frequency of monitoring and duration (a good baseline needs decades)
- Included data from EA, water companies, Citizen Science groups
- Considered flow, water quality, invertebrates, fish plants, habitat, geomorphology, INNS, river habitat survey, urban river habitat survey



River Chess Smarter Water Catchment

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Baseline assessment

Bring those data sources together…

- Carried out Quality Assurance checks on the data
- Divided river into reaches according to land use and critical river inputs and activities
- Produced maps with monitoring activities being carried out in each reach

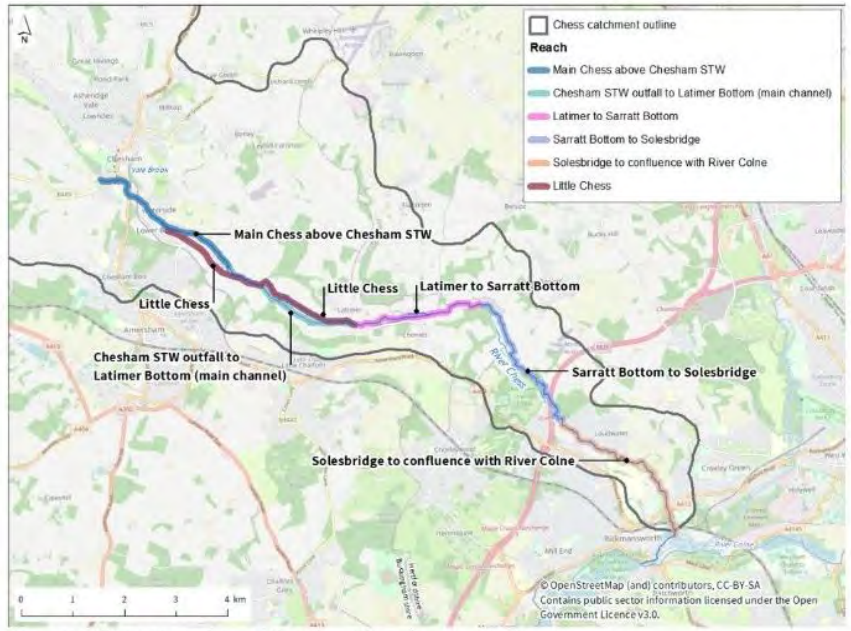

Figure 1 Different reaches of the River Chess for monitoring purposes

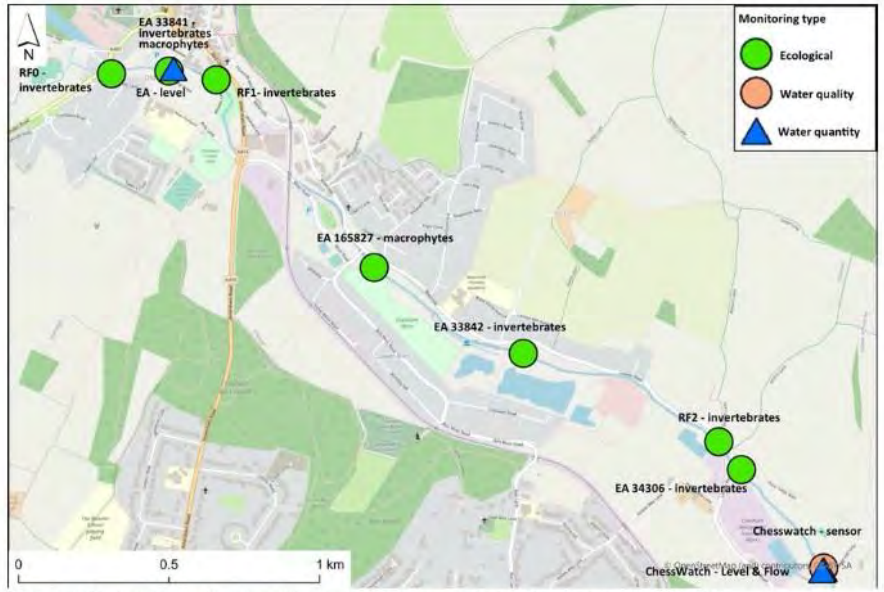

Figure 9 Current monitoring sites in 'main Chess above Chesham STW' (2021)

River Chess Smarter Water Catchment

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Baseline assessment

Source apportionment?

- Compiled all source apportionment information relating to water quality
  - Sediment source apportionment
  - SAGIS P
  - University research

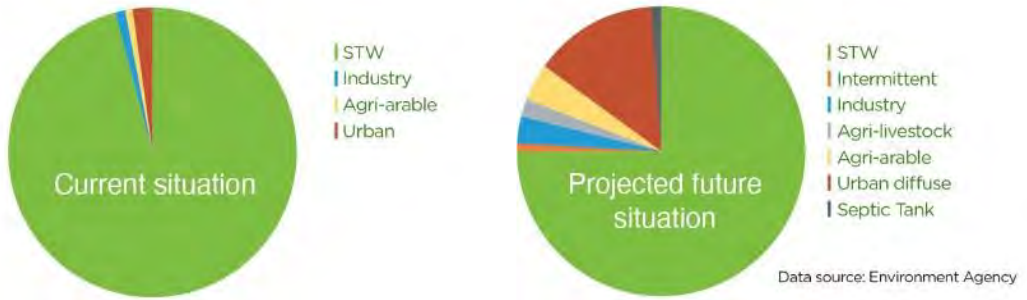

Figure 47 Percentage contribution of different sources of reactive P to the River Chess (a) SAGIS analysis for PR2014; (b) contribution of different sources of P following 2024 permit change (SAGIS modelled prediction).

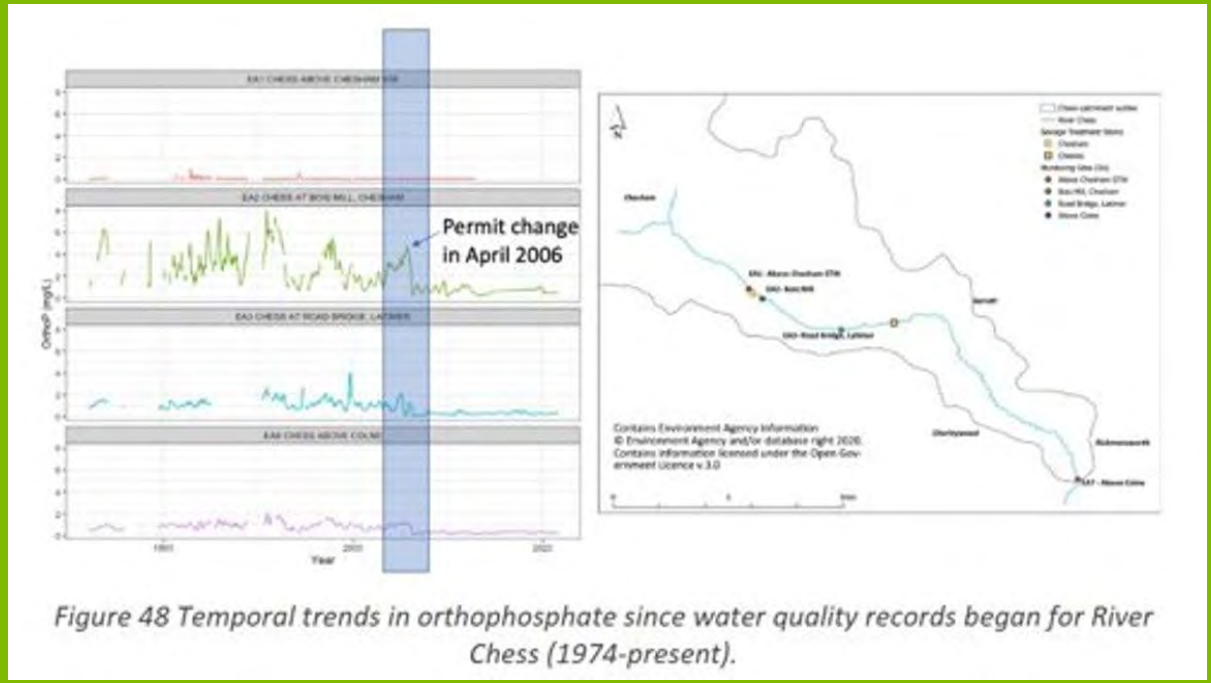

Figure 48 Temporal trends in orthophosphate since water quality records began for River Chess (1974-present).

River Chess Smarter Water Catchment

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Baseline assessment

Identifying the gaps in data and understanding

- Areas of interest to local groups may not be the locations covered by current monitoring activity by EA or water companies; or there may be effort focused in one area at expense of others
- Ideally we would want flows, water quality and ecology to be monitored together but this is often not the case
- Use WFD reasons for not achieving good status (RNAGs) as a starting point but recognise that gap analysis and local input may reveal other issues

Table 11 Summary of Recommendations for Next Steps by Issue and Location

Issue	Evidence base	Location	Proposed methodology / recommendations
Wastewater			
Chesham WWTW treated effluent: *phosphate, nitrate, PBDE and emerging chemicals*	Environment Agency Harmonised Monitoring Dataset, WFD Classification, CS activities	Downstream of Chesham WWTW	Under AMP7 phosphate will be reduced to attain moderate status. Explore further reductions to phosphate and inclusion of nitrate for AMP8. Explore role of Chesham WWTW in PBDE failure for River Chess.
Chesham WWTW storm tank overflow: *dissolved oxygen with potential for faecal contamination and other chemicals*	CS monitoring (dissolved oxygen and emerging chemicals monitoring, riverfly), CS activities	Downstream of Chesham WWTW	Under AMP7 treatment capacity at Chesham WWTW will be increased by 39%. Explore how frequently STOs will occur after AMP7 modifications, quantify their associated pollutant loading with different scenarios of changing rainfall pattern and population growth.
Sewer mis-connections: *faecal contamination, low dissolved oxygen levels, high ammonium, phosphate*	EA real-time monitoring (ammonium), CS activities (electrical conductivity during high rainfall)	Chesham and Rickmansworth urban areas	Thames Water investigation combined with expanded Outfall Safari; real-time monitoring of ortho-phosphate around Chesham to identify any storm-driven flushes of P
Sediment transport to river			
Inputs of sediment through road runoff: *suspended sediment, bed sediment and associated contamination by metals and hydrocarbons*	Local stakeholder and CCSP / RCA observations. MSc dissertations.	Blackwell Hall Lane Bell Lane Plus areas mapped by Jacobs options report using local knowledge.	Trial investigation by volunteers using MudSpotter with data from SCIMAP to identify all sediment inputs. Link to urban runoff mitigation optioneering commissioned by Buckinghamshire Council.
Soil erosion from agricultural fields and transport to river: *suspended sediment and nutrient (N,P) load*	Local stakeholder and CCSP /RCA observations.	Areas of high risk mapped using SCIMAP and included in Section 6.9.3. Also included in Jacobs options report.	Risk maps ground-truthed by Chess Valley Farming Officer to identify mitigation options. Assess relative magnitude of sediment entering river as a result of agricultural activity.
Nutrients – unknown origin			
Elevated nitrate and phosphate downstream of Valley Farm Road	Environment Agency Harmonised Monitoring Dataset	Between EA5 (Valley Farm Road) and EA6 (Solesbridge Lane)	Water sampling campaign to assess spatial variations in phosphate and nitrate within the reach (focusing on potential locations of septic tanks)

River Chess Smarter Water Catchment

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Baseline assessment

What are the key objectives of further monitoring?

- Understand water quality changes arising from storm tank overflows from Chesham STW and from treated effluent (in conjunction with changes in flow)
- Understand how/whether river restoration projects on the River Chess improve habitat and biodiversity
- Understand where fine sediment is sourced from, its impact on ecology, and suitable mitigation measures to put into place

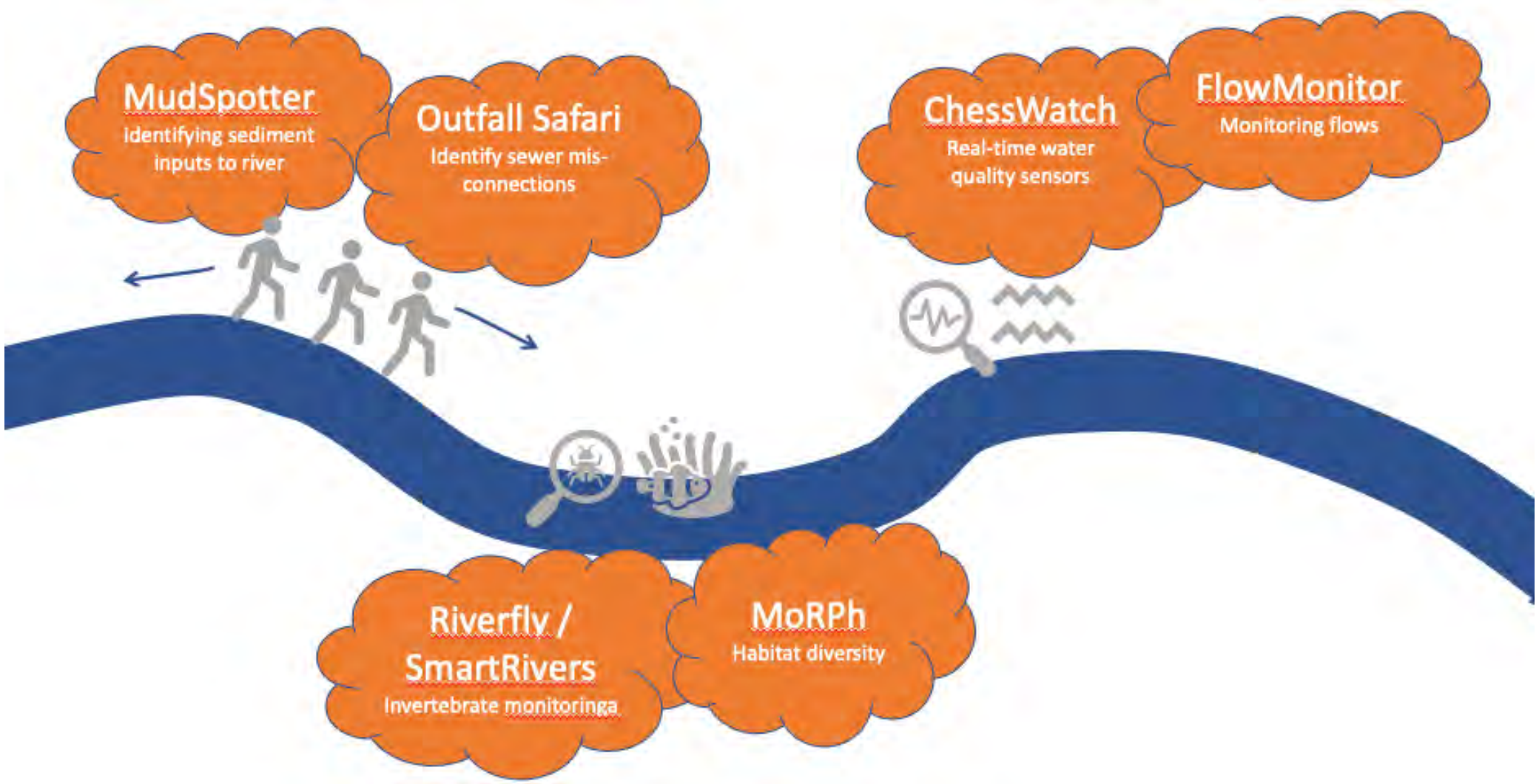
Meades Water Gardens, River Chess, Photos © Allen Beechey

CS toolkit (supported)

Blended supported activities with bespoke

- **MudSpotter** (under development)– to identify locations, times and extent of sediment inputs to rivers, useful easy searchable repository of photographic evidence
- **Riverfly** – long-standing invertebrate monitoring programme
- **SmartRivers** – offers reports on different pressures on invertebrates (flow, sediment, P etc)
- **Outfall Safari** – identify locations of mis-connections & rank
- **Modular River Survey** – fluvial geomorphological and biodiversity assessment
- **EarthWatch Freshwater Blitz** – nitrate and phosphate test kits

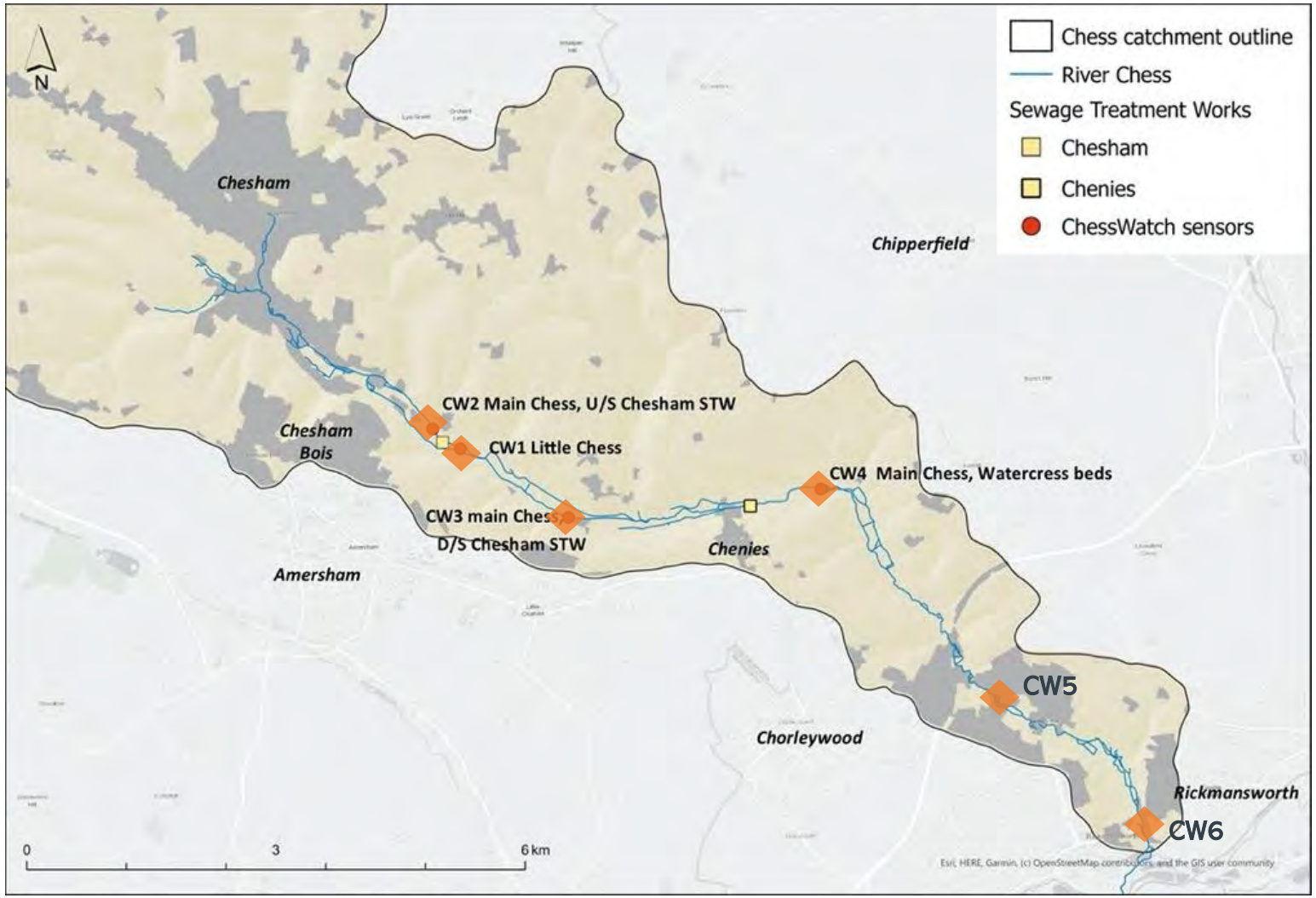
Citizen Science activities on the River Chess



Water quality sensors

River Chess: six sondes

Chesham urban runoff, Chesham sewage treatment works and downstream influence



CW1: Groundwater spring

CW2: Upstream of STW & downstream of urban area

CW3: 1 km downstream of STW

CW4: 8 km downstream of STW

CW5: Downstream of major road network

CW6: At confluence with River Colne

Real-time sensor technology

'Basic' water quality parameters	
Water temperature	
Electrical conductivity	
pH	
'Well established' water quality parameters	
Dissolved Oxygen	Optical optodes
Turbidity	Light scattering
Ammonium	Ion selective electrodes
'Newer' water quality parameters	
Coloured dissolved organic matter, CDOM	UV sensor
Nitrate	UV sensor
Tryptophan	Fluorescence sensor
'Derived' water quality parameters	
Biological and Chemical Oxygen Demand	Tryptophan, temperature, turbidity
Total coliform / Faecal coliform / E. Coli	Tryptophan, temperature, turbidity, CDOM & ?

