



The West Midlands Combined Authority Regional Air Quality Sensor Network

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4th November 2025

The West Midlands Combined Authority

- Established in 2016
- Directly elected Mayor from 2017
- Current Mayor: Richard Parker
- 7 constituent local authorities

Air Quality in the West Midlands

- The 2020 WMCA 'Health of the Region' report outlined that air quality is one of the wider determinants of health for vulnerable people in the region.
- Historically the focus on addressing air quality has been around lowering NO_x and NO₂ emissions through transport interventions etc. However, now focusing wider sources which contribute to PM_{2.5} concentrations within the region such as domestic combustion.



WMCA Air Quality

- In 2023 the WMCA air quality framework was adopted after being developed with key regional stakeholders.
- The Framework aims to bring a strategic and regional approach to addressing air pollution with a focus on particulate matter.
- It has 9 key work packages including one on monitoring and digital engagement.
- The WMCA also received over £1 million from Defra and MHCLG to start delivering air quality actions.



Care for our air.

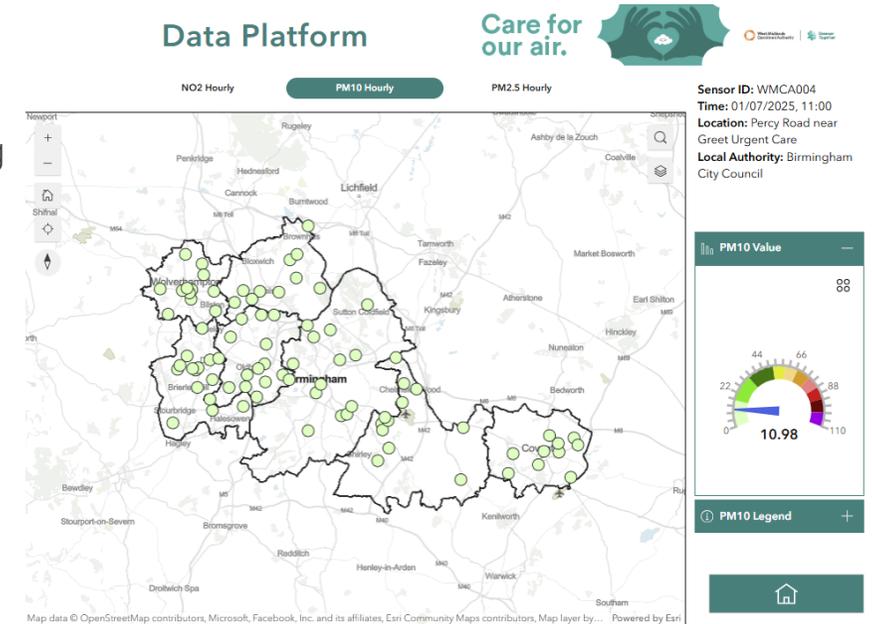
Air Quality Sensor Network – Aims & Target Audience

Network Aims

1. Contribute to improving the health and wellbeing of those who live and work in the West Midlands through the dissemination of air quality data and information in an accessible and understandable way.
2. To improve spatial coverage of particulate matter monitoring across the West Midlands region gaining a better understanding of pollutant levels.

Key User Groups

- **The public** – To understand what air quality is like in their area and gain an understanding of how to reduce their personal exposure and their contribution to local air pollution.
- **The NHS** – To aid clinicians in understanding what air quality is like within the vicinity of their healthcare centre, helping to provide relevant advice and information to patients most vulnerable.
- **Local Authority Officers** – To gain a greater understanding on where potential PM_{2.5} hotspots are within their administrative area, providing a more targeted approach to addressing pollutant concentrations.



Air Quality Sensor Network – Key requirements & Procurement

Key requirements

- Install, manage, and maintain sensors, including replacing and fixing monitors at no additional cost to the WMCA for the duration of the contract (5 years).
- MCERT standard sensors for particulate matter.
- Develop a sophisticated QA/QC system to ensure ‘real time’ data is accurate, consistent and reliable.
- Consistently supply data to the [WM air quality data dashboard](#).
- Sensor supplier to provide insurance for the monitors in relation to damage, theft, and vandalism etc., as well as

Procurement Challenges

- Finding a sensor supplier who could demonstrate previous experience in installing, managing, and maintaining, a sensor network.
- Finding a supplier who was willing to take on all insurance requirements and replacing / fixing monitors like for like throughout the contract.
- Understanding what reasonable KPI thresholds were in terms of data coverage, quality, and transmission, while ensuring the network was reliable and accurate as possible
 - Found PAS 4023 to be ambiguous and hard to understand without a technical background in air quality monitoring.

