

Designing a collaborative citizen science monitoring programme for the Wye catchment

April 2021

A workshop led by Cardiff University for new and active citizen science groups and other key catchment stakeholders across the Wye catchment



School of Earth and Environmental Sciences
Ysgol Gwyddorau'r Ddaear a'r Amgylchedd



Natural Environment Research Council

Part 1 – Plan for this session



Introduction to collaborative monitoring



Hear from the EA about their monitoring



Review an example collaborative monitoring plan



Head into break-out rooms to discuss the collaborative monitoring plan

Aims of the session



Discuss and start to agree the principles of what a collaborative monitoring programme across the Wye will look like



Work towards creating a collaborative monitoring partnership agreement that all groups feel able to sign up to



Introduction to collaborative monitoring



What is collaborative monitoring?

In a report* written by the UN, **collaborative monitoring** is defined as:

“The adoption of a joint and cooperative approach to the targeted and systematic collection of information and data for the purpose of informing the structured assessment of progress on a project or projects...”

Here you can think of the ‘project’ or ‘projects’ as our shared purpose of monitoring or shared goals for the Wye Catchment.

[*https://www.alnap.org/system/files/content/resource/files/main/third-party-and-collaborative-monitoring-pv1.pdf](https://www.alnap.org/system/files/content/resource/files/main/third-party-and-collaborative-monitoring-pv1.pdf)

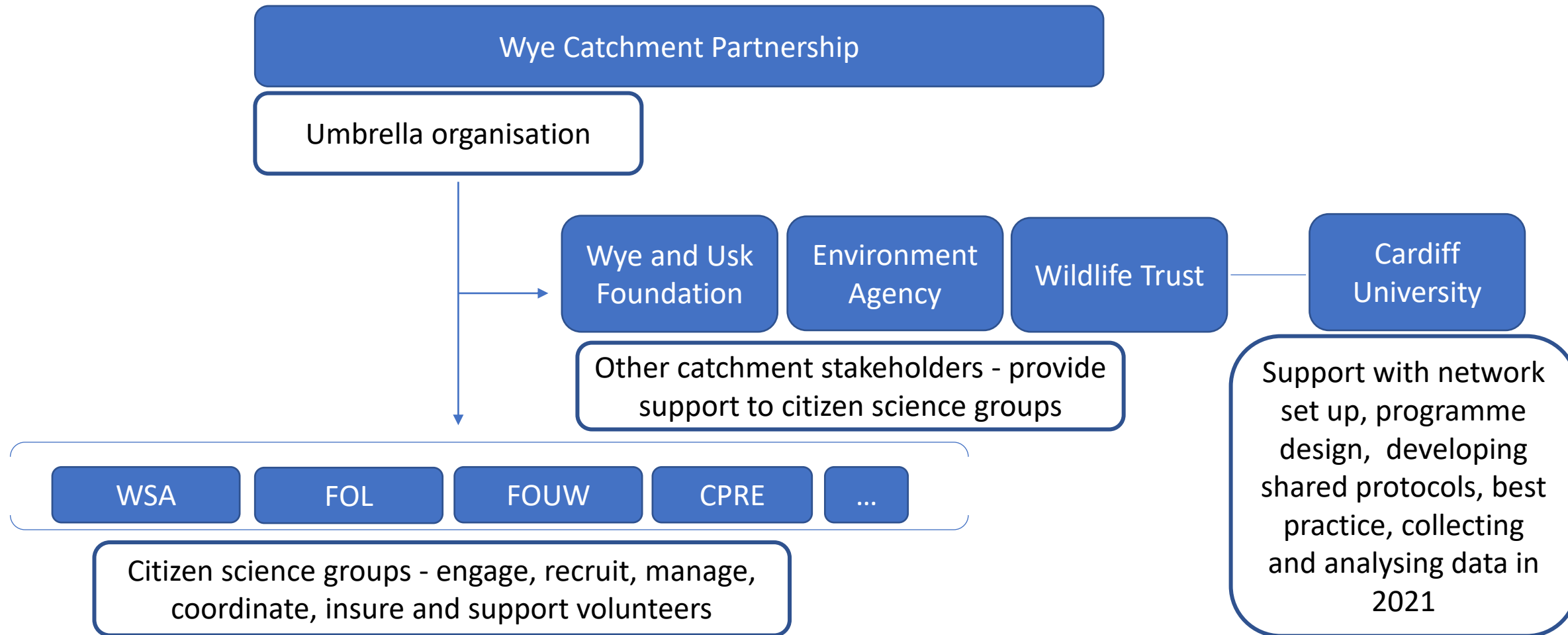


Who would a collaborative citizen science monitoring programme involve across the Wye?