Note the wipers – these are vital

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Maintenance

Conkers, twigs, crayfish, sediment and algae

Be prepared to clean every fortnight, and respond to unexpected events!

Be aware that you can rent a unit and have someone else do the calibration and maintenance

Calibration

Calibration of sensors is essential to ensure accuracy

Calibration frequency depends on sensor type; some are more stable than others – weeks to months

Cost in calibration solutions – can use large volumes (500 mL at a time) depending on sensor design

Need to ensure accuracy and record sensor response function (some parameters more 'indicative', others 'quantitative')

Water quality dashboard in River Chess Storymap

River Chess Smarter Water Catchment

Thames Water

Select which variables you want to plot, and click "Update plots" to refresh the plots. The plots may take a few seconds to load.

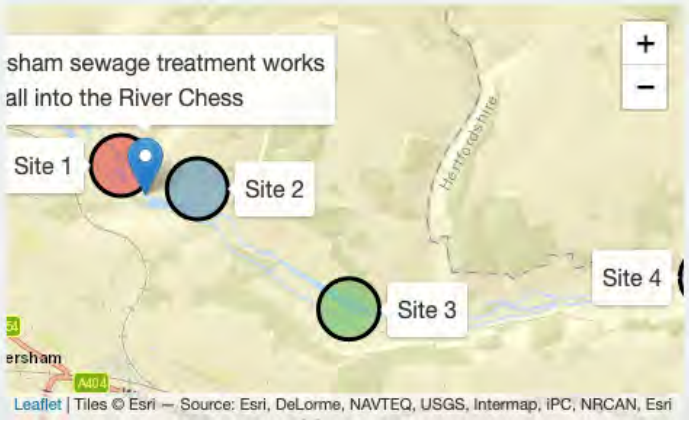
Choose measurements:

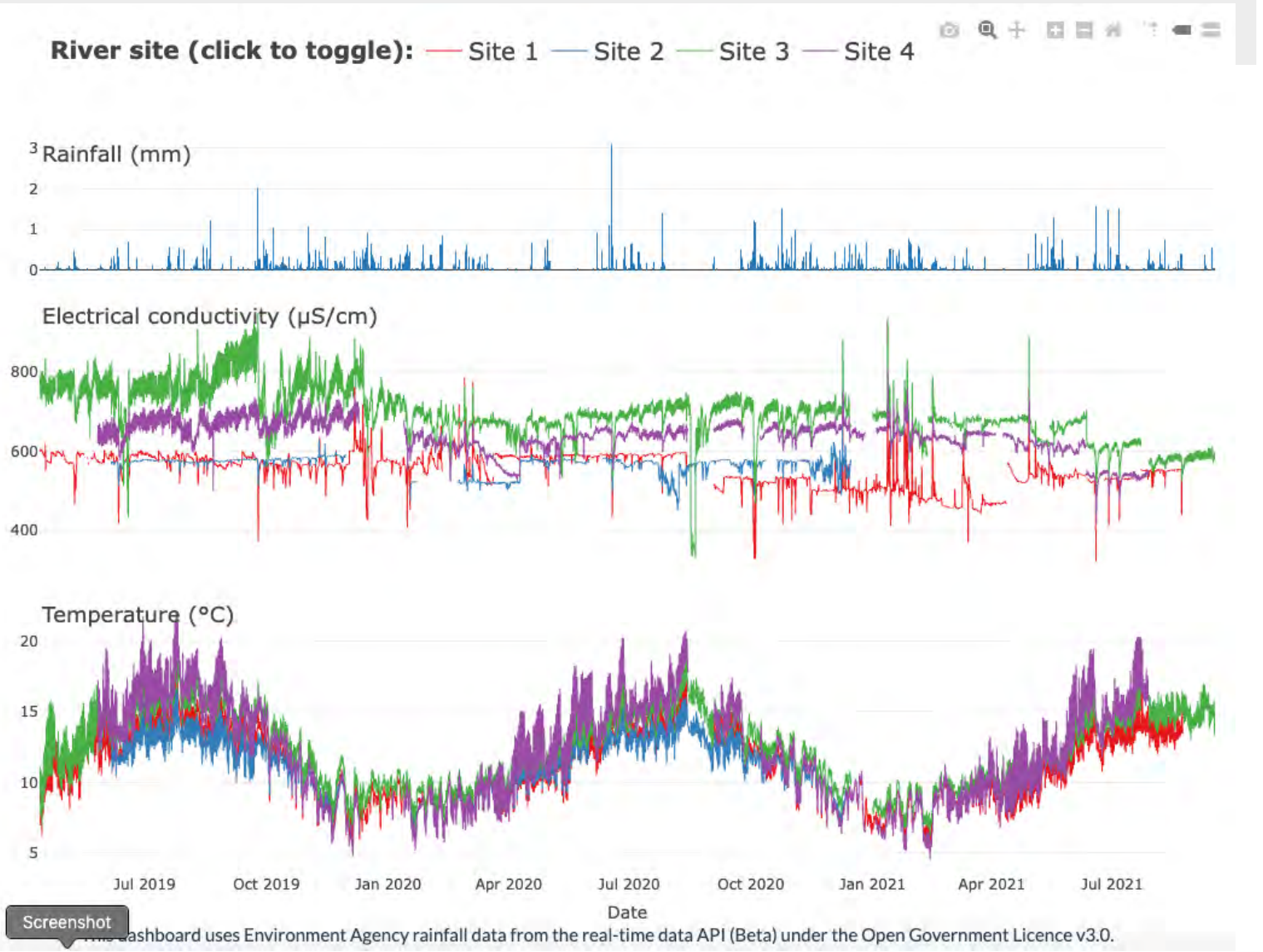
- [ ] Dissolved oxygen (% saturation)
- [ ] Dissolved oxygen (mg/L)
- [x] Electrical conductivity (µS/cm)
- [ ] pH
- [x] Temperature (°C)
- [ ] Tryptophan (RFU)
- [ ] Turbidity (NTU)
- [ ] Water level (m)

Select start and end dates:

Pick 2 dates

Cle | Update plots | Show events



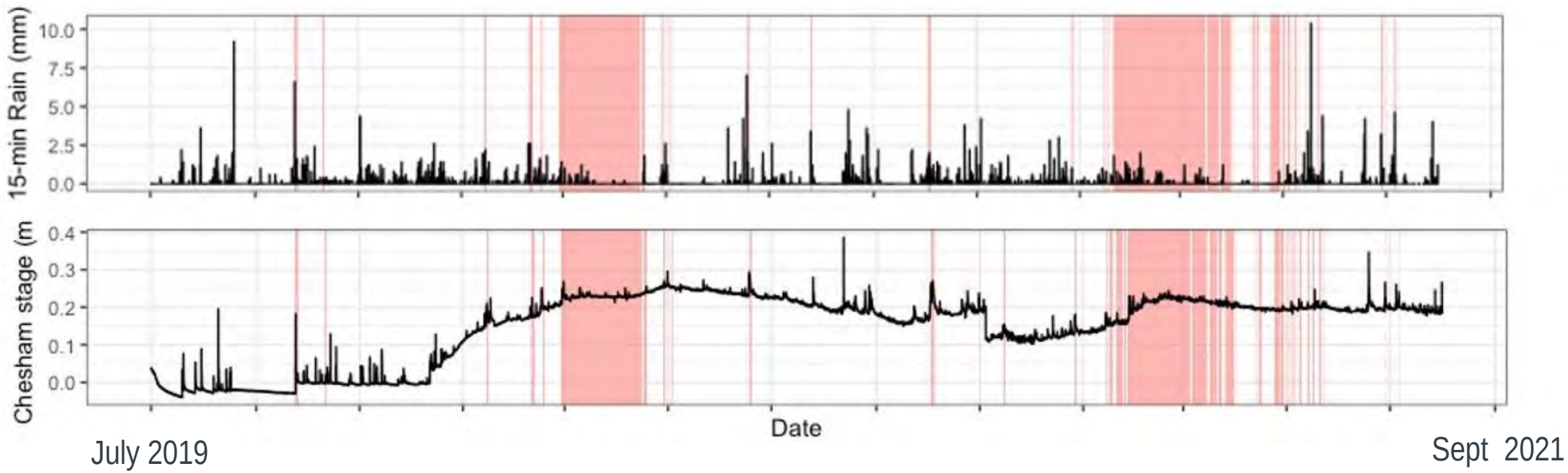


Screenshot

This dashboard uses Environment Agency rainfall data from the real-time data API (Beta) under the Open Government Licence v3.0.

Example 1: Storm tank overflows from Chesham

Peach panels show periods of storm tank overflow



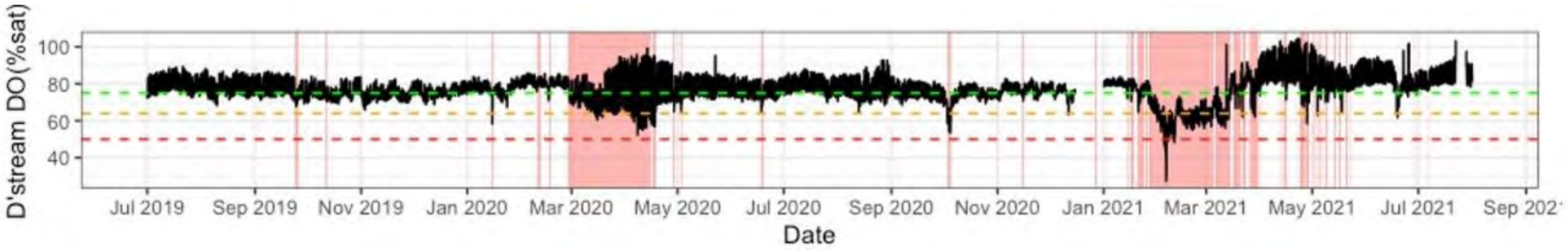
Storm tanks at Chesham WWTW can overflow when capacity of treatment works is exceeded, to prevent water backing up into homes. Over the last few years storm tank overflows have occurred from Chesham WWTW due to:

(i) intense rainfall;

(ii) groundwater ingress to sewer network when groundwater levels are high

Example 1: Tracking dissolved oxygen

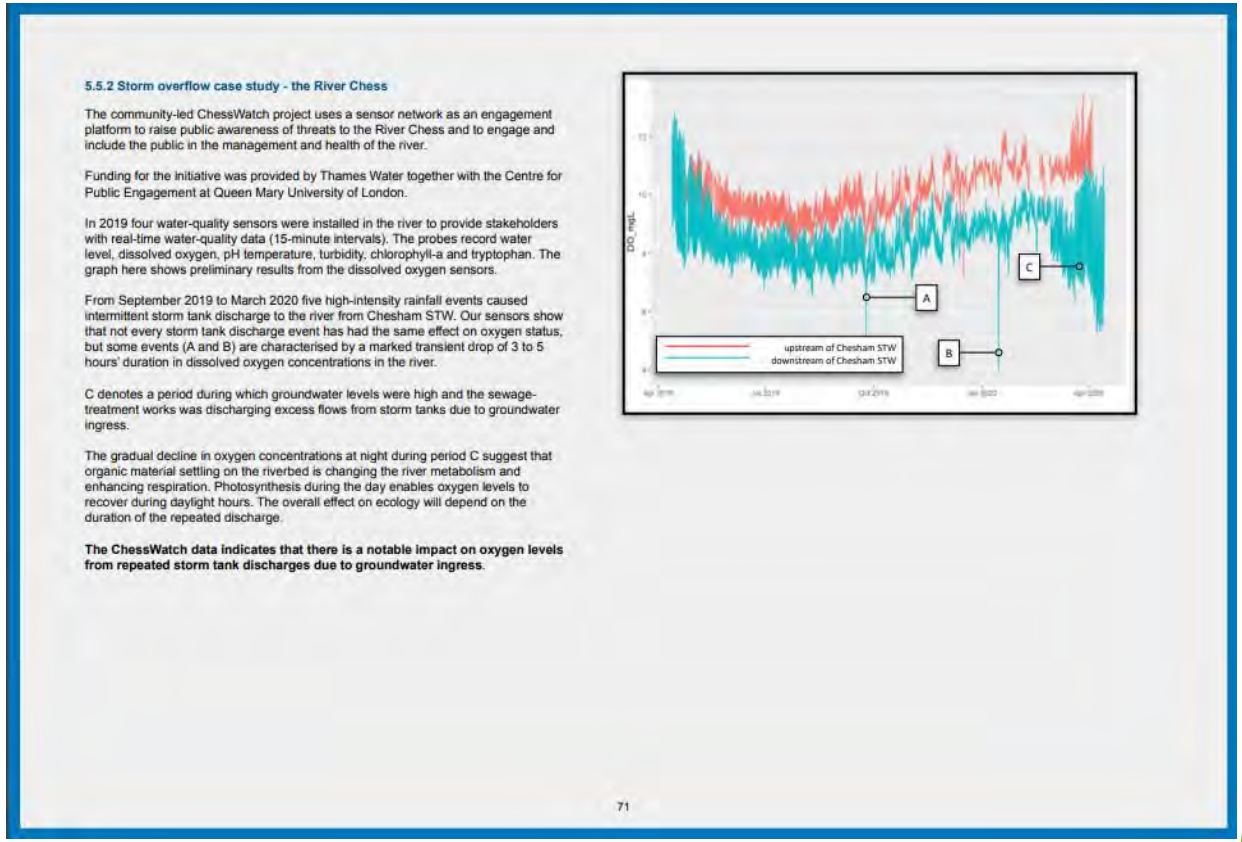
Peach panels show periods of storm tank overflow from Chesham sewage treatment works



- Groundwater ingress causes dissolved oxygen levels in the water to drop downstream of Chesham WWTW for prolonged periods (days to months)
- Intense rainfall can cause transient drops in dissolved oxygen levels (hours)
- Dissolved oxygen levels further downstream (e.g. at Sarratt) remain high
- Levels of bacteria and viruses in the water due to storm tank discharges are not known

Example 1: Tracking dissolved oxygen

See CaBA Chalk Stream Restoration Strategy 2021



5.5.2 Storm overflow case study - the River Chess

The community-led ChessWatch project uses a sensor network as an engagement platform to raise public awareness of threats to the River Chess and to engage and include the public in the management and health of the river.

Funding for the initiative was provided by Thames Water together with the Centre for Public Engagement at Queen Mary University of London.

In 2019 four water-quality sensors were installed in the river to provide stakeholders with real-time water-quality data (15-minute intervals). The probes record water level, dissolved oxygen, pH temperature, turbidity, chlorophyll-a and tryptophan. The graph here shows preliminary results from the dissolved oxygen sensors.

From September 2019 to March 2020 five high-intensity rainfall events caused intermittent storm tank discharge to the river from Chesham STW. Our sensors show that not every storm tank discharge event has had the same effect on oxygen status, but some events (A and B) are characterised by a marked transient drop of 3 to 5 hours' duration in dissolved oxygen concentrations in the river.

C denotes a period during which groundwater levels were high and the sewage-treatment works was discharging excess flows from storm tanks due to groundwater ingress.

The gradual decline in oxygen concentrations at night during period C suggest that organic material settling on the riverbed is changing the river metabolism and enhancing respiration. Photosynthesis during the day enables oxygen levels to recover during daylight hours. The overall effect on ecology will depend on the duration of the repeated discharge.

The ChessWatch data indicates that there is a notable impact on oxygen levels from repeated storm tank discharges due to groundwater ingress.

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Example 2: Changes in electrical conductivity

Diurnal patterns in electrical conductivity from sewage treatment works

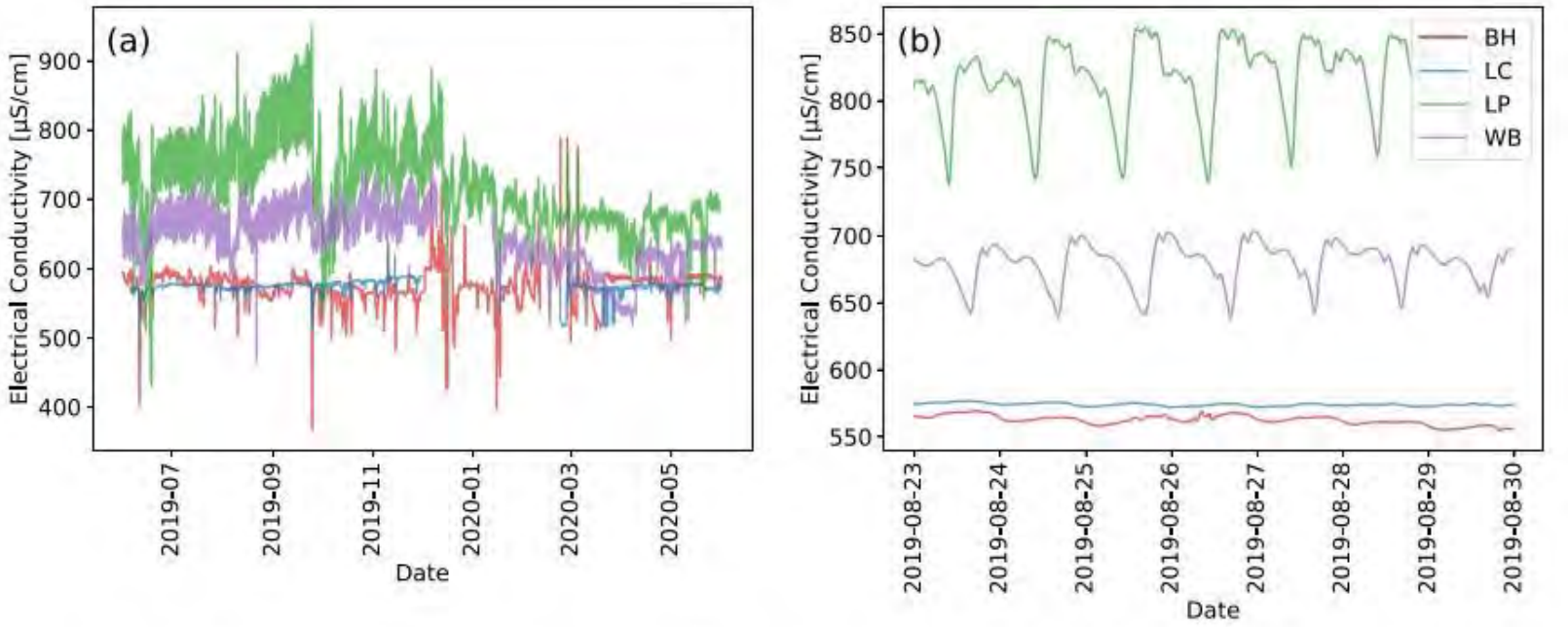

Figure 2. Electrical conductivity time series (**a**) June 2019 to 2020; and (**b**) 23 August to 30 August 2019.