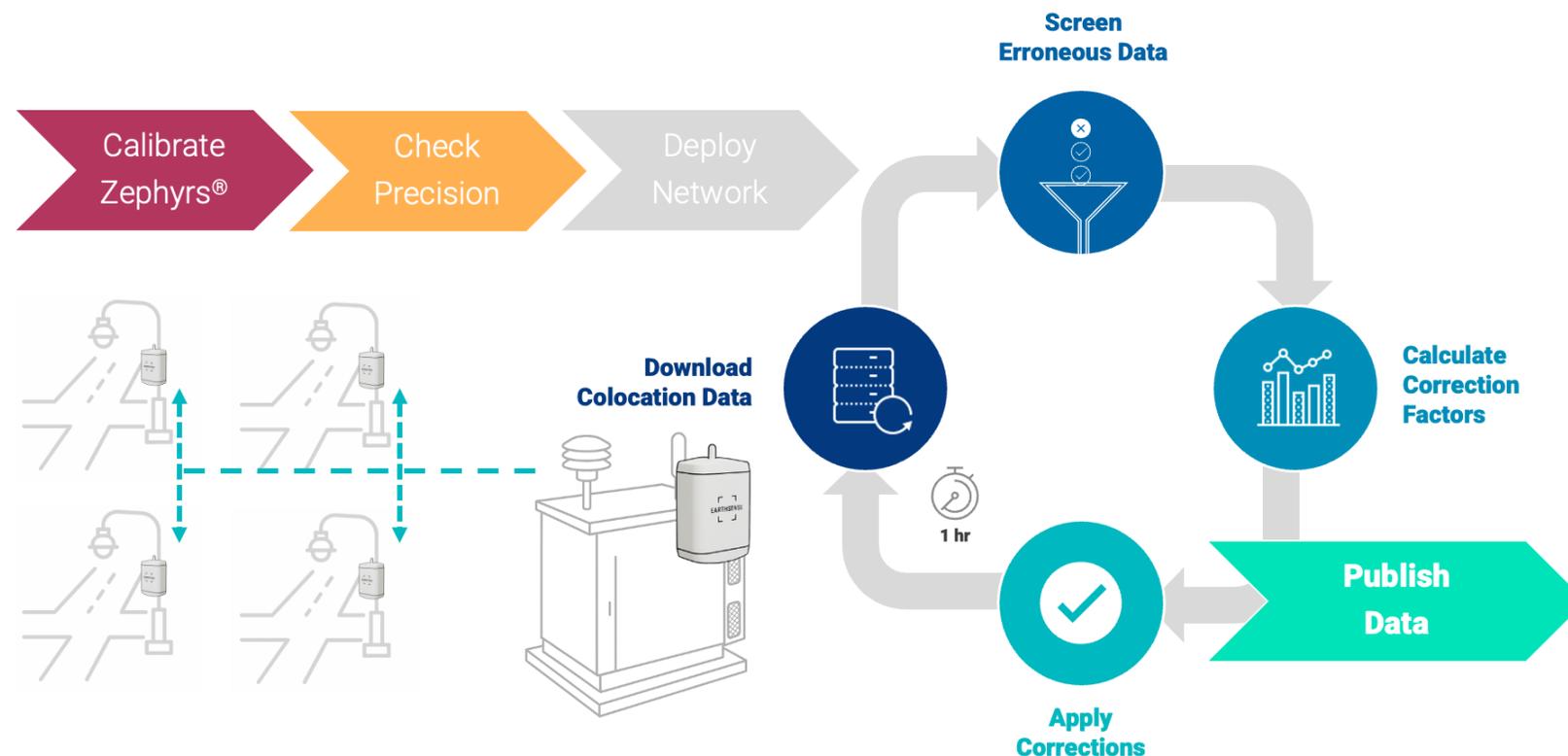
Utilisation of the Sensor Network

Stakeholder	Utilisation of Data
Local Authorities	<ul style="list-style-type: none"> Investigating PM_{2.5} hotspots. Supplementing LA monitoring for statutory duties. Aiding in air quality engagement with the public.
WMCA / TfWM	<ul style="list-style-type: none"> Provide a regional perspective on air pollutants across the West Midlands. Monitor potential impacts from transport schemes. Advising senior leaders on air pollution across the region.
NHS	<ul style="list-style-type: none"> Understanding trends in air pollutants near NHS sites and utilising data in estates reporting and Green Plans. Using data to start conversations on air quality with staff and patients through the WM air data dashboard.
Schools	<ul style="list-style-type: none"> Understanding trends in air pollutants directly outside schools and in the catchment area, helping identify potential mitigation measures. Using the data through the platform to engage children and parents on air quality.

Practical Guidance on QA/QC for indicative sensor networks

Agenda

- Project requirements
- Evaluating the guidance
- Installing the network
- QAQC process
- Progress review
- Opportunities ahead



Quality Assurance (QA) **Preventing Problems**

QA in the context of air quality monitoring focused on establishing processes, protocols and calibration routines to ensure data quality is good from the outset.

By proactively implementing QA, the aim is to minimise errors before they are available to the end user.

Quality Control (QC) **Detecting and Correcting Problems**

QC focuses on evaluating the collected data to ensure it meets the defined performance criteria.

By implementing reactive QC, the aim is to catch errors and resolve issues before they worsen.

Our Requirements

- Supply IAPM MCERTs accredited Air Quality Sensors to monitor PM₁₀ and PM_{2.5}
- Network Installation
- Quality Assured data feeds, close to real-time
- Maintenance and breakdown cover
- Annual network verification / ratification

Key KPIs

- Demonstrate compliance with IAPM MCERTS
- Ensure high levels of data capture
- Provide stable and available data feeds for WMCA to update their data hub / portal

5-year project



Evaluating the guidance

We wanted to ensure that all areas that could affect data quality were addressed, and where available, suitable guidance and performance standards followed.