Cooperation, coordination and collaboration between different citizen science groups, academics, data users and a wide range of other catchment stakeholders...

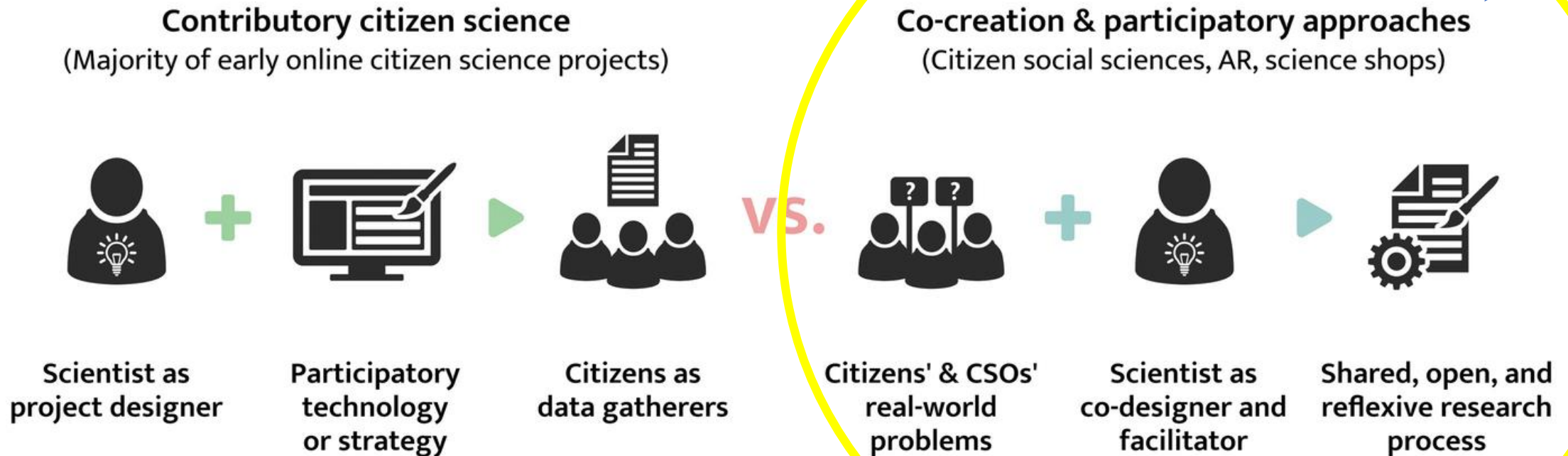
The Wye Catchment Collaborative Monitoring Network

Who's involved and what does its structure look like so far?



How can citizen science monitoring programmes be designed?

This is the approach we're going for



Senabre Hidalgo et al., 2021

Funding announcement!

CU have been awarded a grant from NERC to help support the delivery of a collaborative citizen science monitoring programme this year

This funding will enable Cardiff to:

- Continue to provide advice, training and support to citizen scientists across the Wye
- Collect complementary data to support your monitoring
- Purchase some additional monitoring equipment for citizen scientists
- Analyse some of the data collected by citizen scientists across the catchment
- Organise a forum to share findings with other catchment stakeholders and help plan the next phase of monitoring



Questions
we're aiming
to answer by
the end of
the
workshop...

Why are we monitoring collaboratively?

What are we going to monitor?

How are we going to monitor?

Who is going to do the monitoring?

When are we going to monitor?

Where are we going to monitor?



Why?

Why are we monitoring collaboratively?

- **What is our shared purpose of monitoring and collaborative monitoring goal or mission?**
- **Who are we collecting the data for?**

Consider:

- Each group might have individual local goals and objectives which will shape their monitoring programmes to some degree
- To achieve a successful collaborative monitoring programme a shared purpose, goals and group of target data users needs to be agreed

Example shared monitoring ambitions

Shared purpose of monitoring:

To improve scientific understanding of water quality across the Wye catchment

Collaborative monitoring programme goal:

To collect a large, shared data set using standardised monitoring methods to increase the amount of useful water quality information available for the Wye catchment

Data users:

All interested catchment stakeholders, to inform catchment management decisions



What?

What are we going to monitor?

➤ Which water quality parameters are we going to monitor?