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scientific reports

OPEN **Machine learning approach towards explaining water quality dynamics in an urbanised river**

Benjamin Schäfer[1,2,3✉], Christian Beck[1,4], Hefin Rhys[5], Helena Soteriou[6], Paul Jennings[7], Allen Beechey[8] & Catherine M. Heppell[9]

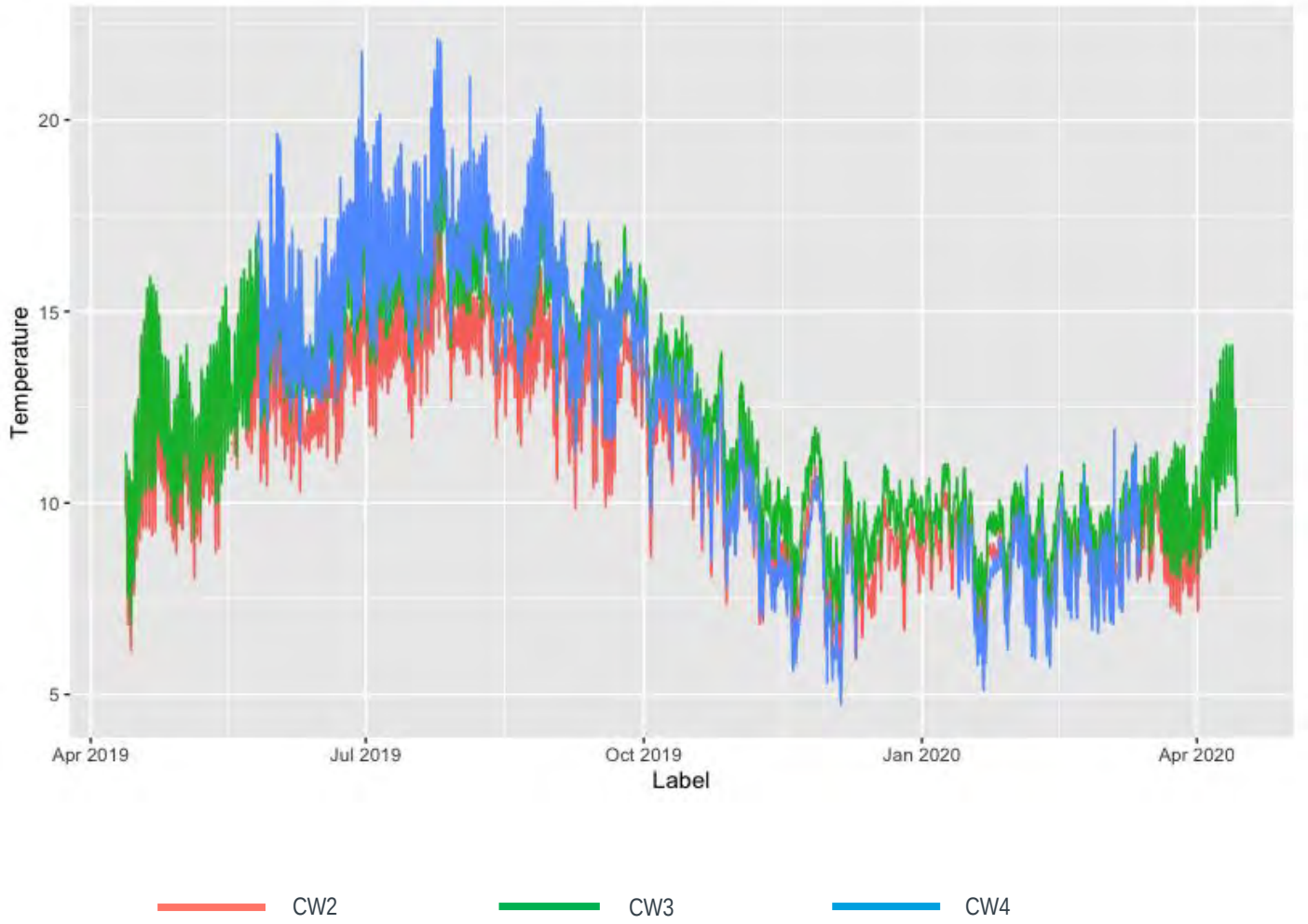
Human activities alter river water quality and quantity, with consequences for the ecosystems of urbanised rivers. Quantifying the role of human-induced drivers in controlling spatio-temporal patterns in water quality is critical to develop successful strategies for improving the ecological health of urban rivers. Here, we analyse high-frequency electrical conductivity and temperature data collected from the River Chess in South-East England during a Citizen Science project. Utilizing machine learning, we find that boosted trees outperform GAM and accurately describe water quality dynamics with less than 1% error. SHapley Additive exPlanations reveal the importance of and the (inter)dependencies between the individual variables, such as river level and Wastewater Treatment

- River Chess is 40-70% treated effluent in upper reaches below Chesham STW

- Could help Citizen Scientists decide when to target taking water samples

e.g. when dilution of treated sewage is at highest / lowest in river

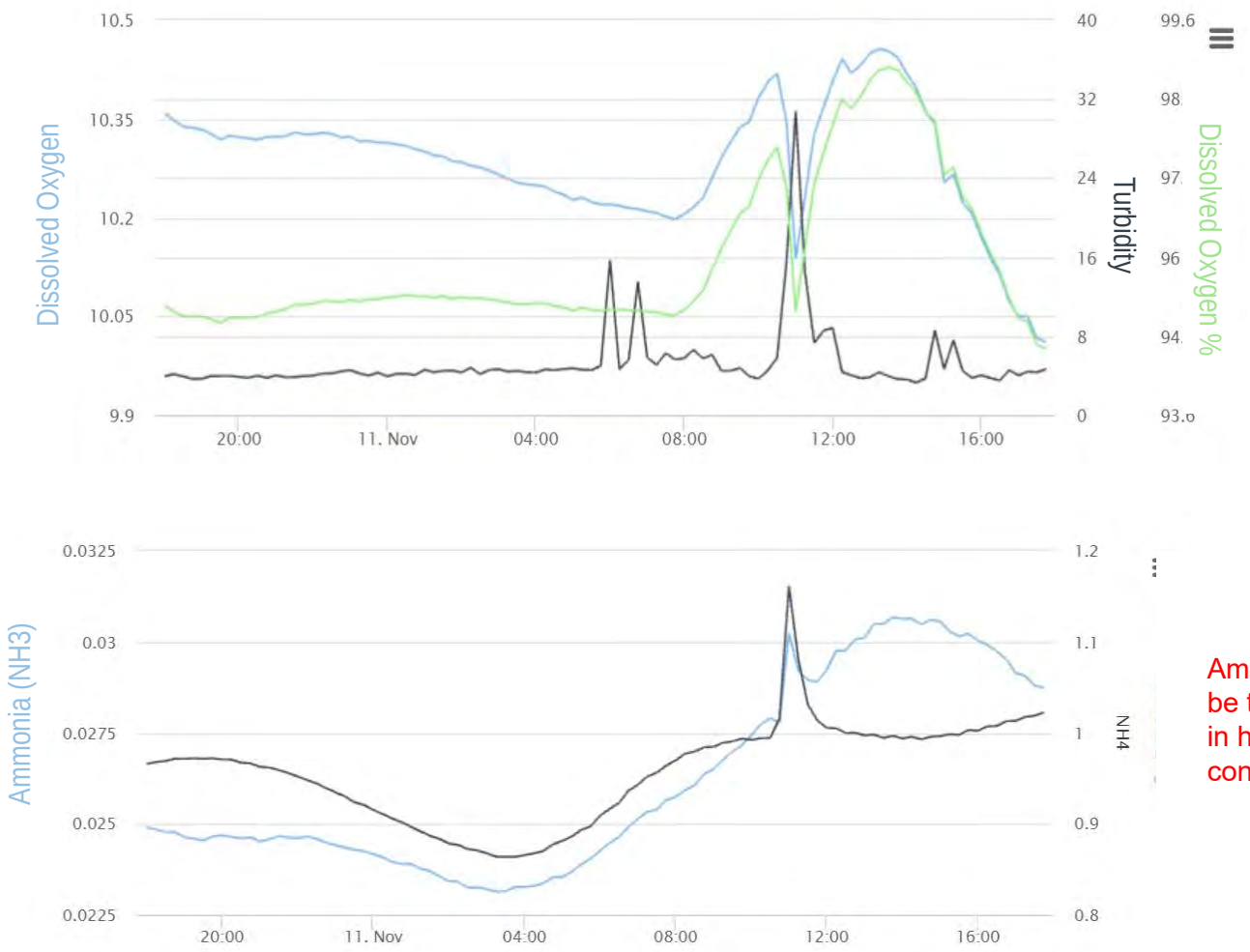
Example 3: Variations in temperature (2019 - 2020)



- Our data has enabled stakeholders to better understand changes in temperature in the river water during a hot summer of notably low flows.
- Chalk streams are described as having stable temperature regimes, but our data shows marked diurnal variations exacerbated by low flows.
- Water temperatures exceeded 20°C in unshaded reaches during hot weather in summer when water levels in the river are low (< 30 cm depth). Low flows and prolonged elevated temperatures such as these will stress fish such as brown trout and affect recruitment success of fish such as grayling[3].

Example 4: Investigating urban runoff?

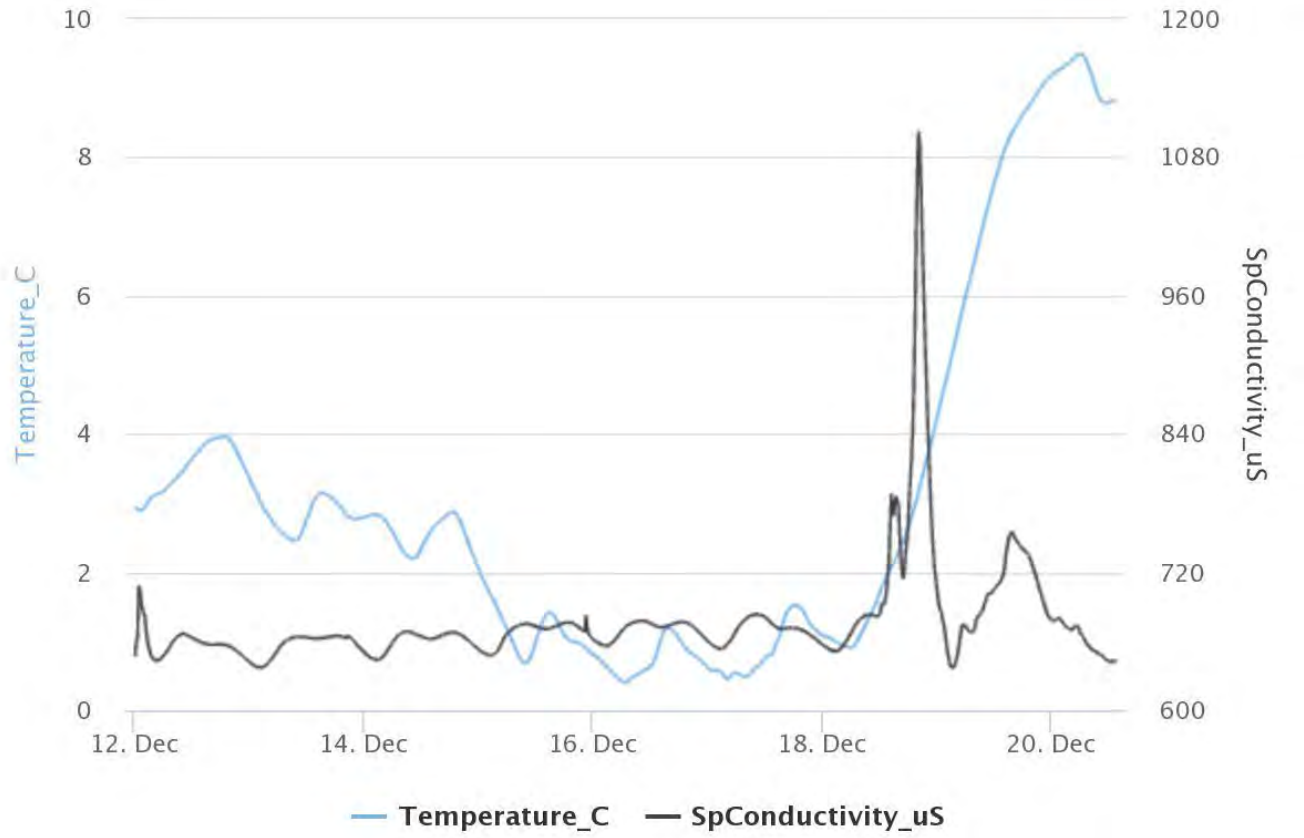
Rickmansworth River Chess sonde



Ammonia can be toxic to fish in high concentrations

Example 5: Urban runoff and road salts

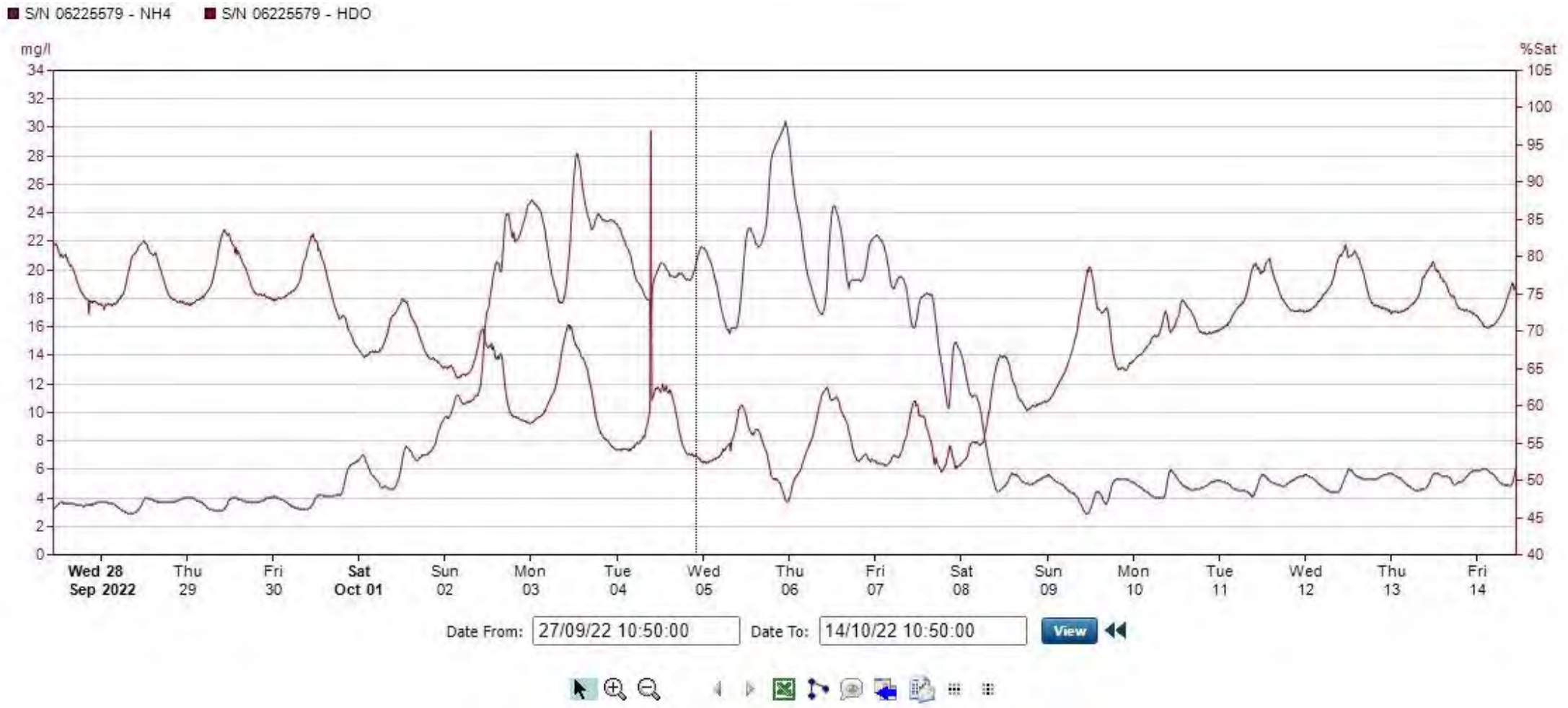
Influence of road salts during snow melt before Christmas on total dissolved solutes



Not at all problematic levels of specific conductivity (measure of the total dissolved solutes in the river), but a reminder that what we put on our roads does end up in our rivers.