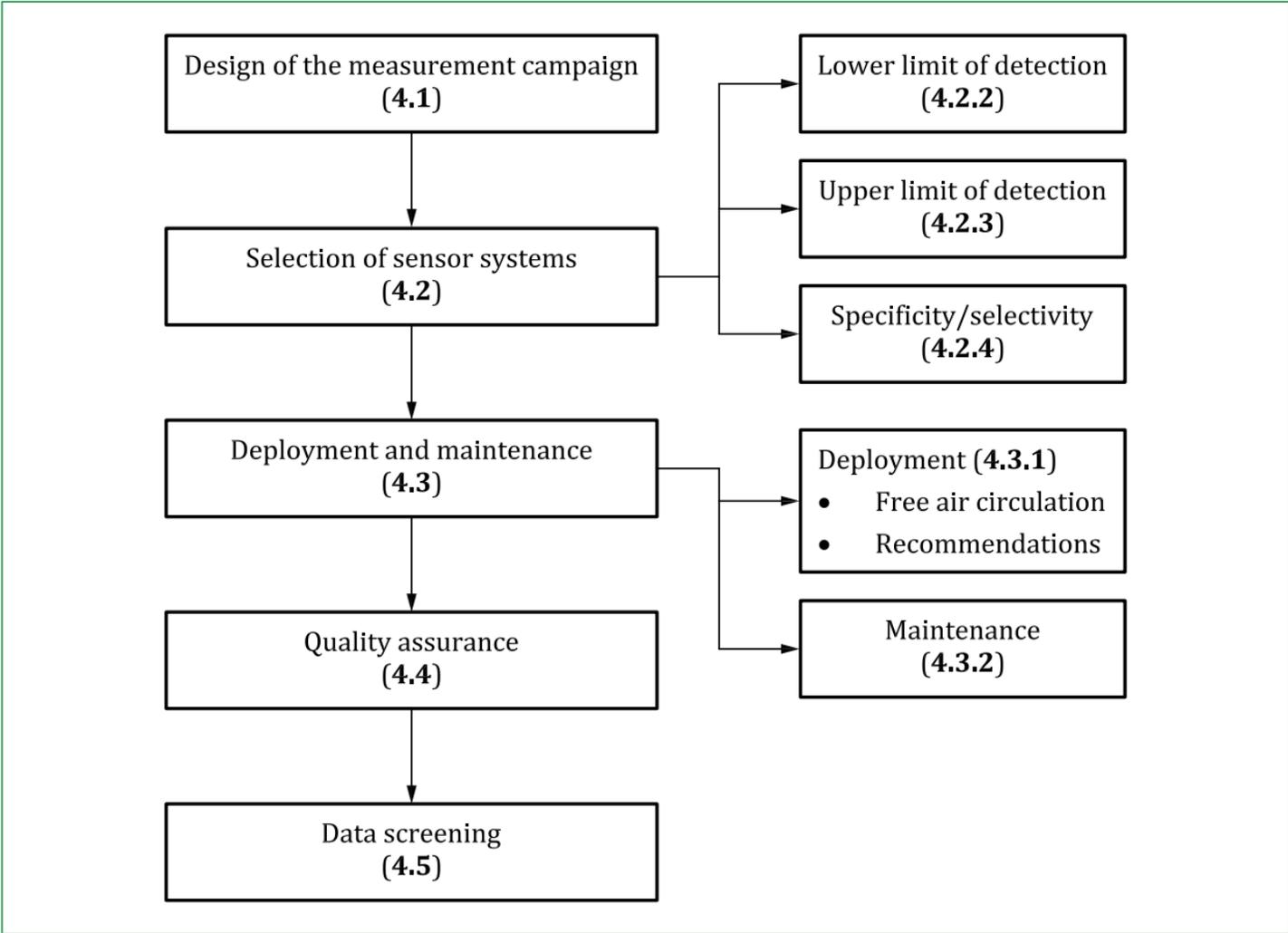
- **DEFRA | PAS 4023:2023** - Selection, deployment and quality control of low-cost air quality sensor systems in outdoor ambient air.
- **EA | Performance standards for Indicative Ambient Particulate Monitors**



Evaluating the guidance



Figure 1 – Steps to performing a measurement campaign



Evaluating the guidance

Raw Measurements

Quality Assured

Citizen Science:

- Short research field studies
- Precise measurements are less important than indication of pollutants presence or absence

Essential QA Measures

These should be provided by the sensor manufacture but comparability can also be tested ad-hoc at the start of the project with a colocation.

Intervention Study:

- Pre- & post-planning impact studies
- Hot spot identification
- Identification of change

More precise and stable measurements are required to allow the quantification of pollutant concentration and detect changes in concentrations

Long-term screening of areas:

- First stage in local air quality management, town/city wide networks
- Good data quality with known uncertainties

continuous, or pre- / post-assessment comparison with reference analysers. Applied correctly, known uncertainties will ensure data is quantitative and traceable

Pressure

Coordination and Installation

Contract Start: July 2024

First Zephyr Installed: 1st August 2024

Final Zephyr Installed: 18th December 2024

Site Permissions

Finding the person responsible and agreeing installation parameters

Site Suitability

Structural surveys, physical surveys, availability of power.