Consider:

- Each group might have an individual set of parameters based on their local goals and objectives
- However, for the data to be useful there should be at least some overlap in the parameters measured
- Cardiff will do some complementary monitoring of certain parameters

Example – approach to selecting parameters

Shared monitoring parameters:

phosphate, nitrate, electrical conductivity, temperature

Shared metadata:

date, time, location, recent rainfall, monitoring equipment used

Optional additional parameters:

ammonia, dissolved oxygen, turbidity, water depth, pH

Optional additional metadata:

evidence of algal bloom, presence of ranunculus, signs of pollution

A dark blue, irregularly shaped ink blot with white splatters on a white background. The word "How?" is written in white, sans-serif font in the center of the blot.

How?

How are we going to monitor?

- **What monitoring equipment, methods and protocols are we going to follow?**
- Each group might have their own preferences for monitoring equipment based the requirements and experience of their citizen scientists, their budget and their local goals and objectives
- However, for the data to be useful:
 - a limited variety of monitoring equipment should be used
 - comparisons should be made between different equipment
 - shared monitoring methods and protocols should be adopted
 - monitoring equipment must be used correctly and in the same way

Example – approach to monitoring equipment

- A **tiered approach** is adopted
- **Options for different groups/** citizen scientists taking account of local goals, objectives, experience and requirements
- Most citizen scientist would use the **basic kit** as this is cheapest and easiest to use
- Some citizen scientists would use the **intermediate and advanced kit**, ideally alongside the basic kit, to build a more comprehensive data set and help better understand data quality from different equipment
- **Cardiff support** by doing **additional monitoring** – lab analysis for phosphate and deploying a sonde for EC, temp, level, turbidity, pH, DO

How are we going to monitor?

➤ How will we record and share data?

- Each group might have unique ideas about the range questions they want to ask their volunteers based on their local monitoring goals and objectives, the parameters monitored, and equipment used, and the capacity of their citizen scientists
- However, for the data to be as simple to analyse as possible using a shared database and at least some universal survey questions is hugely beneficial

Example – approach to data collection

- All citizen scientists collecting data for the collaborative programme input use **epicollect**
- **Each group sets up and manages its own ‘project’** on epicollect
- **A set of standard questions** suitable for all citizen scientists are used in each group’s form
- Any **additional extra questions** an individual group wants to ask can be added



Who?

Who is going to monitor?

- **Who are your volunteers and how are you going to engage, recruit, train and support them?**
- **Is anyone else going to be monitoring alongside volunteers?**
 - Each group will have different volunteer citizen scientists with different interests, ambitions and capacities and their of approaches to volunteer management (engagement, recruitment and support)
 - It's important that all volunteers are trained in the technical aspects of water quality monitoring in the same way to obtain comparable data sets from different groups

Example volunteer management approach

- All citizen scientists collecting data for the collaborative programme receive the same instructions/ training materials/ resources on the technical aspects of monitoring
- Technical aspects of monitoring are led by Cardiff
- Each group engages, recruits and supports its volunteers in its own way using its own networks



When?

When are we going to monitor?

- **How frequently and at what times are we going to ask volunteers to monitor?**

Consider:

- Changes in water quality can occur on very short timescales
- Cost is per sample for many parameters
- Volunteers are time restricted
- Regular/random vs responsive monitoring
- Mass monitoring events vs individual monitoring schedules

When are we going to monitor?

➤ **How long are we going to monitor for?**

Consider:

- Working in phases is helpful
- We can think about this as Phase 1
- It's a “pilot stage”, but that doesn't mean we can't collect valuable data
- Cardiff currently have funding to support groups over the next year
- Phase 2 could be developed after the stakeholder forum and review

Collaborative approach considerations

- Each group will likely have different ideas of how frequently their volunteers are able to monitor and what times will be acceptable to volunteers
- It is a good idea to set a minimum monitoring frequency for all citizen scientists taking part in the programme so we can ensure enough data is collected for each site
- It would be useful to have some occasions when all volunteers sample at the same time (or at least on the same day)
- It is important to agree a set length of time for the agreed monitoring programme

Example monitoring duration and frequency

- Run a 6 month collaborative monitoring programme – from May to October 2021
- All citizen scientists collect samples as a minimum on the same day – e.g. last Saturday of the month - once each month for the duration of the monitoring programme
- Any additional monitoring is great but not required – it can be set by individual monitoring groups for their volunteers or initiated by individual citizen scientists by agreement with their monitoring group

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Where?

Where are we going to monitor?