Example 6: Ammonia treatment issue

Issue at Chesham STW (Sat 1 Oct 2022 – Sat 8 Oct 2022)



Example 6: Ammonia treatment issue

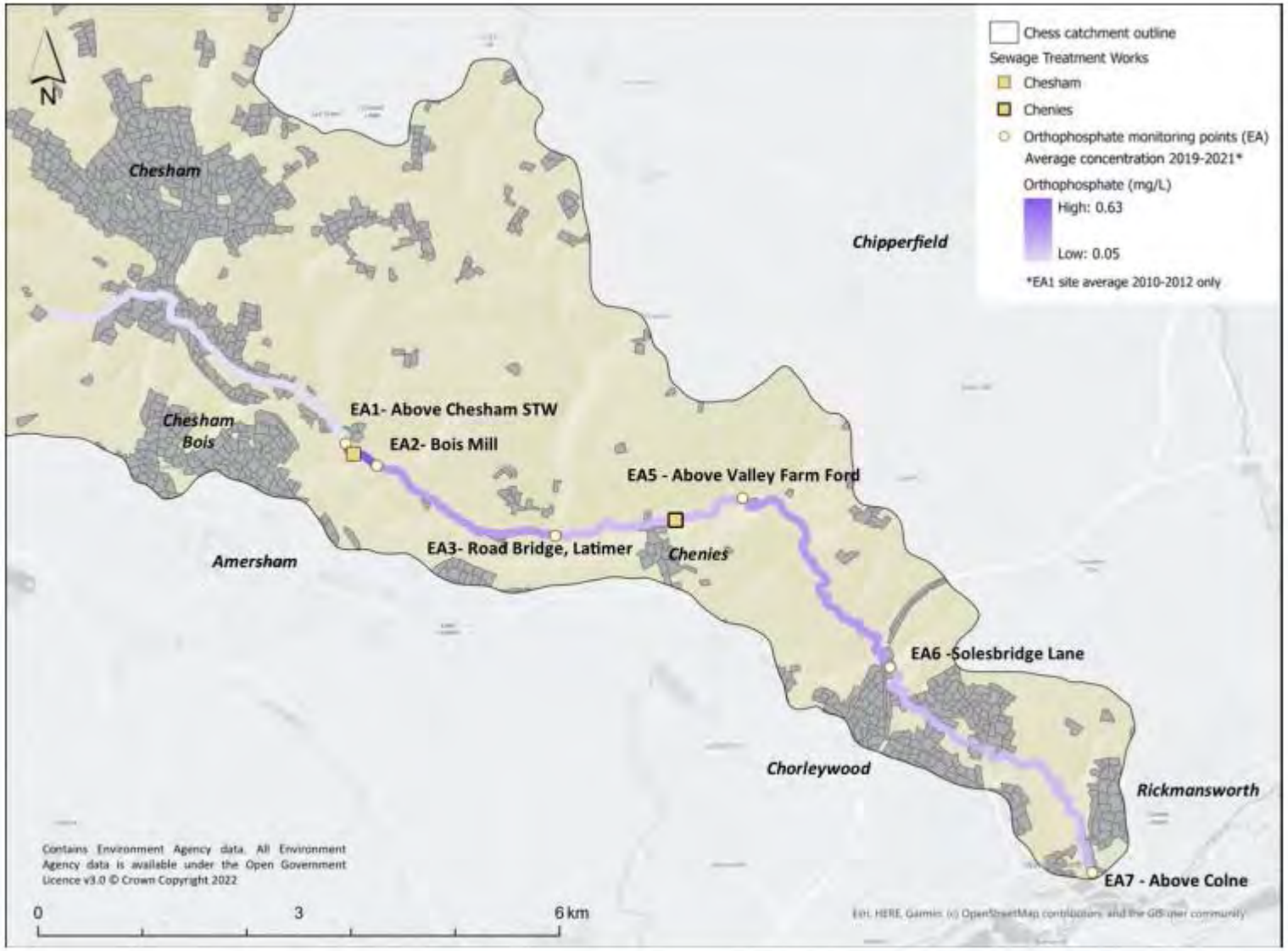
Issue with aeration pumps at Chesham STW (Sat 1 Oct 2022 – Sat 8 Oct 2022)

Nutrient analysis: NOSES

Working in partnership

Thames Water
The River Chess Association
Chilterns Chalk Streams Project
CHILTERNS CONSERVATION BOARD
Chiltern Society
We care for the Chilterns
Buckinghamshire Council
Environment Agency
Affinity Water
Herts & Middlesex Wildlife Trust
Queen Mary University of London

Reducing Phosphorus in the River Chess



Environment Agency monitoring shows that orthophosphate concentrations are 0.63 mg/L P below Chesham STW

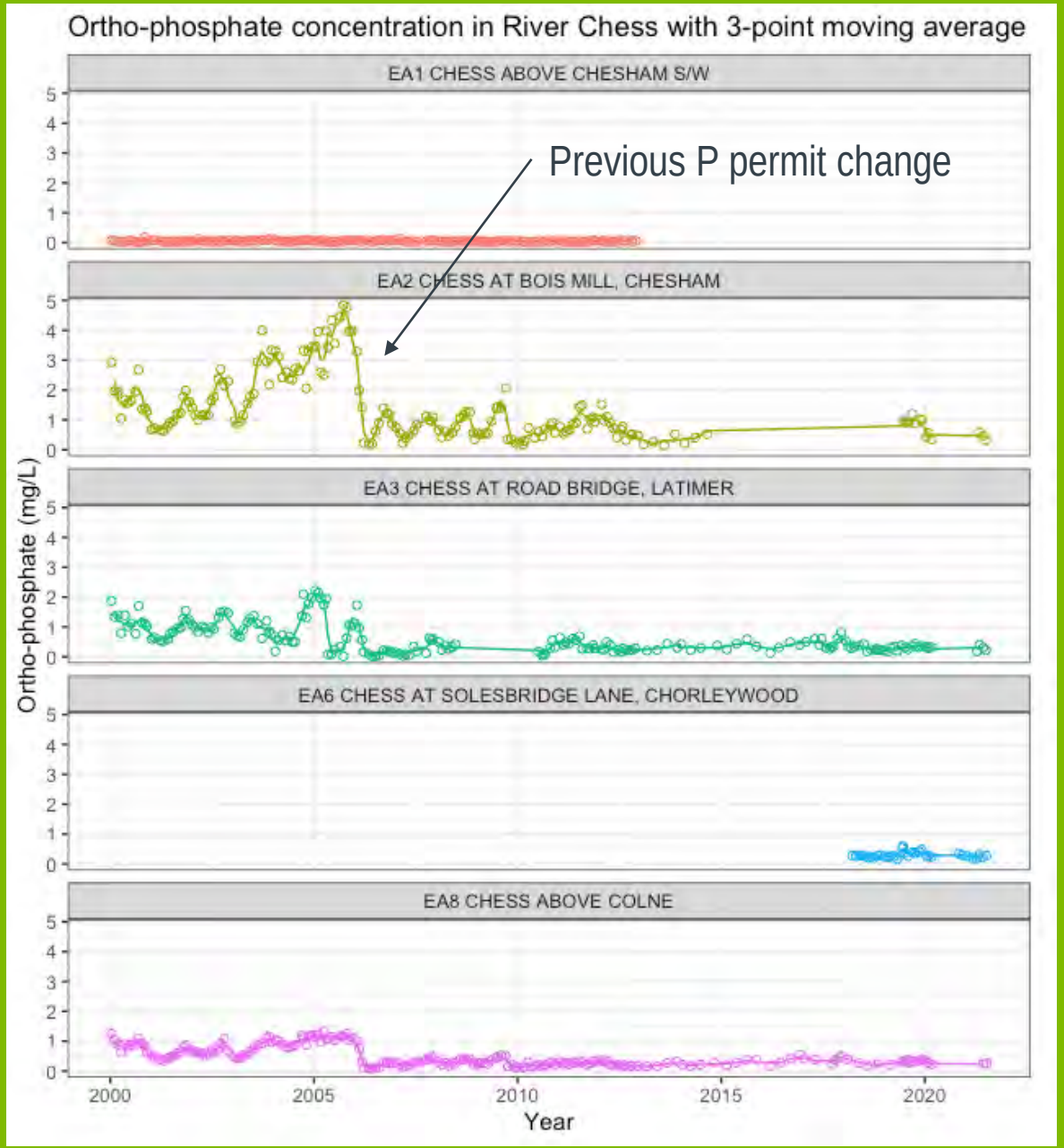
Groundwater concentrations are c. 0.03 mg/L P in the catchment

SAGIS-P modelling suggests 96% of reactive P from STW

Upper ecological threshold for P limitation is 0.05 mg/L P

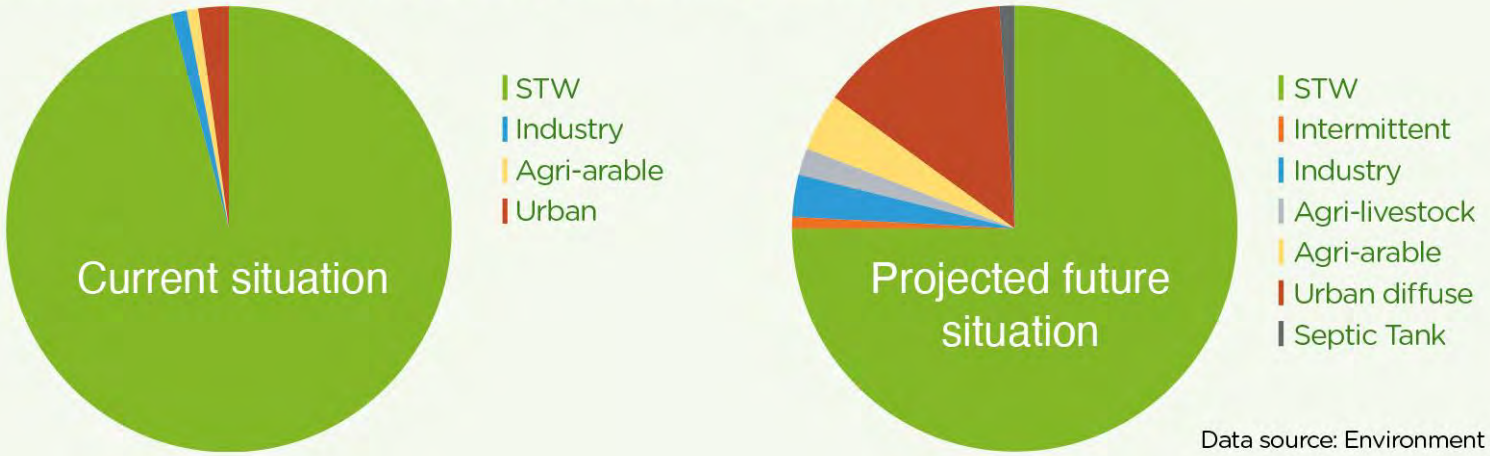
Investment in Chesham STW by Thames Water (WINEP)

Permit change: Upgrade Chesham STW to reduce concentration of Phosphorus in final effluent from 2mg/l to 0.25mg/l (by end of 2024)



Reactive Phosphorus

Percentage contribution of different sources of Reactive Phosphorus to the River Chess as calculated by the Environment Agency (a) current scenario; (b) predicted contribution of different sources of P following 2024 permit change to Chesham STW



Data source: Environment Agency

Challenge:

- 75 % of total reactive phosphorus load will be from Chesham STW after P-stripping (EA, SAGIS)
- River Chess predicted to reach 'moderate' P status. Not below ecologically-relevant threshold concentrations.
- Climate change scenarios of reduced groundwater recharge and higher temperatures mean less dilution and greater algal growth?

Total reactive phosphorus in the River Chess

Phosphorus is a critical nutrient for plants in the river, but too much of it can lead to a condition known as cultural eutrophication. This happens when nutrient enrichment changes the biodiversity of the river system, reducing the variety of plant species and encouraging the growth of algae.

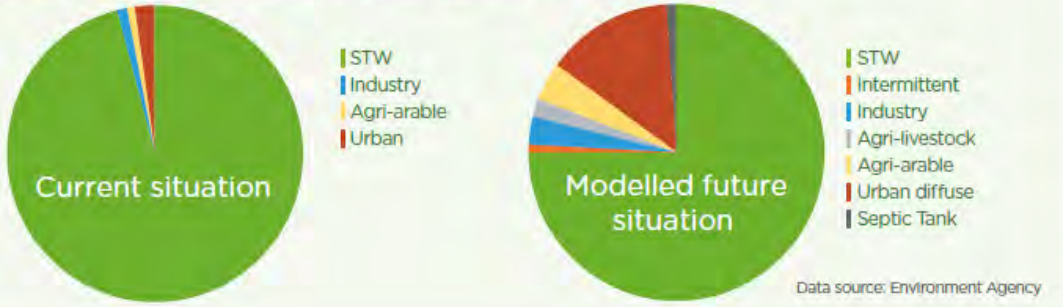
Sources of total reactive phosphorus

The River Chess is classified as having 'poor' phosphorus status under the Water Framework Directive. This means that the phosphorus concentrations in the river may be having a harmful effect on the river ecosystem. The Environment Agency estimate that 96% of the total reactive phosphorus (the proportion of phosphorus that is available to biota) currently originates from treated effluent entering the river from Chesham STW.

Addressing the challenge

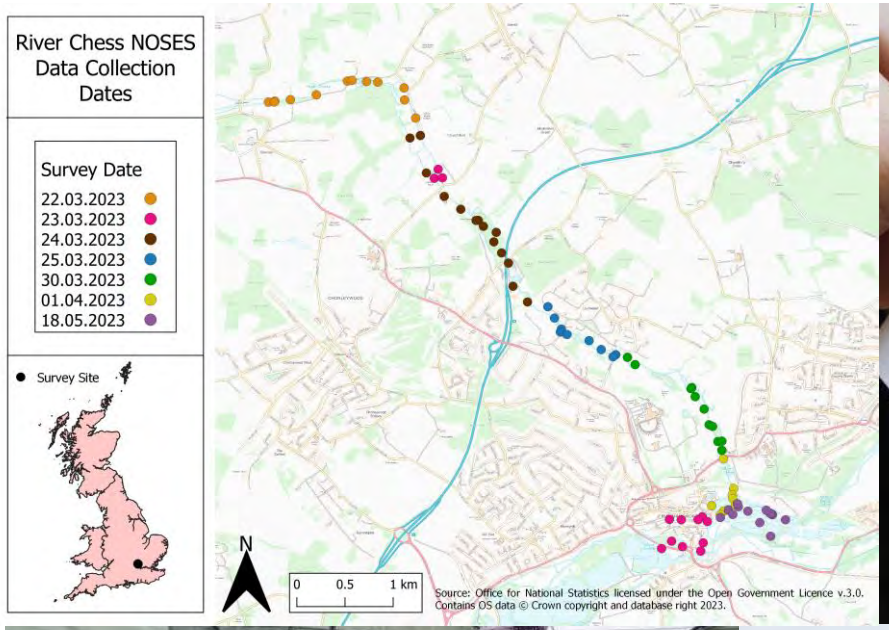
To help improve the phosphorus status of the River Chess at Chesham, the maximum phosphorus concentration permitted in treated effluent will reduce from 2 to 0.25 mg P/L. Thames Water will be introducing additional treatment processes by the end of 2024; this is predicted to change the watercourse status to 'moderate' phosphorous condition.

Percentage contribution of different sources of Reactive Phosphorus to the River Chess as calculated by the Environment Agency (a) current situation; (b) modelled contribution of different sources of P following 2024 permit change to Chesham STW



Data source: Environment Agency

Nutrient investigations using Citizen Science - NOSES



What is the unidentified source of phosphate in the lower reaches of the catchment?

- 6 survey days
- 8.9 km of river surveyed
- 75 sites sampled
- 43 citizen scientists involved

Established quality assurance with spectrophotometers (precision of 0.04 mg/L phosphate)

Highest concentration was 0.74 mg/L phosphate following period of storm tank overflow from Chesham STW

Confirmed groundwater springs at c. 0.04 mg/L phosphate

Emerging contaminants

Working in partnership

Thames Water
The River Chess Association
Chilterns Chalk Streams Project
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Chiltern Society
We care for the Chilterns
Buckinghamshire Council
Environment Agency
AffinityWater
Herts & Middlesex Wildlife Trust
Queen Mary University of London

What is the Emerging Contaminants Survey?

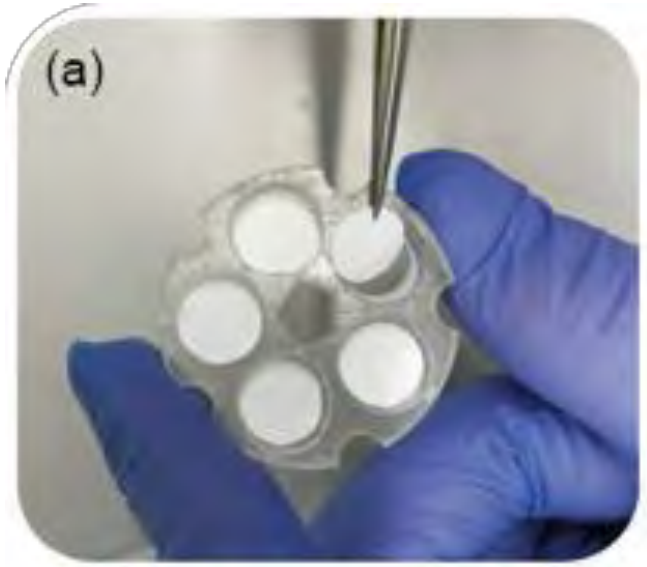
- Water sampling to identify up to 200 chemicals in the Chess and what risks they may pose.
- Water samples bottled and sent away to Imperial College London for analysis.
- Monthly sampling to look at changes over time that might correspond to sewage outflow events, overland runoff, etc.
- Complement data collected by water sensors and passive samplers deployed along the length of the River Chess.

River Chess Smarter Water Catchment

Thames Water

What are passive samplers?

- Passive samplers made up for us by scientists at Imperial College London.
- Each passive sample dot can record presence of up to 2,500 chemicals in the River Chess.
- Passive sampler disks deployed for one week at a time at six locations between Bois Mill and Rickmansworth.
- After collection, then returned to Imperial College London for analysis.