Installation

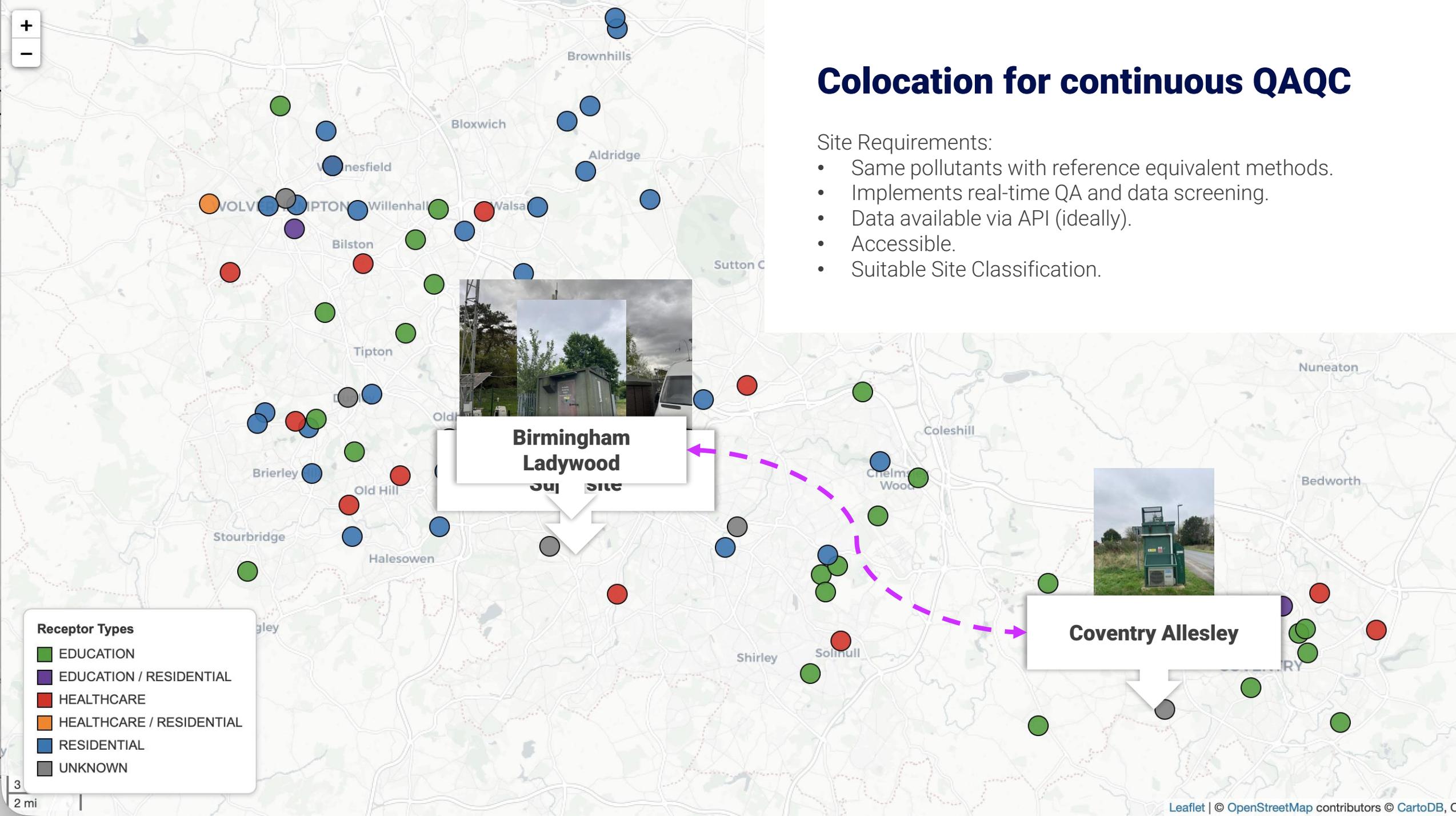
Height equipment, road closures, access, unmetered power register.



Colocation for continuous QAQC

Site Requirements:

- Same pollutants with reference equivalent methods.
- Implements real-time QA and data screening.
- Data available via API (ideally).
- Accessible.
- Suitable Site Classification.

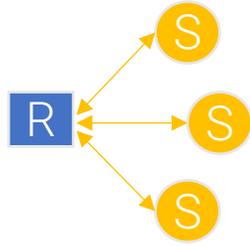


Receptor Types

- EDUCATION
- EDUCATION / RESIDENTIAL
- HEALTHCARE
- HEALTHCARE / RESIDENTIAL
- RESIDENTIAL
- UNKNOWN

Calibration Options

Reference 
Sensor 
Transfer Sensor 



Periodic Colocation

Adjusts for short-term weather shifts?



All Sensors tested at the same time?

Possible

All Sensors tested against reference?



All Sensor tested at their monitoring site?