➤ **Where are citizen scientists going to focus their monitoring efforts?**

Consider:

- Each group is likely to have target areas where they currently monitor or regions of interest across the Wye catchment
- The more data that can be collected for a sub-catchment, the clearer a picture of trends and patterns across it will be
- In most situations volunteers will have a significant role in deciding exactly where the monitoring takes place

Example – approach to selecting sites

- Each group selects one or a number of unique sub-catchments across the Wye catchment to focus their monitoring efforts on
- Each group works with new citizen scientists to identify suitable monitoring locations within focus sub-catchments
- Citizen scientists monitor at the same site(s) for the duration of the monitoring programme (phase 1)
- Each group keeps a record of all the active monitoring locations and gives each a unique identifier

What we'd like groups to discuss and agree by the end of this session...

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Shared metadata:

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Optional additional parameters:

ammonia, dissolved oxygen, turbidity, water depth, pH

Optional additional metadata:

evidence of algal bloom, presence of ranunculus, signs of pollution



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→ Check out an example public form created on Epicollect (via your phone app): “*EXAMPLE Wye Citizen Science Water Quality Project*”



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- Technical aspects of monitoring programme design are led by Cardiff
- Each group engages, recruits and supports its volunteers in its own way using its own networks
- Cardiff coordinates additional sample collection and analysis for a number of sites with the support of citizen scientists



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- Citizen scientists monitor at the same site(s) for the duration of the monitoring programme (phase 1)
- Each group keeps a record of all their active monitoring locations and gives each a unique identifier

Over to you!

We've created a google form to guide you as you work through those why, what, how, who, when and where questions in your groups...

Think about:

- Your resources: finance, support and volunteers
- Your purpose of monitoring, monitoring goals and objectives
- Ideal vs realistic monitoring plans
- **Other groups across the Wye catchment**



Next steps



Follow up meeting - group discussion about outcomes of today's surveys



Create collaborative monitoring agreement



Plan working groups if required



Create shared resources



Aim to start collaborative monitoring programme in May 2021



Designing a collaborative citizen science monitoring programme for the Wye catchment

Part 2 – Reviewing and refining the scope
of our shared monitoring programme

Plan for this session



Review survey results – similarities and differences



Discuss any differences and explore the solutions



Agree a shared approach

Who responded to the survey?

→ **FOUW** and **FOL** (with support from CU and the EA)

→ **WSA** (with support from CU and the EA)

→ **CPRE**

→ **WUF**

→ **CU**




Your responses...

In what ways would you be willing to contribute to a collaborative monitoring programme?

- Sharing data (100%)
- Sharing learning (100%)
- Sharing non-financial resources (100%)
- The overall design (80%)
- Provision or sharing of equipment (40%)



What should
we monitor
collaboratively?



→ All citizen scientists across
the Wye should monitor a
selection of the same water
quality parameters (100%)

Which parameters should we monitor?



Everyone should monitor:

Phosphate (100%)

Nitrate (100%)

Electrical conductivity/ TDS (100%)

Temperature (100%)

Water level (75% + 25%)*

Optional extras:

Ammonia (0 + 75%)

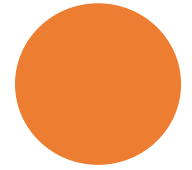
Turbidity (25% + 75%)

Dissolved Oxygen (0 + 75%)

pH (25% + 25%)

Rainfall in mm (25% + 0)

What metadata should we record?



Everyone should record:

Location (100%)

Time (100%)

Date (100%)

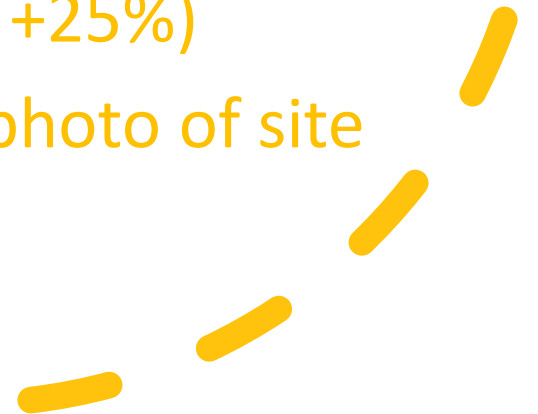
Monitoring equipment used (100%)*

Recent rainfall (descriptive) (100%)

Flow conditions/ water level
(descriptive) (100%)

Optional extras:

- Signs of pollution (75% + 0)
- Presence of rhobunculus (75% +25%)
- Presence and size of algal bloom (75% +25%)
- Fixed point photo of site (25% + 0)





How should we monitor collaboratively?