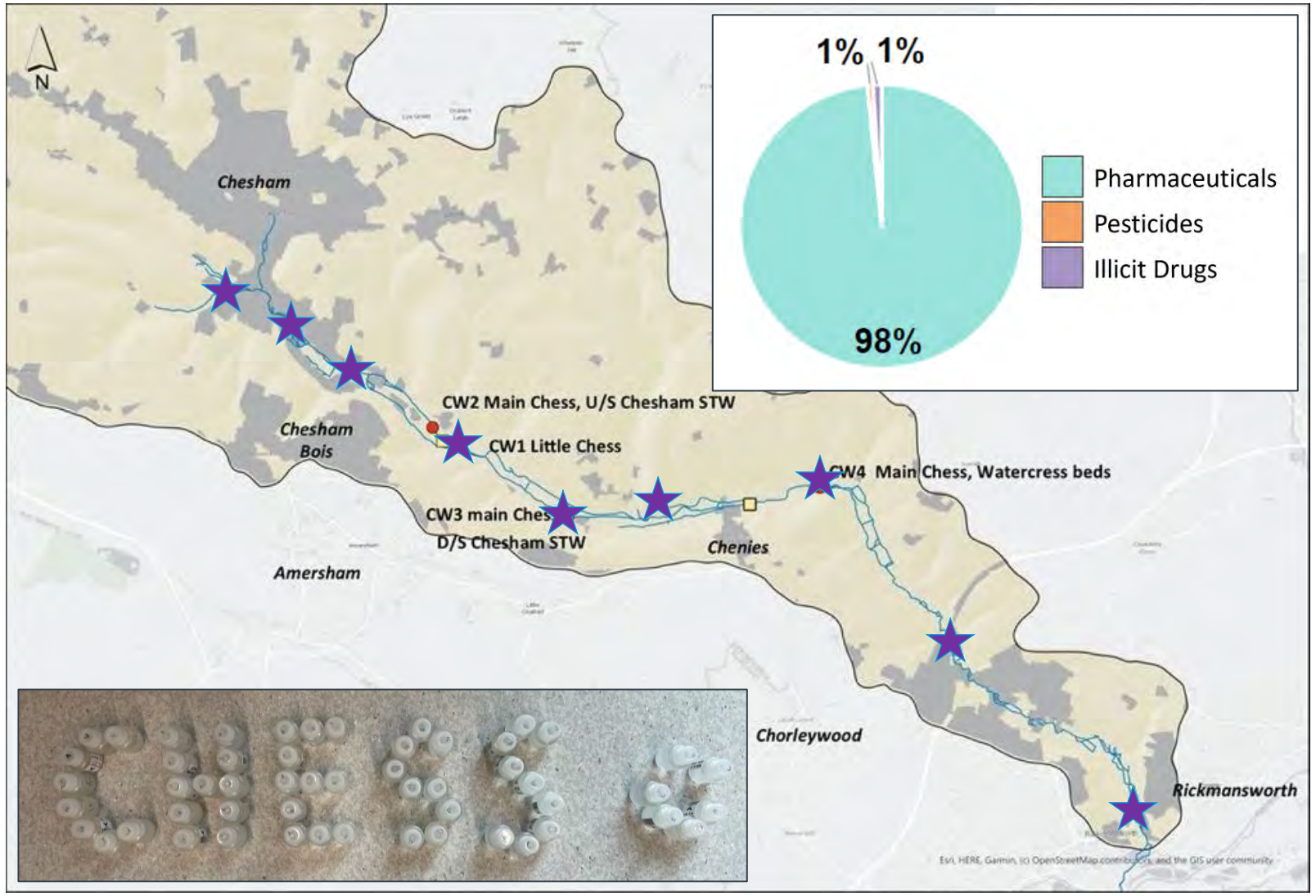


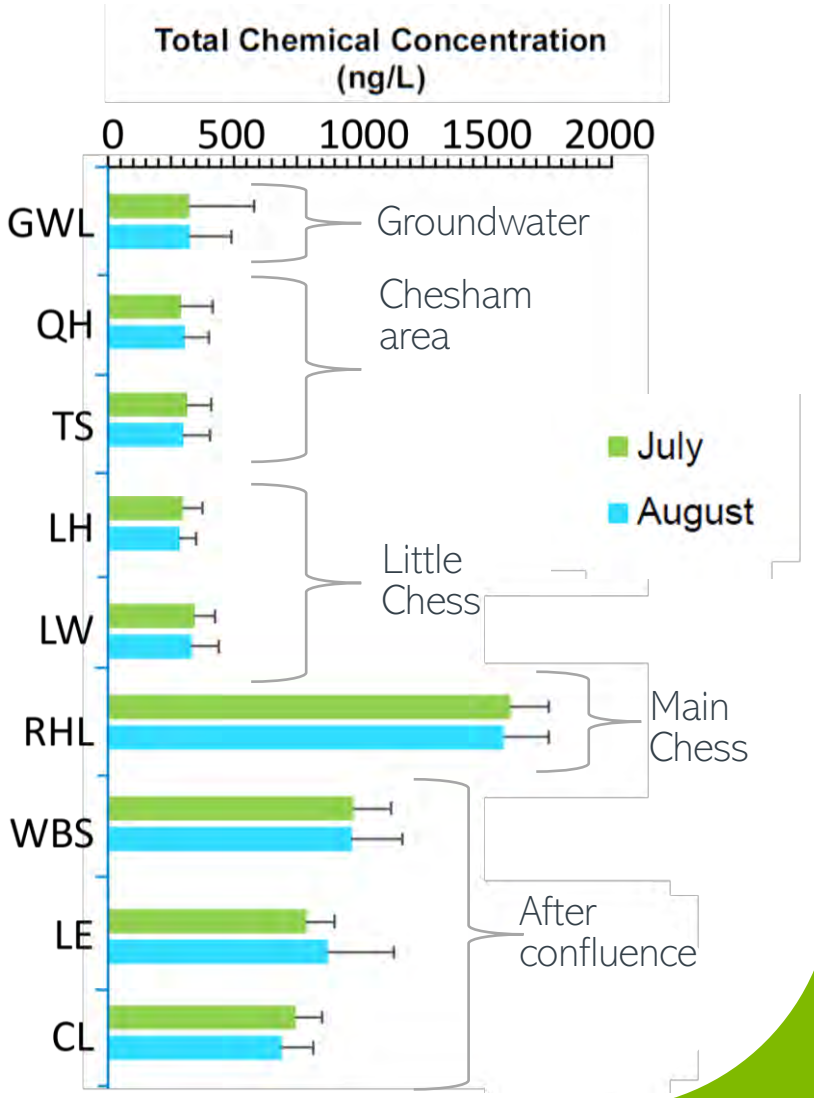
River Chess Smarter Water Catchment

Thames Water

Emerging Contaminants

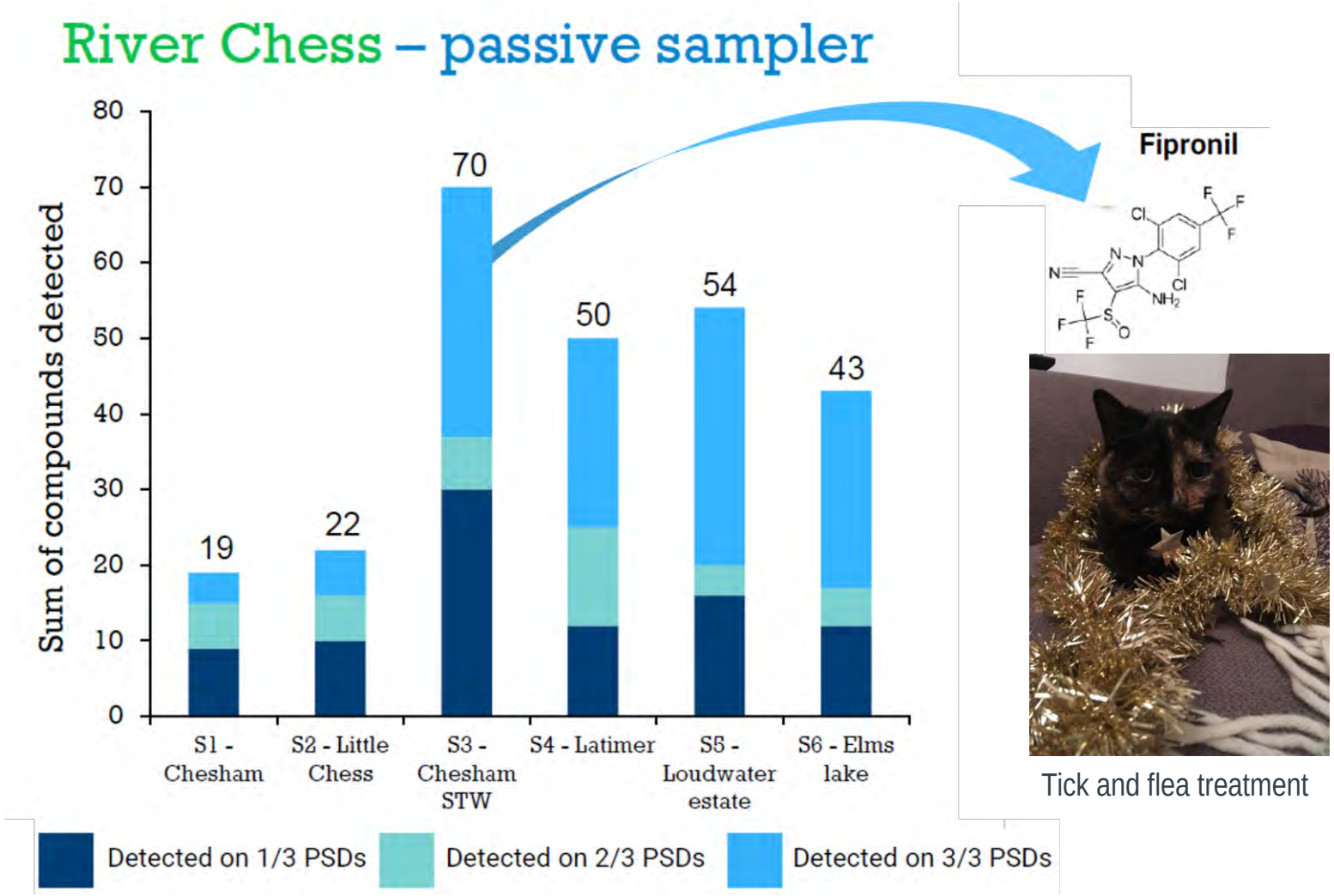
Results so far – Citizen science water sampling





Emerging Contaminants

Results so far – passive sampler: 1st – 8th June 2022



Fipronil

Tick and flea treatment

- Five PSDs (passive sampler dots) per disc; three analysed per site.
- Passive samplers detect presence only, not concentrations of each compound.
- Higher confidence in presence of compounds if all three PSDs carry the same compound.

Fine sediment

Working in partnership

Fine sediment

- Fine sediment infills gravels and prevents exchange of ground and surface water
- A coating of fine sediment smothers the riverbed, preventing fish from finding suitable areas to lay eggs, and aquatic plants from taking root
- Fine sediment carries pollutants such as metals and hydrocarbons from urban runoff
- Fine sediment lowers oxygen levels in the spaces between gravels preventing fish eggs from developing

SOURCE: Chilterns Chalk Streams Project

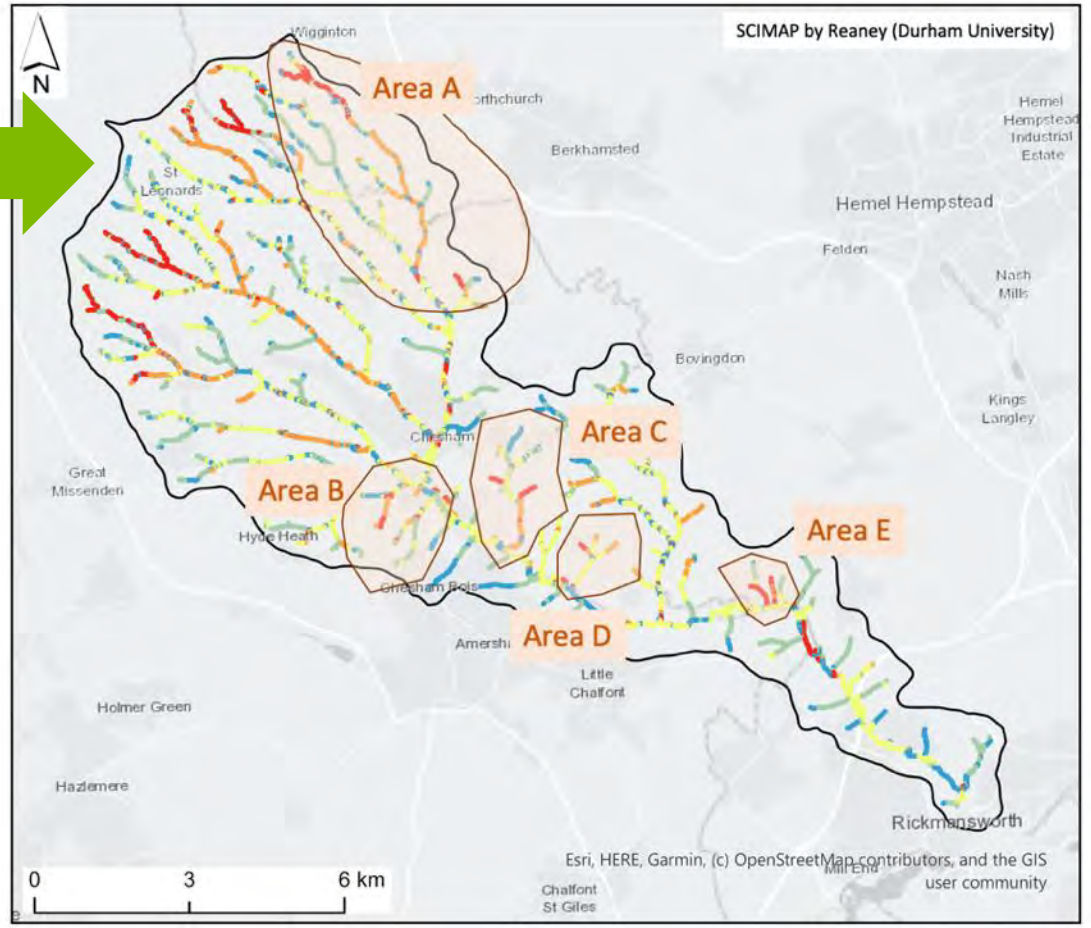
SOURCE: River Chess Association

When and how does fine sediment enter the River Chess?

Poor pre-existing evidence base because not a parameter collected a part of WFD

When and how does fine sediment enter the river?

- On-line free GIS tool
  - SCIMAP
  - University of Durham
- Pre-existing local knowledge
  - Photographs
  - Local rivers groups
- Citizen Science
  - Water quality sensors
  - MudSpotter



River Chess Smarter Water Catchment

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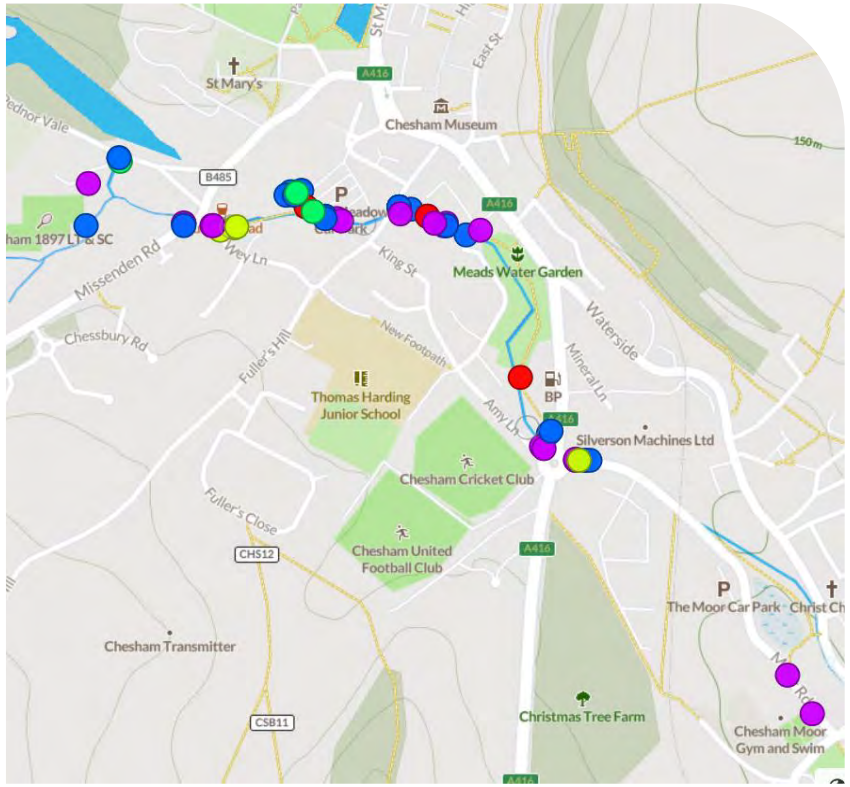


Legend

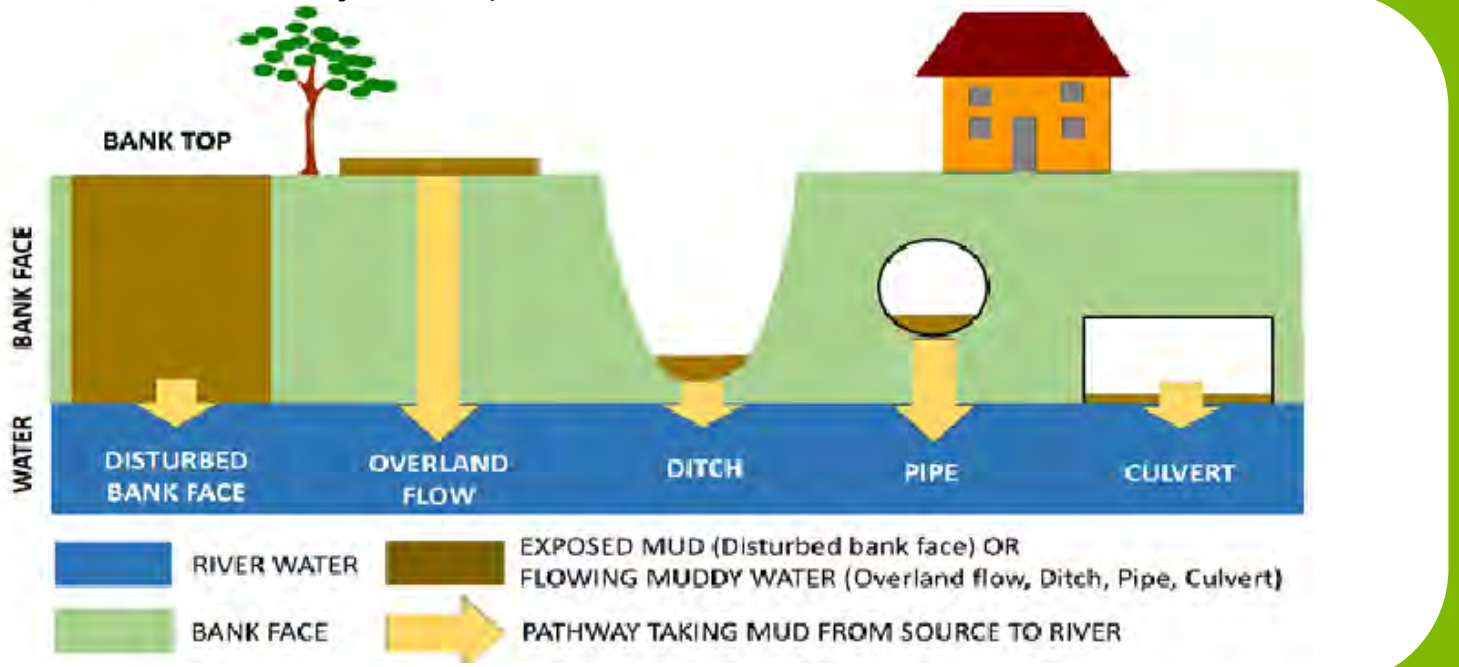
- Disturbed Bank Face
- Overland Flow
- Ditch
- Pipe
- Culvert

River Chess Smarter Water Catchment

What is MudSpotter?

Urban citizen science surveys

- An investigative survey, monitoring riverbanks for possible sources of sediment input.
- Conducted within 24 hours of rainfall event (ideally during).
- Has recently been piloted in Chesham.



What are the main sources of fine sediment?

Poor pre-existing evidence base

What are the main sources of fine sediment, and mitigation options?