Equipment Costs

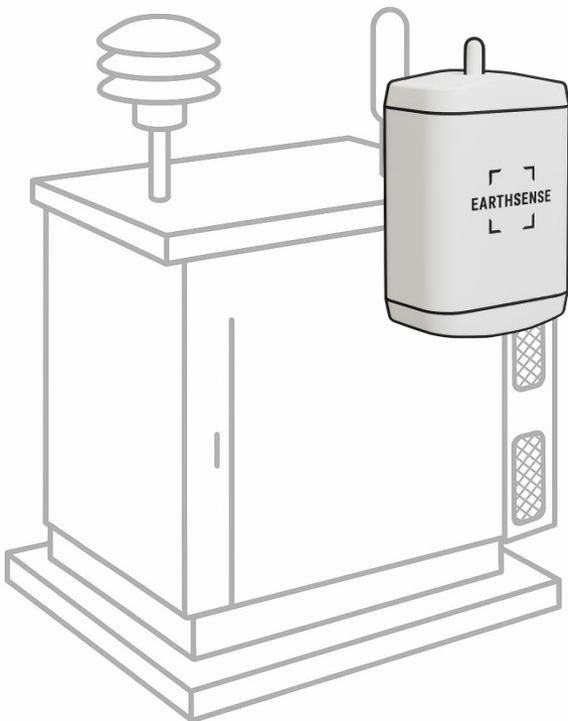
£

Engineering Costs

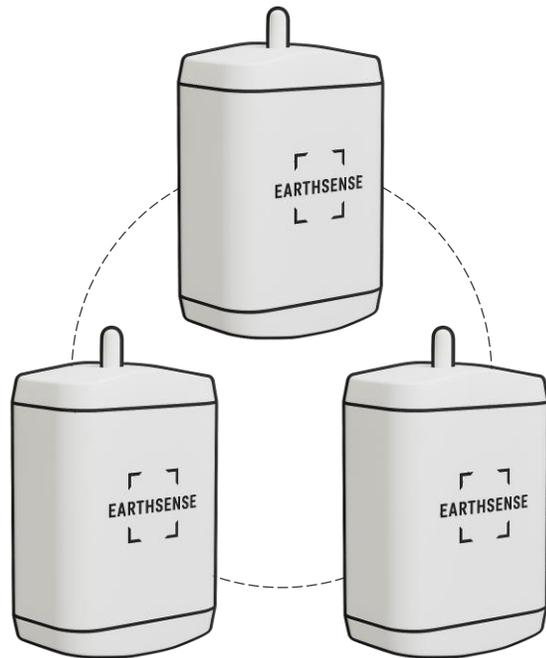


Real-Time QAQC

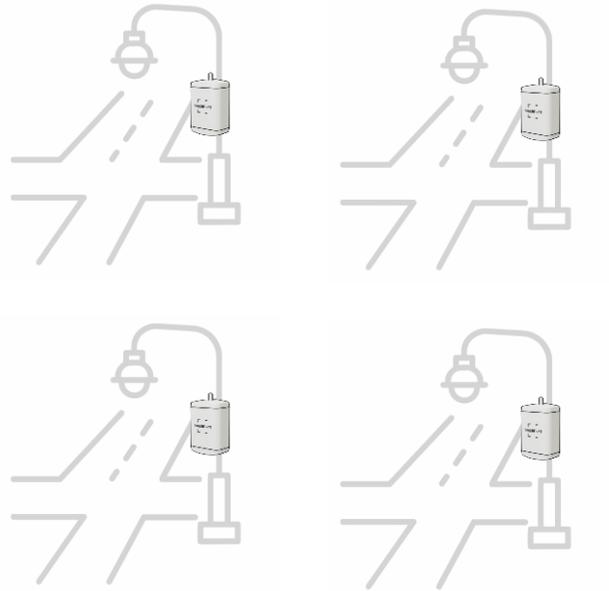
Calibrate
Zephyrs®



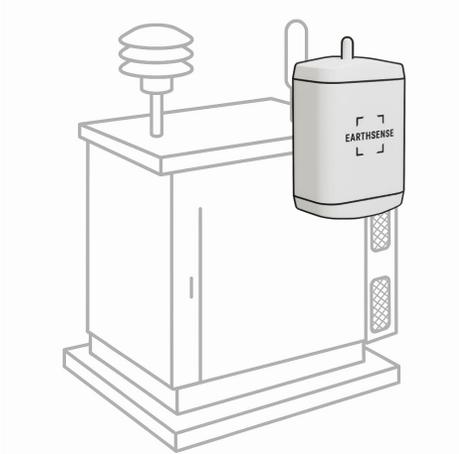
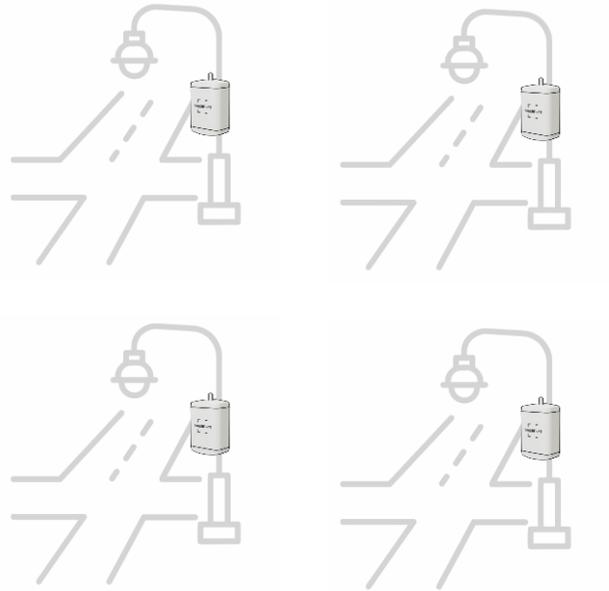
Real-Time QAQC