- More advanced monitoring should be carried out alongside basic monitoring to improve our understanding of the reliability of data (100%)
- Shared training materials and resources should be created so that equipment is used correctly and in the same way across all citizen scientists (100%)

Do you support the idea of a tiered approach to citizen science monitoring equipment options across the Wye?

Yes – 80%

2 tiers vs. 3 tiers...

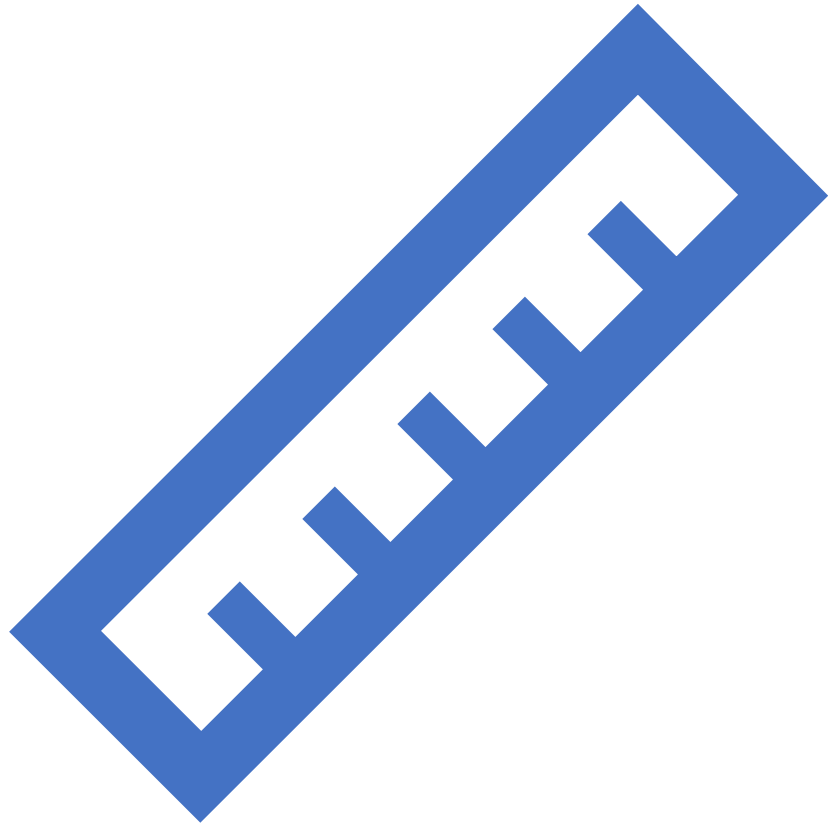
3 tiers – basic, intermediate and advanced

2 tiers – basic and intermediate

Perhaps, it could be a mix depending on the parameter...

So, what are the monitoring equipment options?

- Phosphate
 - Nitrate
 - EC/TDS
 - Temperature
 - Water level
 - Ammonia
 - Turbidity
 - DO
 - pH
- It's important we agree the options for each parameter for this phase of monitoring, so we know what we're working with
 - If anything's not working out, options can change in the next phase



Required
measurements –
equipment options

Phosphate

Basic



LaMotte Insta-test strips

- Range: 0-2.5ppm
- Increments: 0, 0.1, 0.2, 0.3, 0.5, 1, 2.5 (ppm)
- Each pack of 25 comes with a field test tube
- **£38.78** + VAT (for 6 x 25)

Intermediate



Hanna Phosphate Checker

- Range: 0-2.5ppm
- Resolution: 0.01ppm
- Accuracy: ± 0.04 ppm/ $\pm 4\%$ of reading @ 25°C
- Reagents - HI-713-25 (£15/25)
- Calibration checker - HI-713-11 (£22/25)
- **£70** + VAT (plus reagents)

Advanced



Hach DR300 Pocket Colourimeter (Phosphate)

- Range: 0.02 - 3.00 mg/L
- Resolution: 0.01mg/L
- Reagents - powder pillows (£50/100)
- **£560** + VAT (plus reagents)

Nitrate

Basic



Hach water quality test strips nitrate (and nitrite)

- Range: 0- 50ppm
- Increments: 0, 1, 2, 5, 10, 20, 50 (ppm)
- **£15 + VAT (25 tests)**

Intermediate



Hach Nitrate test kit (NI-11) Colour wheel

- Range: 0-40mg/L
- Resolution: 1mg/L
- Reagents: £37 for 100
- **£118 + VAT (100 tests+)**

Advanced



Hach DR300 Pocket Colourimeter (Nitrate)

- Measuring range: 0.4 - 30.0 mg/L NO₃-N)
- Resolution: 0.01mg/L
- Reagents - powder pillows (£50/100)
- **£560 + VAT (plus reagents)**