- Sediment source apportionment (expert)
  - Colour method
  - Grassland, Cultivated, Roads, Banks
- Urban investigations (expert)
  - Sediment quality
  - Mitigation strategy
- Rural work with farming adviser (expert)
  - Soil health
  - Walkover surveys
  - Mitigation options

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River Chess Smarter Water Catchment

What are the impacts of fine sediment?

Poor pre-existing evidence base

Wildfish SmartRivers (Cit Sci)

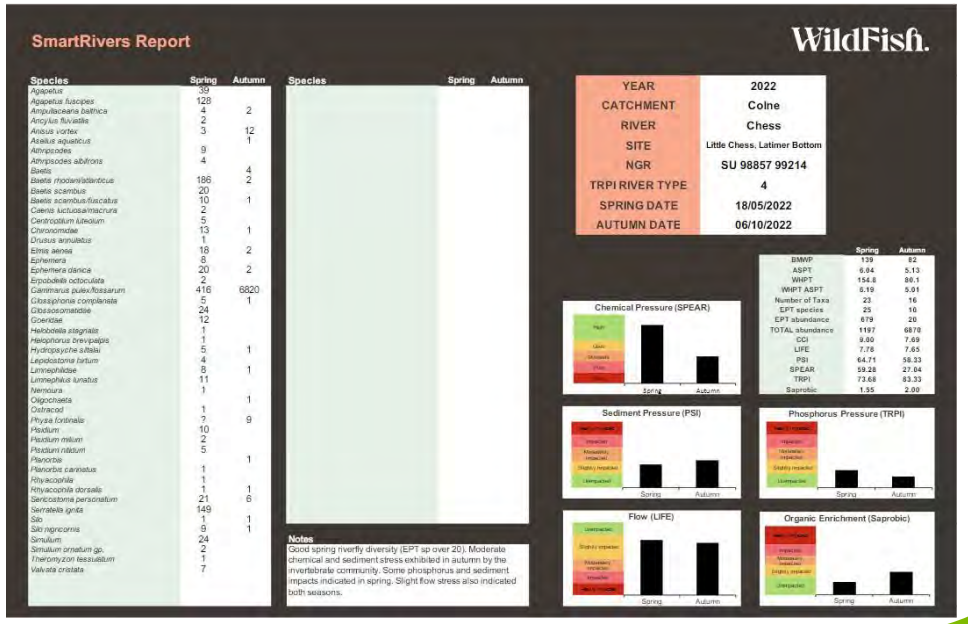
- Invertebrate monitoring
- Stress index

Modular River Survey (Cit Sci)

- Geomorphology
- Bed sediment index

Environment Agency

- River Habitat Survey
- Fish surveys



River Chess Smarter Water Catchment

Points to consider....

Can take considerable lead-in time (years) to collate evidence before mitigation actions can be taken forward. **Many rivers would need long-term investment / funding to help drive catchment-scale changes in this area because evidence base is incomplete.**

Where road runoff and connection with road network is an issue we **need collaborative partnerships with local authorities and Highways England to create solutions.**

Capital investment is not enough here, as we **need agreements and finance for maintenance of any solutions. Landowner agreement is critical.**

Without change/direction at a national level (ideally legislation & funding) it will be very difficult to address road runoff as there is currently no obligation/requirement for **local authorities** to do so.

The End

Working in partnership

MudSpotter

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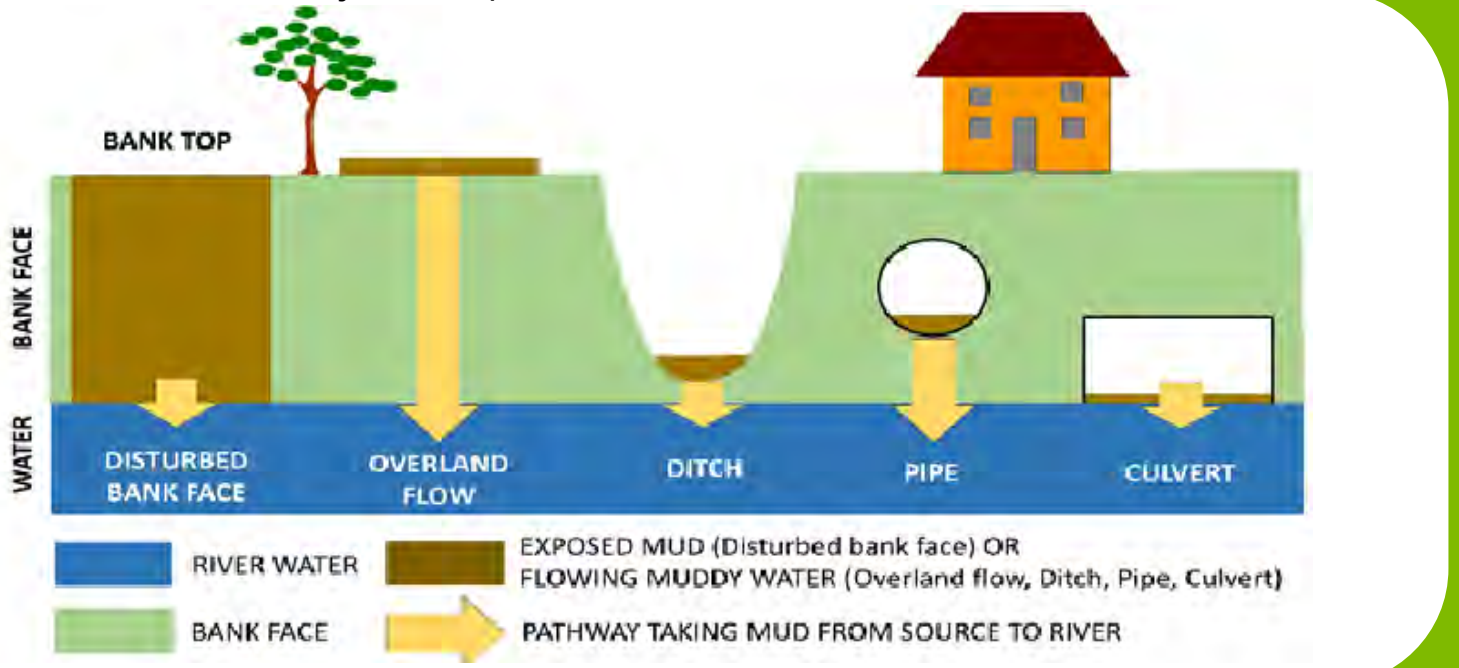
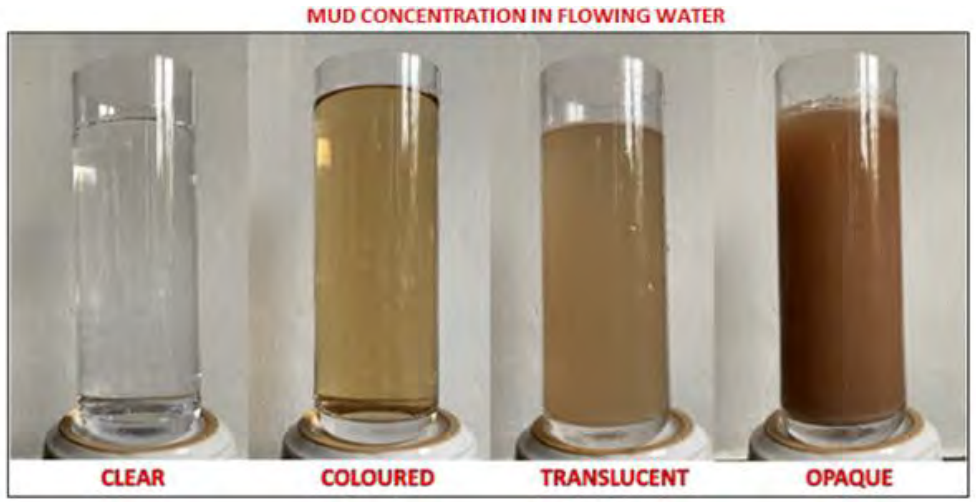


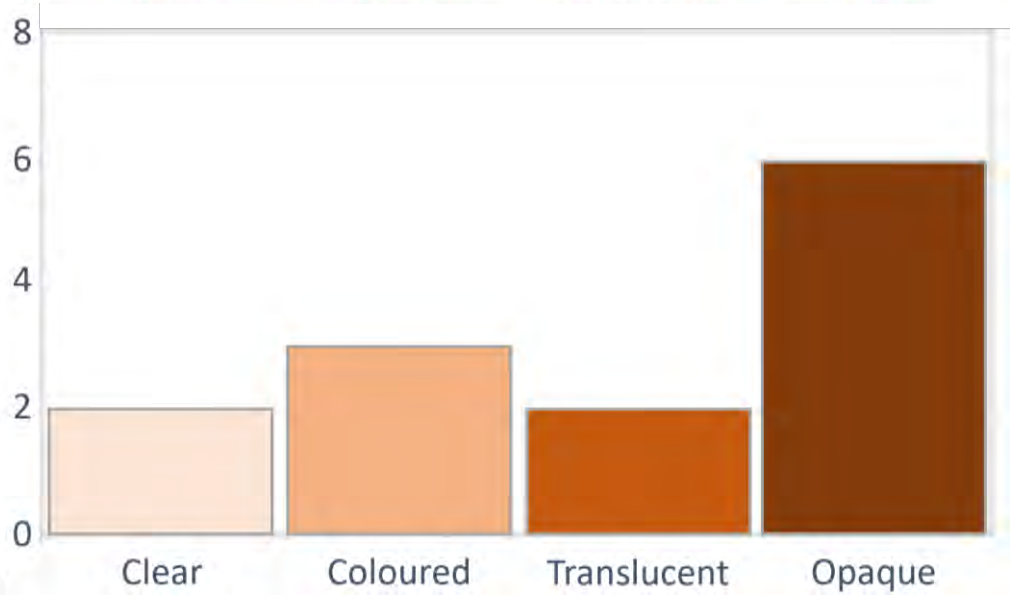
MudSpotter Pilot

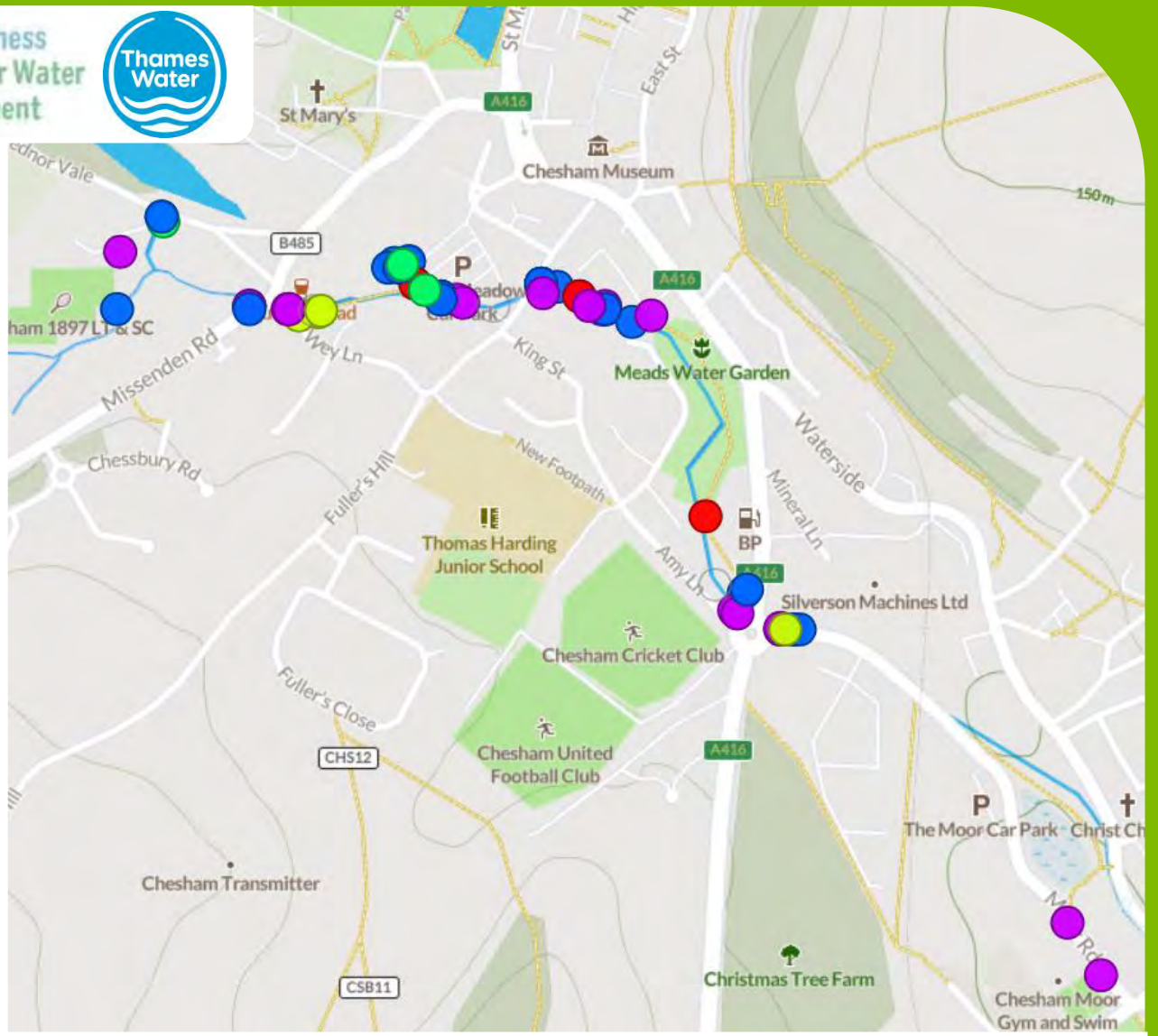
River Chess Smarter Water Catchment

Thames Water

Chesham







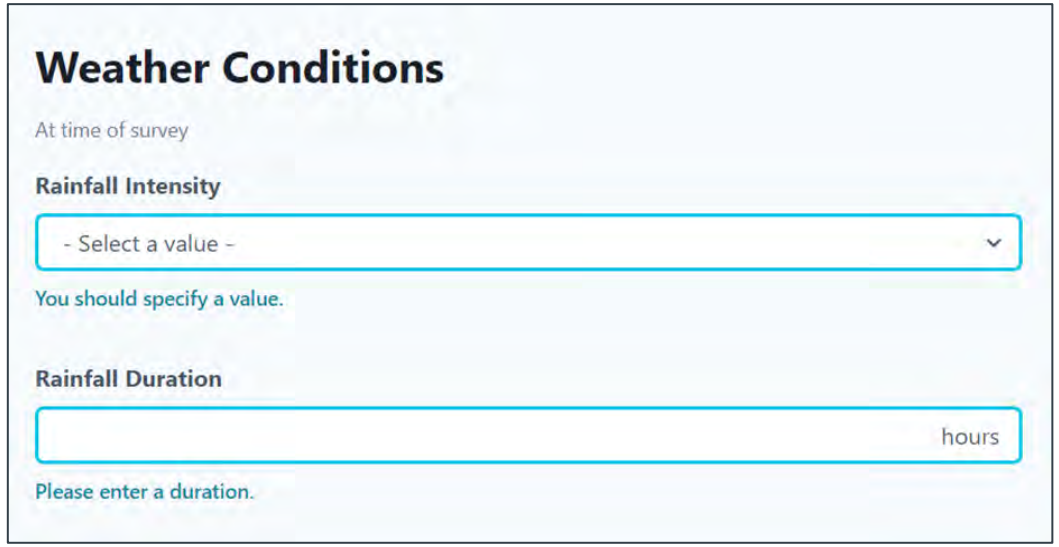
Legend

- Disturbed Bank Face
- Overland Flow
- Ditch
- Pipe
- Culvert

MudSpotter

Pilot outcomes

- Established possible sources of sediment input during dry periods.
- Added weather conditions to data upload page:



Training

- Two-hour practice session

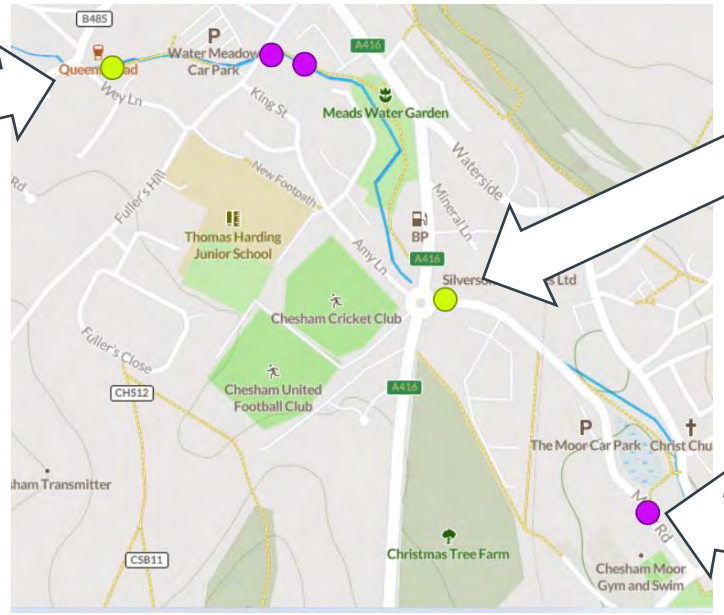
Data recording

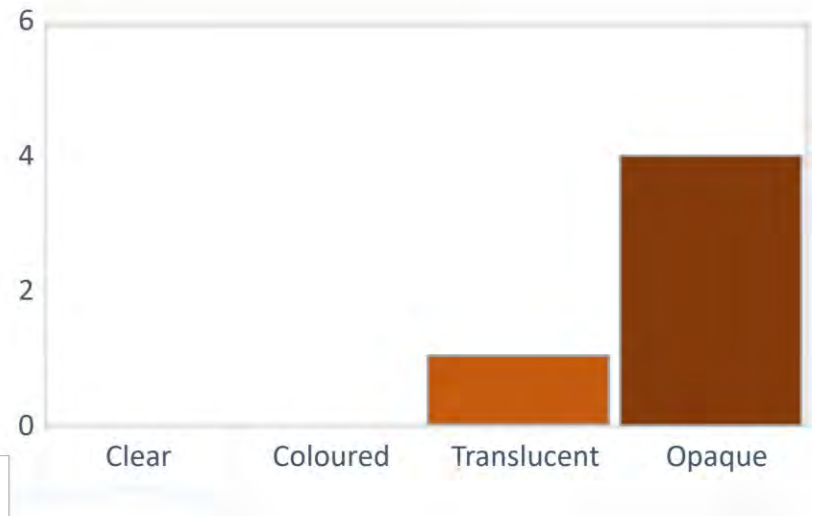
- Mobile phone on-site
- Paper sheets

MudSpotter Survey

15th November 2022: Holly & Hannah

Queen's Head to Chesham Moor





ECOLOGICAL
CITIZEN SCIENCE SURVEYS

Modular River Survey (MoRPh)

Working in partnership

Thames Water
The River Chess Association
Chilterns Chalk Streams Project
CHILTERNS
Chiltern Society
Buckinghamshire Council
Environment Agency
Affinity Water
Herts & Middlesex Wildlife Trust
Queen Mary University of London

What is MoRPh?