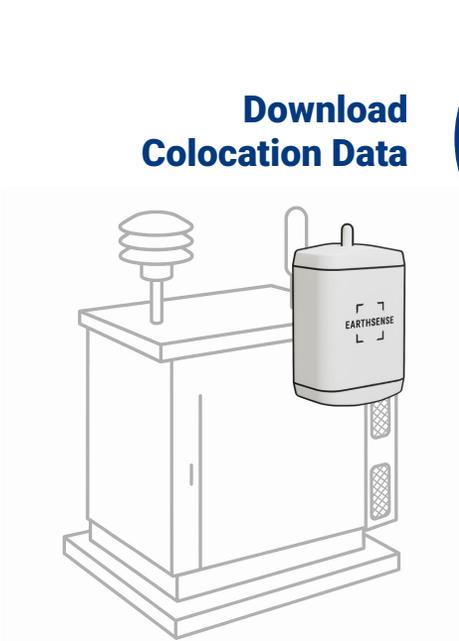
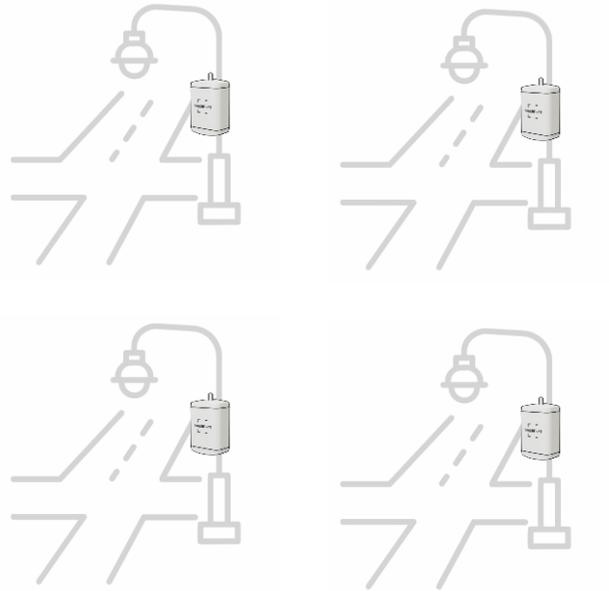
Real-Time QAQC