EC and Temperature

Basic



Intermediate



Advanced



HM Digital EC-3 meter

- EC Range: 0 – 9990 μS ($\mu\text{S}/\text{cm}$)
- Increments: 1 $\mu\text{S}/\text{cm}$ up to 1000; 10 $\mu\text{S}/\text{cm}$ > 1000
- Temp. Range: 0 – 80 degrees C
- Accuracy: +/- 2%
- **£15 each**

HM Digital EC-3 meter

- Range: 0 to 2000 $\mu\text{S}/\text{cm}$
- Resolution: 1 $\mu\text{S}/\text{cm}$
- Accuracy +/- 2%
- **£80 each** + calibration solution

Hach pocket pro+ multiparameter

- Range: 0 to 2000 $\mu\text{S}/\text{cm}$
- Accuracy: Cond: $\pm 1\%$; pH: ± 0.01
- pH; Sal: $\pm 1\%$; TDS: $\pm 1\%$; Temp: ± 0.5 °C
- **£205 each** + calibration solution

Water depth (fixed point)

Water depth gauge

- Various options
- Approx. £80

Existing local depth gauge

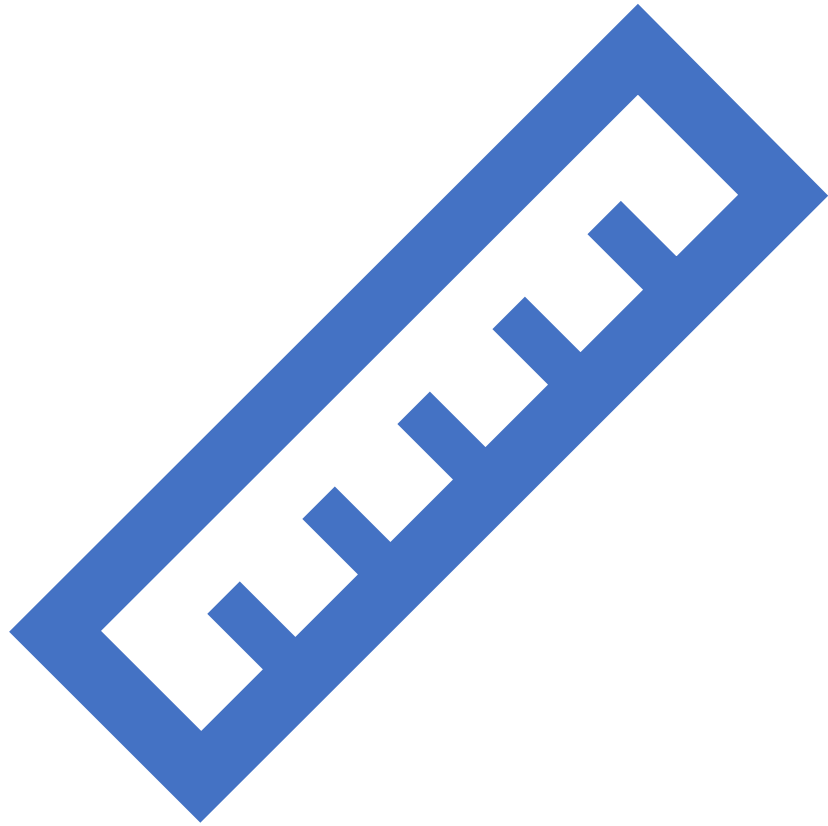
- Free

Local gauging stations

- Some online data available for free

Visual assessment

- Free



Optional
measurement –
equipment options

Ammonia

Basic



Hach water quality test strips ammonia

- Range: 0- 6ppm
- Increments: 0, 0.25, 0.5, 1, 3, 6 ppm
- **£15 + VAT (25 tests)**

Intermediate



Hanna Ammonia Checker

- Range: 0-3ppm
- Resolution: 0.01ppm
- Accuracy: ± 0.05 ppm $\pm 5\%$ of reading
- Reagents - HI-700-25 (£15/25)
- Calibration checker - HI-700-11
- **£70 + VAT (plus reagents)**

Advanced



Hach DR300 Pocket Colourimeter (Ammonia)

- Measuring range: 0.01 - 0.80 mg/L NH₃-N
- Resolution: 0.01mg/L
- Reagents - powder pillows (£50/100)
- **£560 + VAT (plus reagents)**