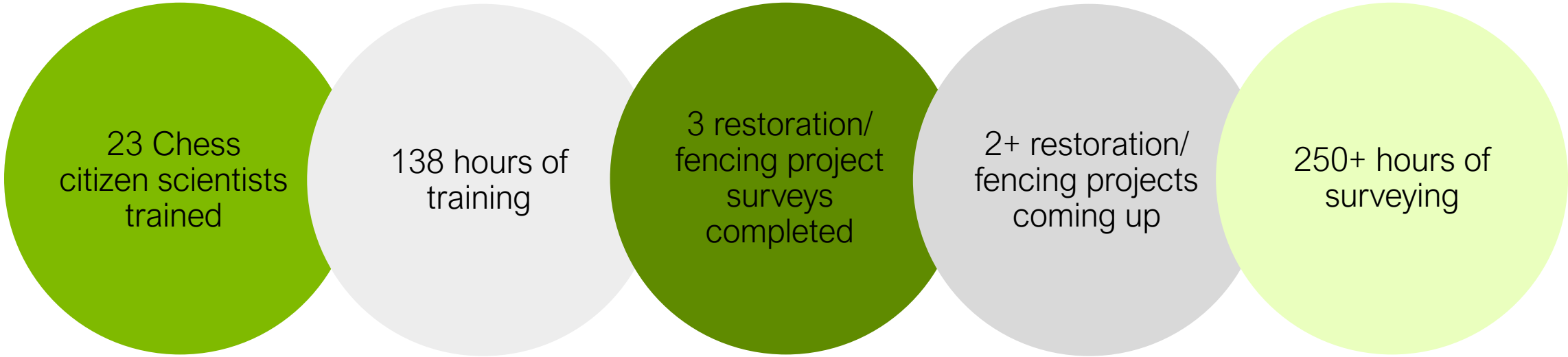
A technique to identify habitat quality and ecological indicators of river health, e.g.

- How biodiverse is the bankside habitat?
- To what extent is the riverbed coated in fine sediment?
- Are there any invasive plants on the banks?

Has been used to assess whether restoration work has improved biodiversity and hydromorphological function of the River Chess.

MoRPhing the Chess

As part of the Smarter Water Catchment initiative: 2022



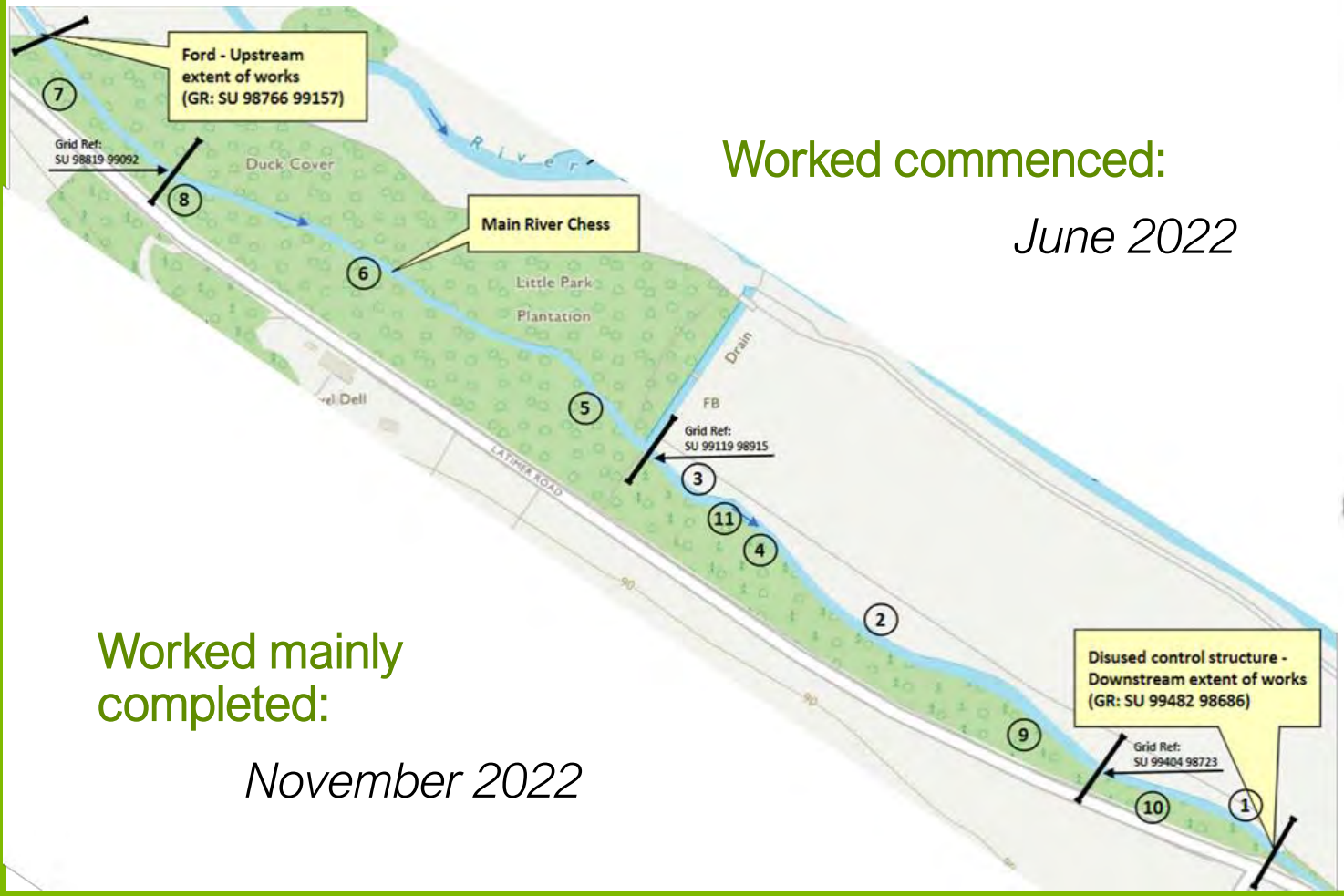
River Chess Smarter Water Catchment

Thames Water

Restore Hope Latimer

Restoration of the main channel

Improvements along the main channel of the River Chess

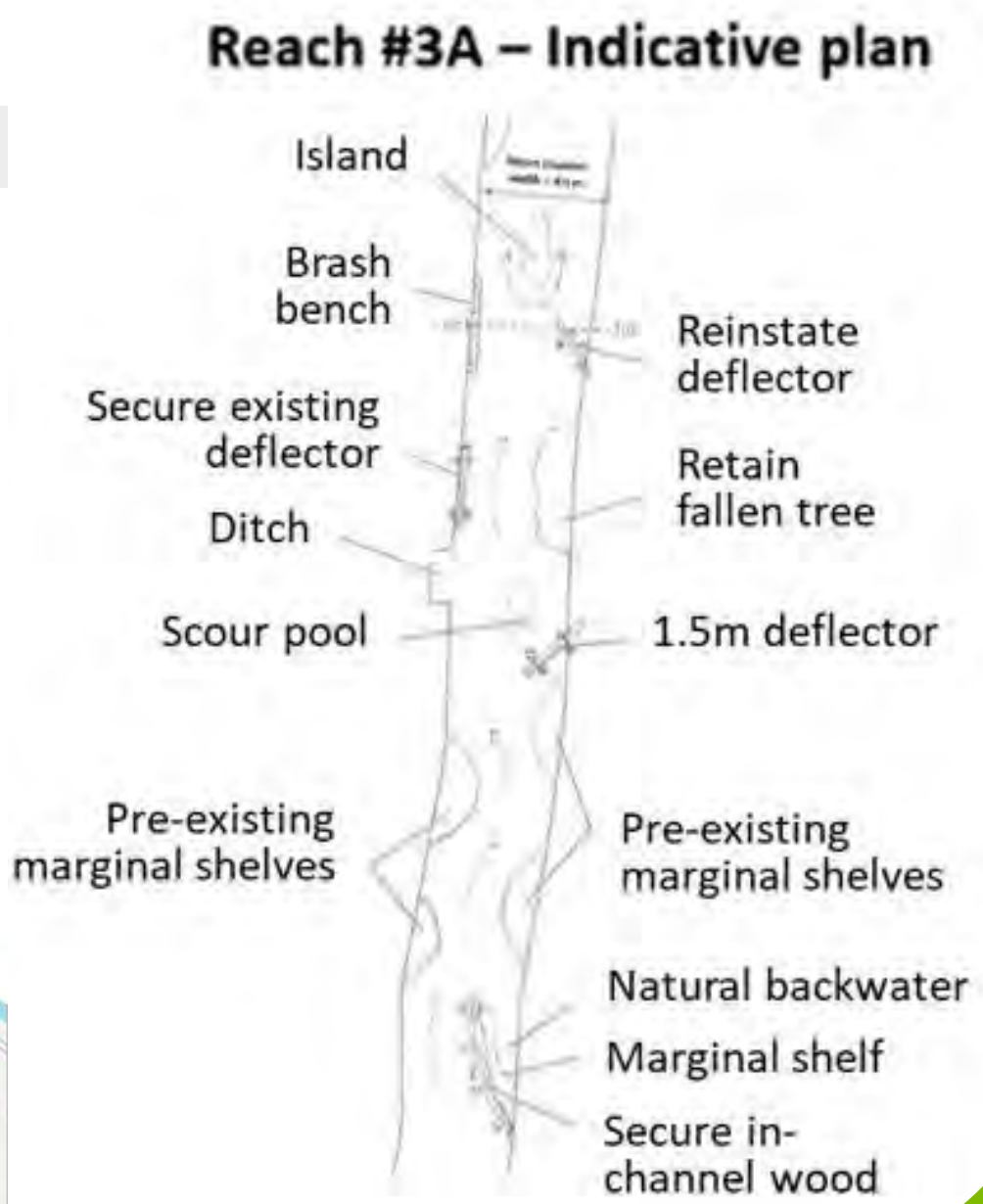


Worked commenced:

June 2022

Worked mainly completed:

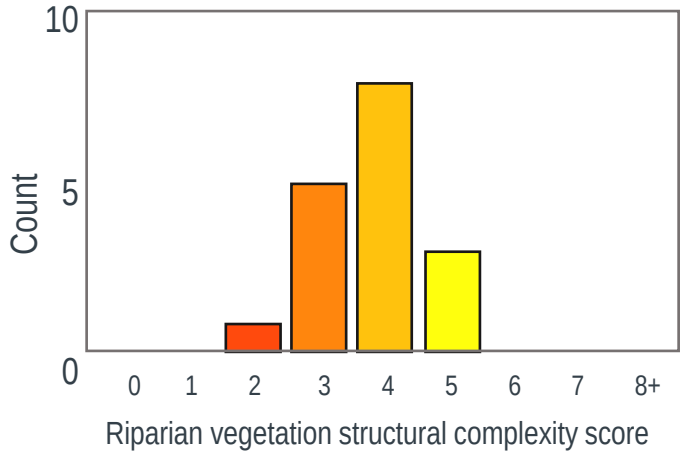
November 2022



Adrian Porter, June 2022

Restore Hope Latimer

Bankside vegetation structural complexity



River Chess Smarter Water Catchment

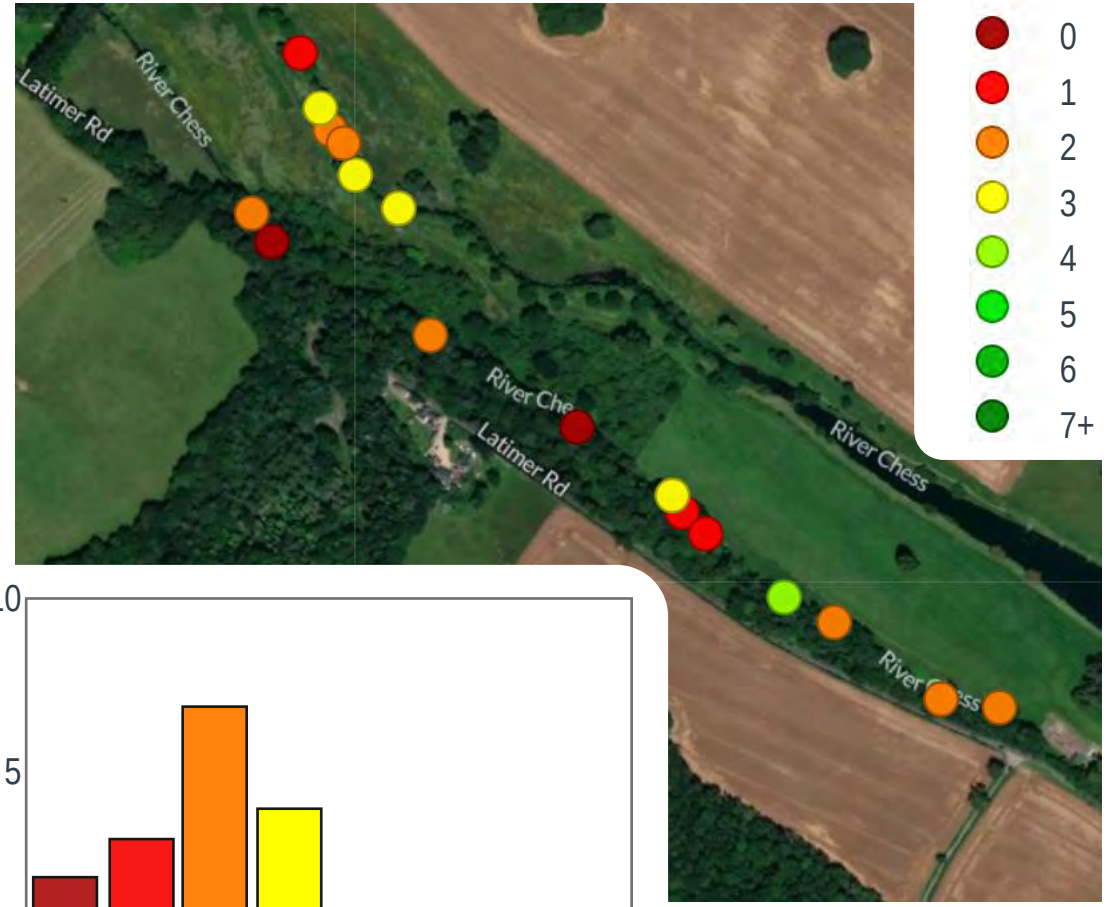
Thames Water

A low score indicates poor complexity (i.e. not a very diverse habitat) whilst a high score indicates a good mix of trees, shrubs, tall and short grasses, beneficial to different types of wildlife

Growth of vegetation around a ‘tree sweeper’

Restore Hope Latimer

Pre-restoration aquatic vegetation 2022



River Chess Smarter Water Catchment

Thames Water

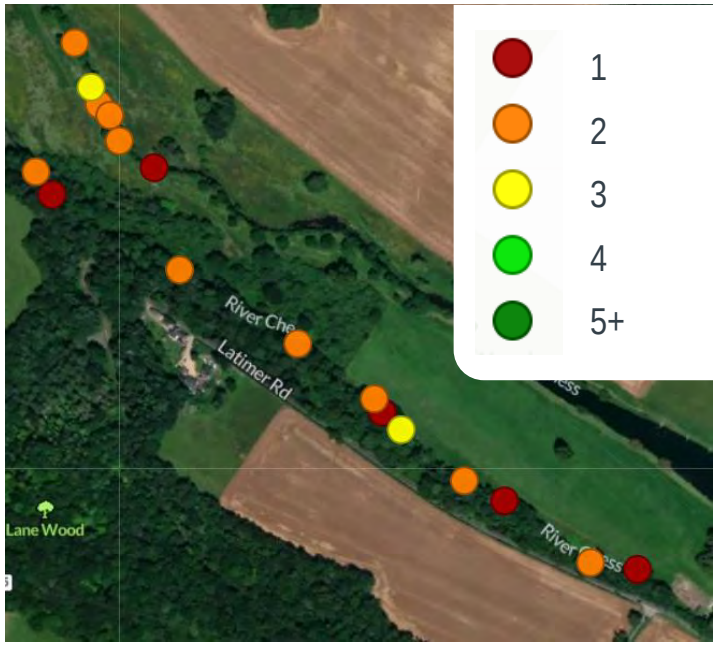
Number of morphotypes (types of aquatic vegetation) refers to the number of categories present, such as broad-leafed, fine-leafed, reeds, floating leaved, floating free, etc.

Higher the number, higher the aquatic vegetation diversity.

Restore Hope Latimer

Pre-restoration data 2022

Number of flow types



Flow types include, smooth, rippled, waves, chute, waterfall, etc.

Average bed material type

Lower average bed types including silt could require work to improve flow rates.

Channel physical habitat complexity

In-channel habitat complexity counts the number of habitat types; the higher the better for biodiversity!

MoRPh in 2023

Projects to revisit post-restoration:

- Restore Hope Latimer main channel
- Restore Hope Latimer Little Chess fencing
- Chesham Moor (once work has taken place)

Two upcoming projects awaiting approval in the upper Chess.

Aspirational project plans in the lower Chess.

Apply the Modular River Survey to other parts of the Chess to help direct possible future restoration efforts.

Training planned for spring/autumn 2023 (requires minimum of 10 people).