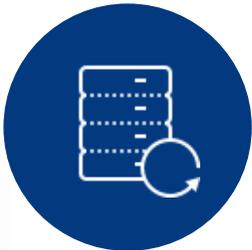
Real-Time QAQC



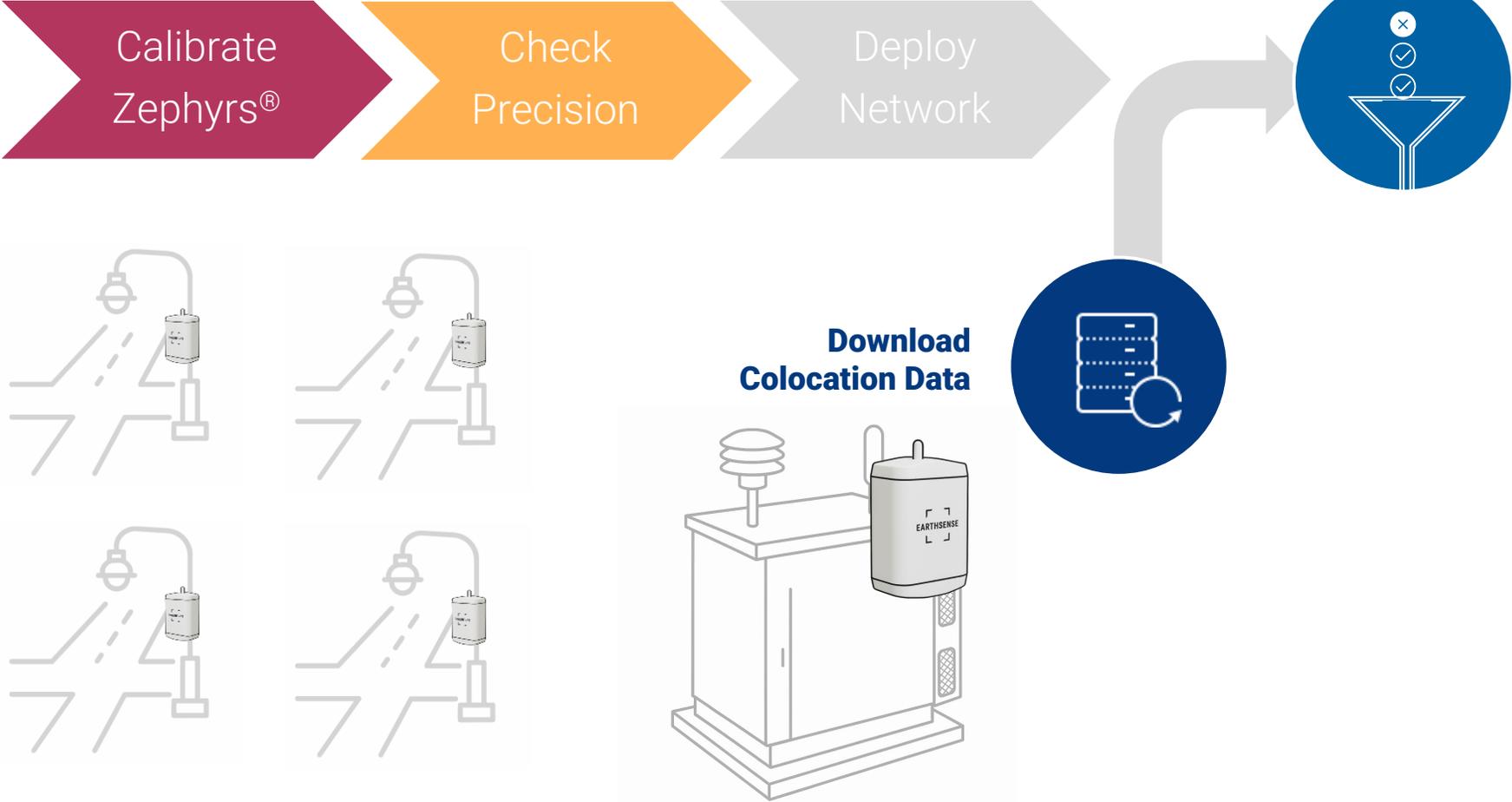
Real-Time QAQC



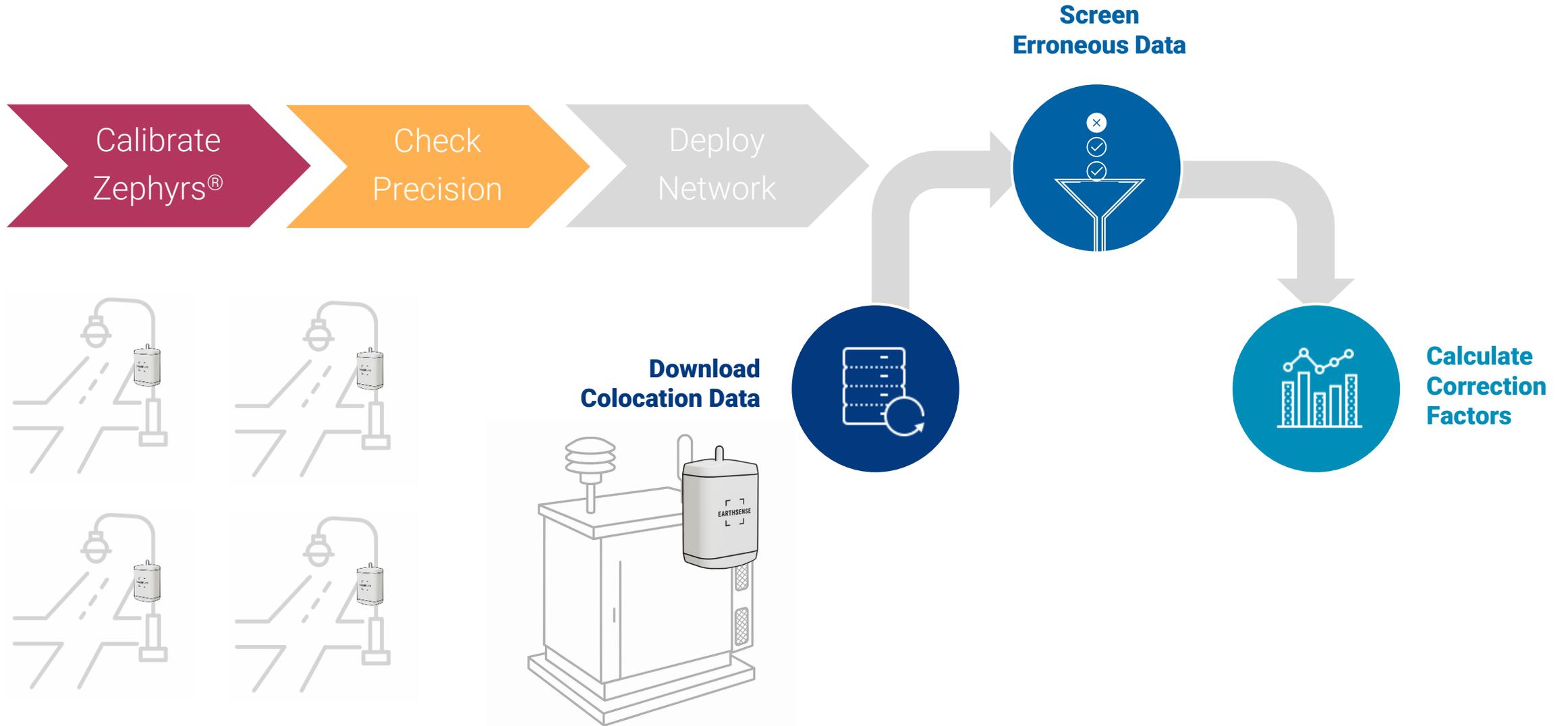