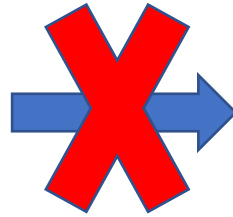
Turbidity

Credit: Eamon Bourke, FOUW



Secchi tube

- Build your own for approx. £4
- Buy for £60



Turbidity sensors

- Very expensive

Dissolved Oxygen

Basic



JBL Dissolved Oxygen Test kit

- Range: 0.2- 10 mg/L
- Increments: 0.2, 1, 2, 4, 6, 8, 10ppm
- **£15** (40 tests)



Advanced



Lutron Dissolved Oxygen Meter

- Accuracy (dissolved oxygen): ± 0.4 mg/L
- Accuracy (temperature): ± 0.8 °C
- Sensor type: Polarographic
- **£140**

pH

Basic



Simplex water wide-range water pH test strips

- Range: 2-12 pH
- Increments: 2, 3, 4, 5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 11, 12 pH
- **£13** for 15 tests

Intermediate



HM Digital pH meter (PH-80)

- pH (accuracy +/- 0.2 pH) and temperature (+/-2%)
- **£30** + calibration solution

Advanced



Pocket ISFET pH Meter

- Accuracy: +/- 0.1pH
- Range: 2-12pH
- Resolution: +/- 0.1pH Unit
- **£180** + calibration solution

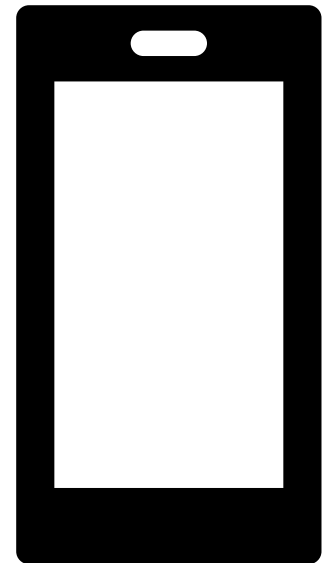


How should we collect data collaboratively?

- Those in the collaborative monitoring network should be able access data collected by other groups in the network (100%)
- A standard set of questions should be included in the 'form' (survey) created by each citizen science group (100%)
- Epicollect should be used as the main data collection platform (80%)
- Each group should manage their own 'project' on epicollect (75%)

An example epicollect survey form

- Demo project form
 - Go to epicollect on your phone app
 - Add this project: EXAMPLE Wye Citizen Science Water Quality Project
 - Have a play!
- What changes would you like made?





Who will
monitor
collaboratively?

- Volunteer citizen scientists engaged, recruited, supported and insured by groups across the catchment (100%)
- Cardiff university intend to carry out supportive monitoring with the support of citizen scientists across the catchment...

Cardiff's supportive monitoring plan



Deploy sondes to measure EC, temperature, DO, turbidity and depth at various citizen science monitoring sites



Send monthly samples from citizen science monitoring sites to an accredited lab for phosphate and nitrate analysis

Technical training for volunteers

- Cardiff university will lead on collating shared resources to cover the technical aspects of training for volunteers so that everyone follows the same methods and protocols (100%)
- Training resources in the form of video recordings, written guidance, training sessions (100%)