River Chess Smarter Water Catchment

Thames Water

ECOLOGICAL
CITIZEN SCIENCE SURVEYS

Riverfly & SmartRivers

Working in partnership

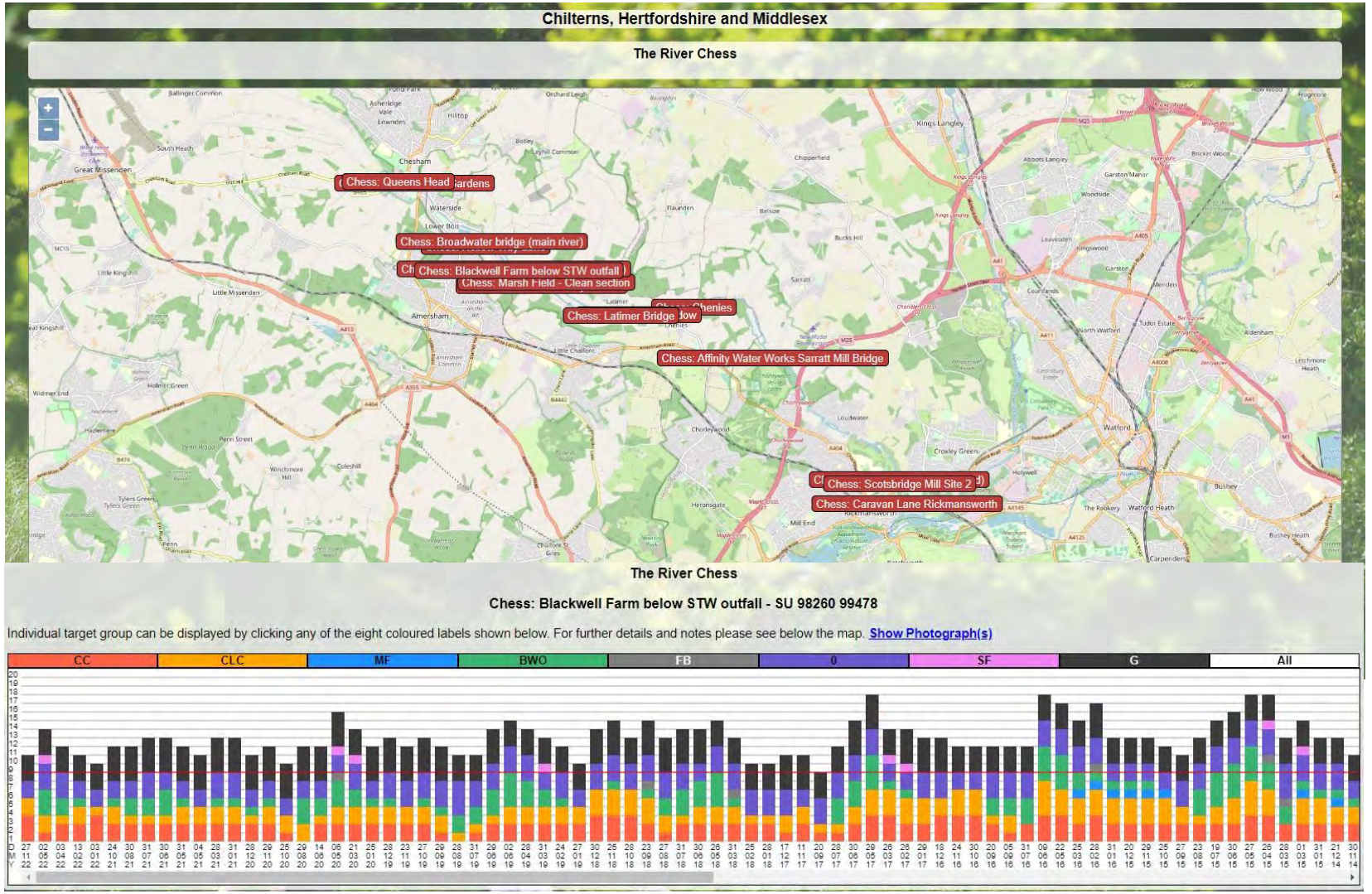
What is Riverfly?

Quick intro…

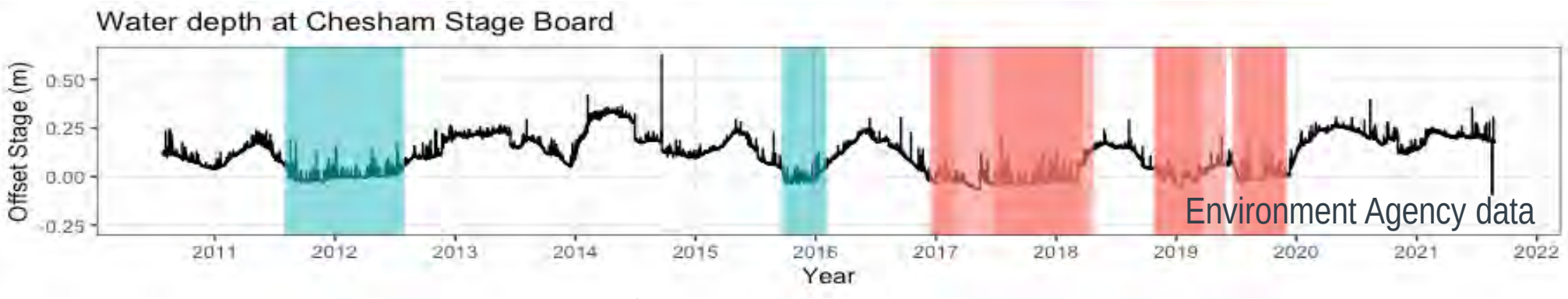
- Riverflies are freshwater invertebrates which are a vital part of the aquatic food chain and sensitive indicators of water quality.
- Anglers Riverfly Monitoring Initiative (ARMI) is an established method for sampling invertebrate communities, creating a trigger score in a river.
- ARMI Riverfly volunteers sample a river site each month using kick sampling method and classify and count different invertebrate groups.

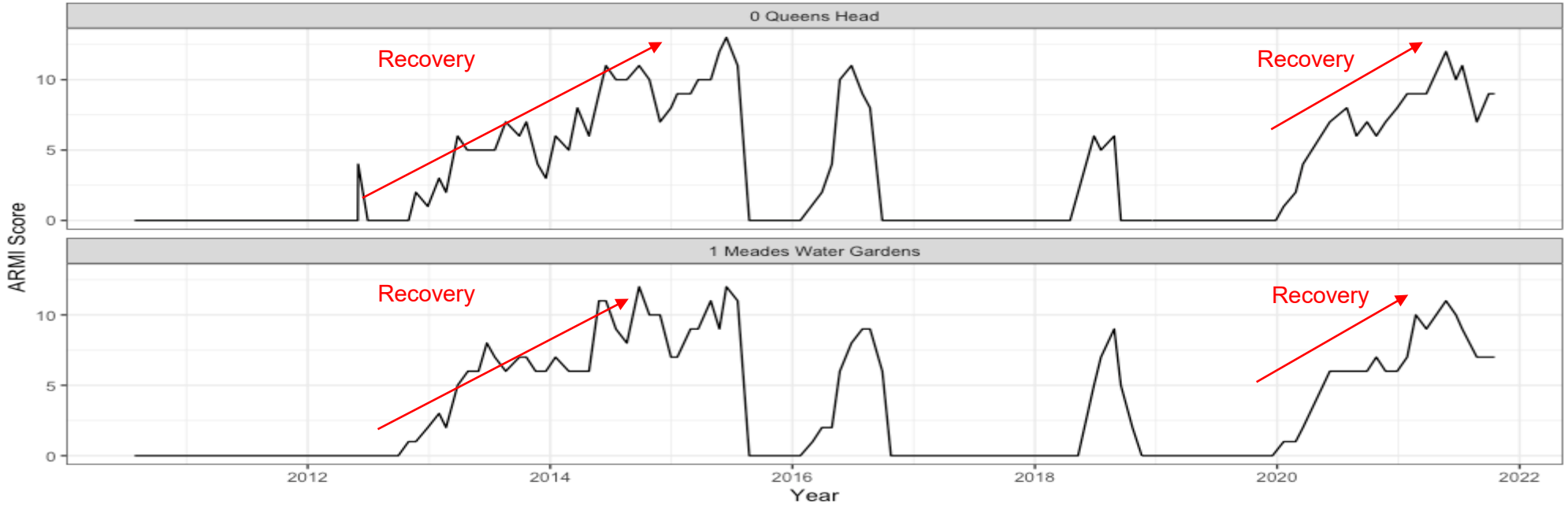
Riverfly website

Ten years of effort recorded on…….https://cvfc.org.uk/rflies/select.html



Insights into wetting and drying cycles in the river





Rivers do naturally dry up in upstream winterbourne reaches, sometimes seasonally, sometimes for years at a time.

What is SmartRivers?

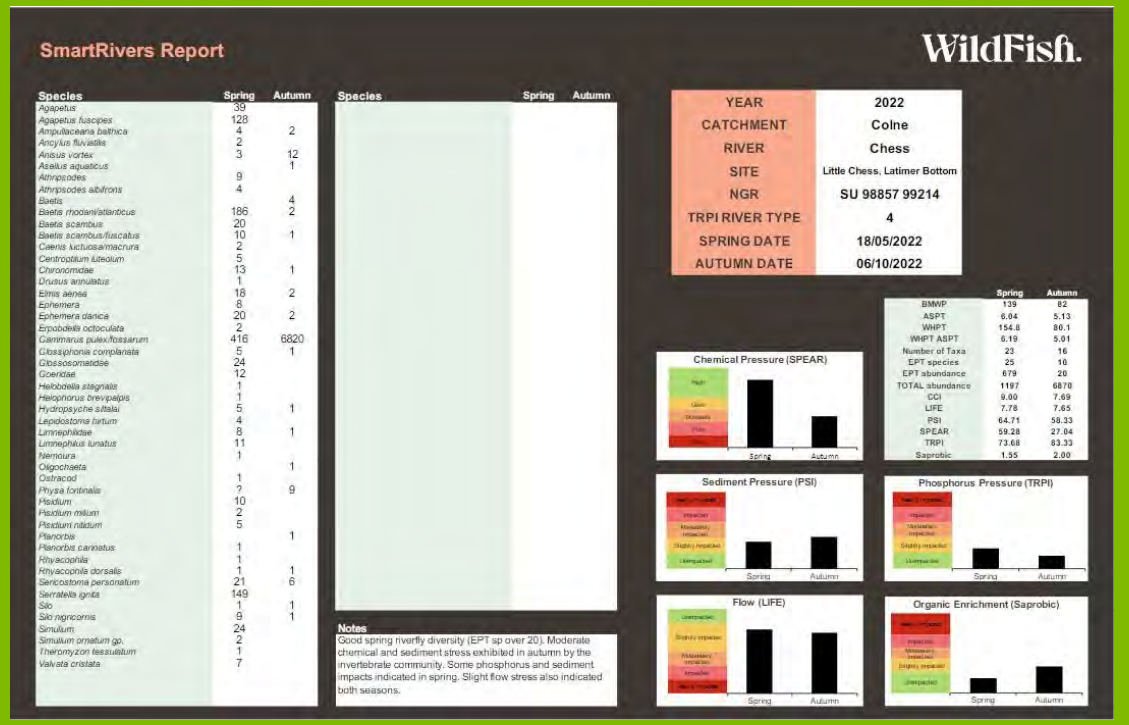
Quick intro….

- Nationwide citizen science scheme to collect data on the pressures impacting wild fish.
- Enables assessment of invertebrate species diversity and abundance – the foundation of the food web.
- Sample Riverfly life twice a year in Spring and Autumn through kick sampling methodology.
- Produces a water quality scorecard to identify the impact of organic pollution, nutrient enrichment, sediment, chemical and flow stress.
- Provides insight into the condition of habitat.

River Chess Smarter Water Catchment

Thames Water

WildFish.



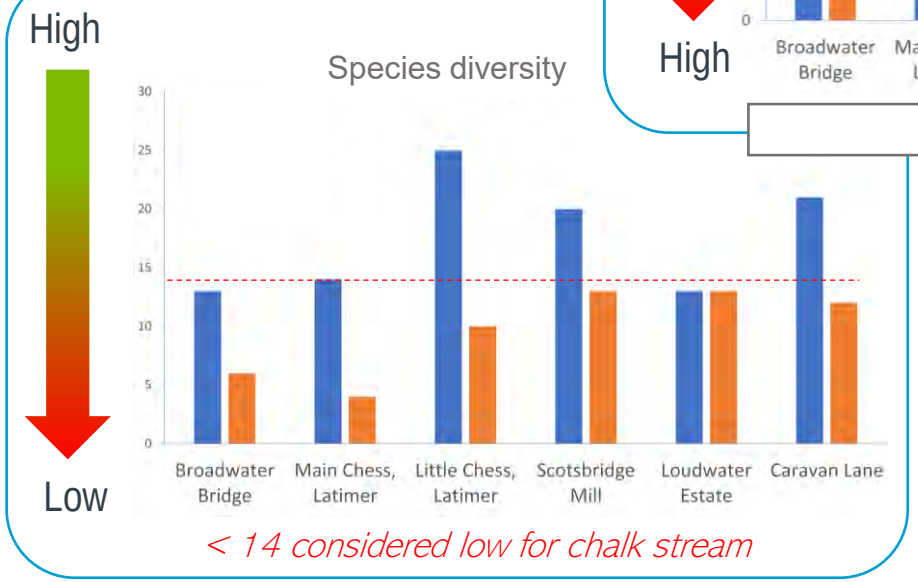
SmartRivers Results 2022

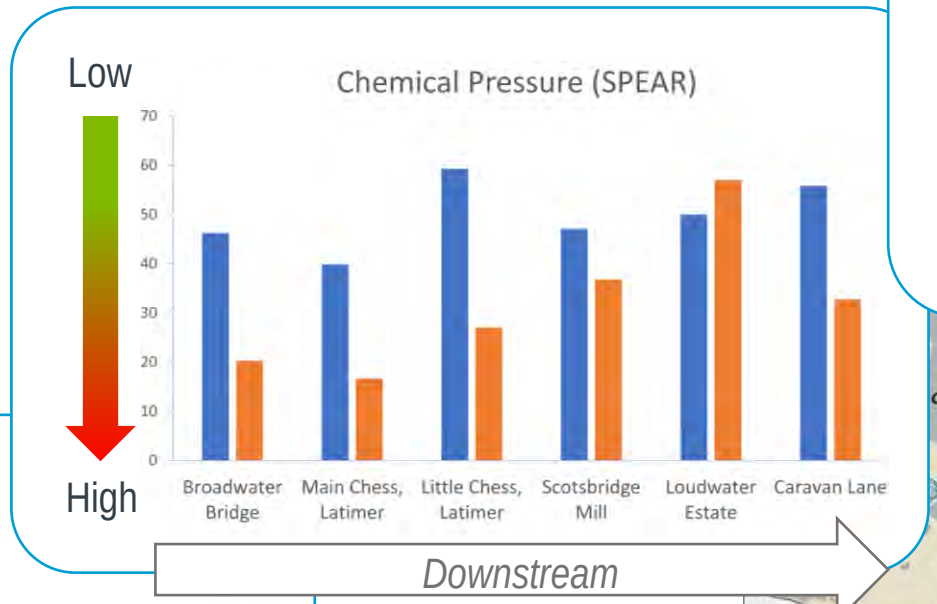
River Chess Smarter Water Catchment

Thames Water

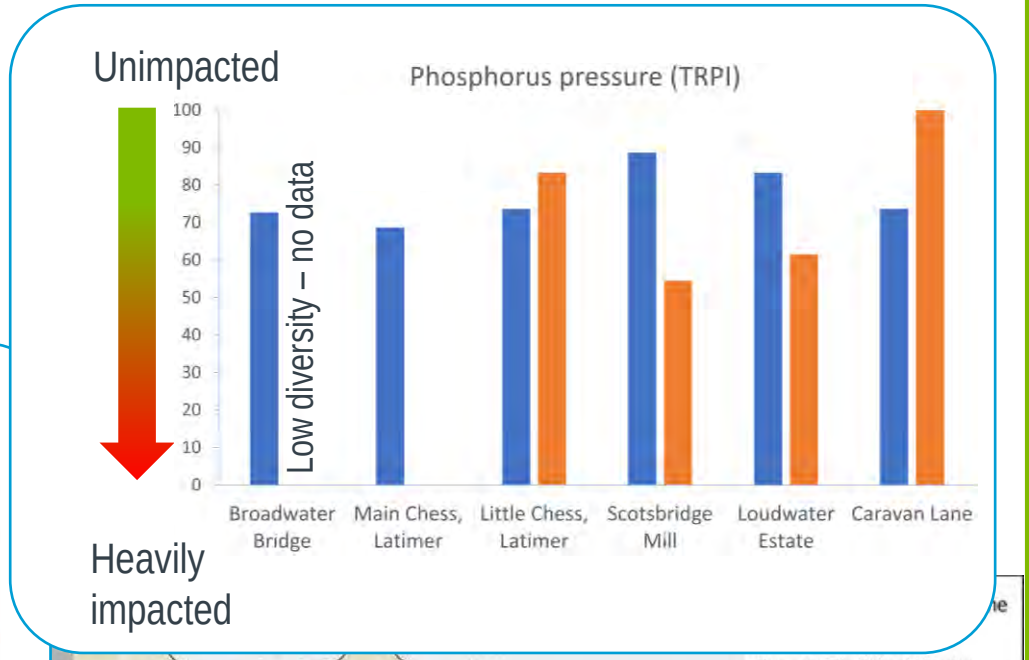
Key finding:

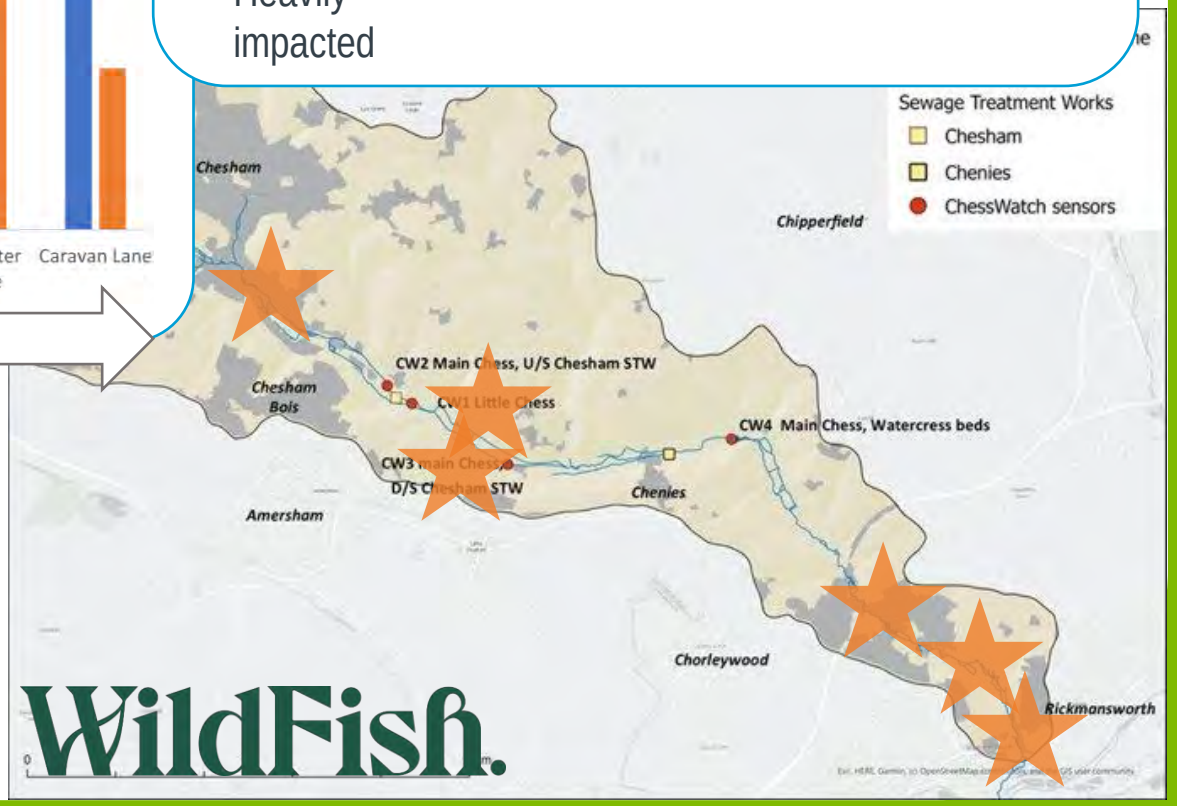
Main River Chess channel at **Latimer** has lowest species diversity, highest chemical pressure and highest phosphorous pressure in Autumn.





Downstream





Spring 2022

Autumn 2022