Volunteer management: engagement, recruitment, support and insurance

This will be the responsibility of those coordinating each monitoring group

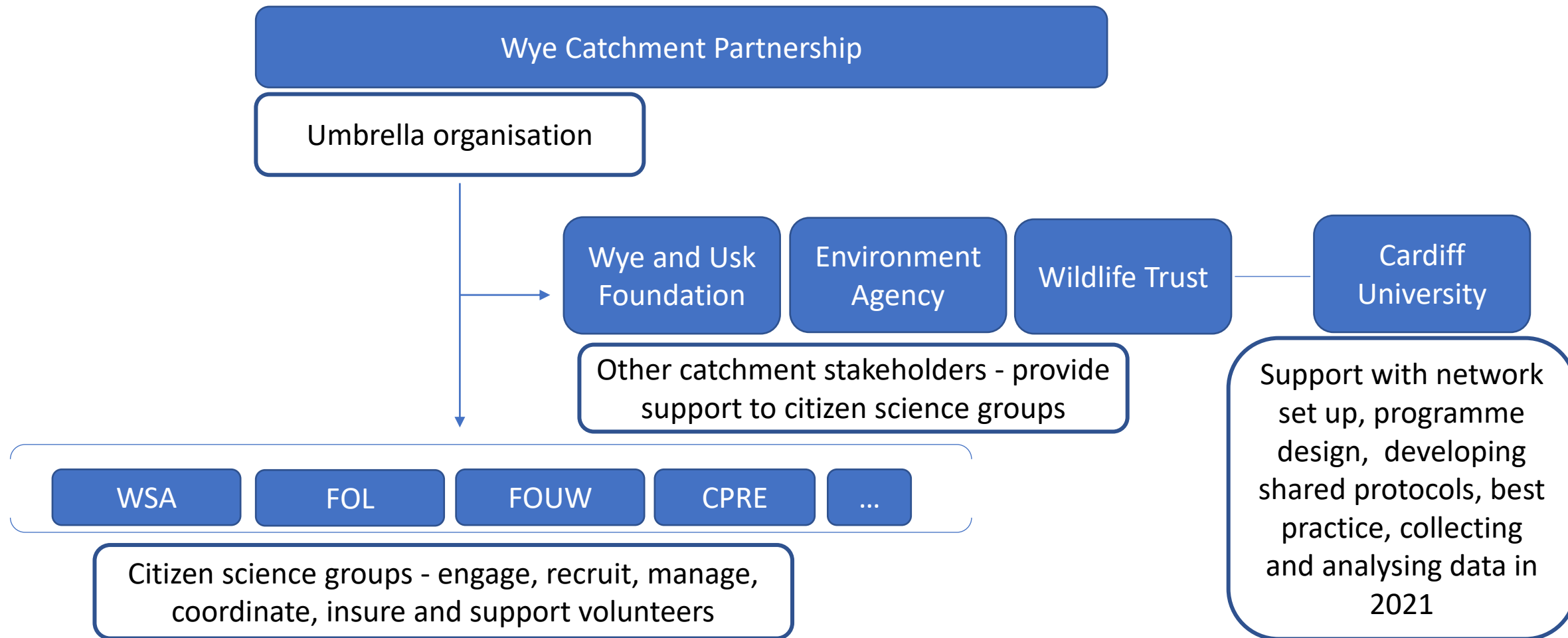
This is beyond the remit of Cardiff


Does your group need support with this?

If so, where might you be able to seek support?


The Wye Catchment Collaborative Monitoring Network

Who's involved and what does its structure look like so far?





When will we
monitor
collaboratively
and for how
long?

- 
- All groups will monitor and share data with other in the collaborative monitoring network for an initial 6-month period (100%)

Do you support the idea of having a mass sampling day once each month?

Yes – 80%

This could be a proportion of volunteers but not mandatory for everyone

Mass sampling is required to some degree for Cardiff's current monitoring plan

Volunteers could be asked to go out at the same time once a month *within a window*

What's the minimum amount of sampling each citizen scientist should be asked to do?


Recommended minimum:

- Once a month (40%)
- Once a fortnight (20%)
- Once a week (20%)
- Don't know (20%)

Encouraged frequency:

- Once a week (40%)
- > Once a week (40%)
- Don't know (20%)





Where will we monitor across the Wye?

- Each group should select one or more focus sub-catchments (60%)*
- Exact monitoring sites should be chosen through discussion with each new volunteer citizen scientists (80%)
- Sites chosen should be based on volunteer requirements, other monitoring sites (EA and cit sci) and known sites of interest
- All citizen scientists should monitor the same site(s) for the duration of the 6-month programme (80%)



Where is your group planning to focus its monitoring efforts..?

Tips for selecting monitoring sites...



You might need to do some more research to find out where to focus...



The Wye catchment is very big(!)- the more volunteers you can get monitoring the same sub-catchment the clearer the picture of what's going on there will be



Use EA, NRW and other organisation's existing or planned monitoring sites to help plan



'Priority' subcatchments are worth considering but so are understudied catchments...



When selecting sites think about volunteers safety, access etc

Things remaining to discuss in groups

- Will we ask all volunteers to try and measure water level using one of the approaches described?
- Will we ask all volunteers to note the presence of pollution, presence and size of algal bloom and presence of Ranunculus?
- Are people happy with the tiered equipment options as presented? What (if any) changes would you like to see?
- How should we develop a standard set of questions?
- Is everyone on board with the idea of some citizen scientists being asked to go out on the same day each month to collect data and a water sample for analysis in the lab?
- What should the agreed minimum monitoring frequency for any volunteer be?
- Do you know where you're going to focus your monitoring efforts (which tributaries or sub-catchments) or know how you're going to decide?



Next steps

Cardiff univeristy

- Draft and share a collaborative monitoring agreement
- Work on developing training resources for everyone to use

Citizen science groups

- Make plans to recruit, train, equip and support your volunteers for the duration of the first stage of the collaborative monitoring programme