Download Colocation Data



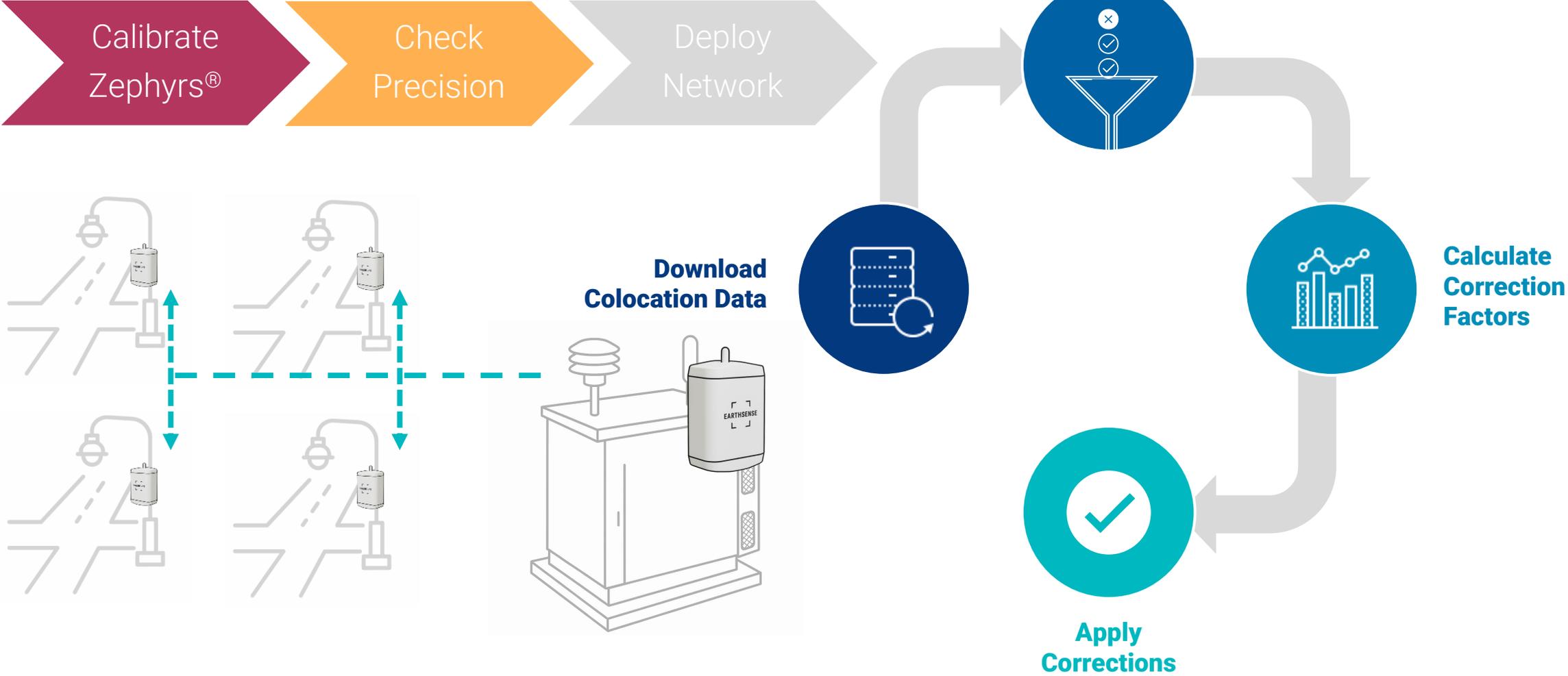
Real-Time QAQC



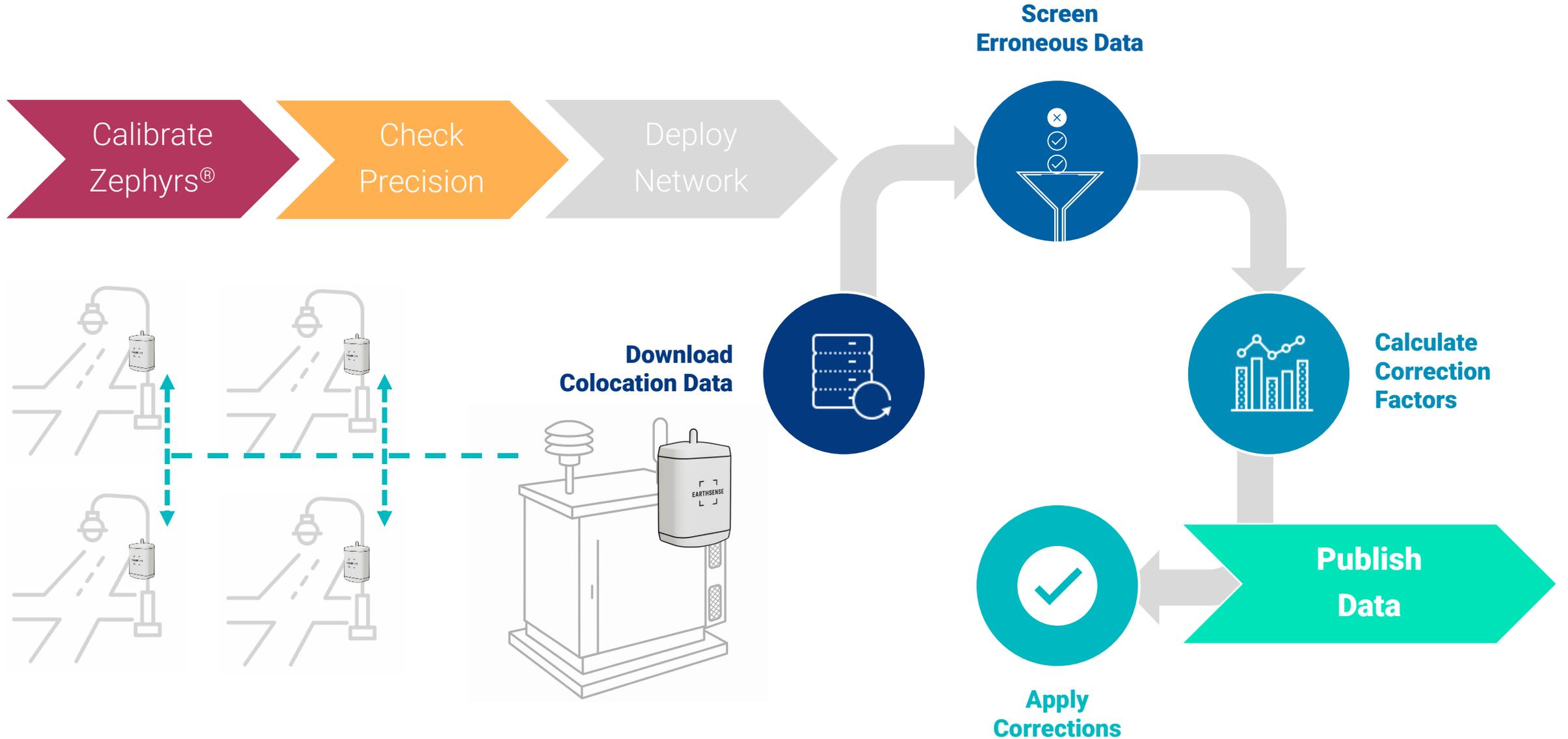
Real-Time QAQC



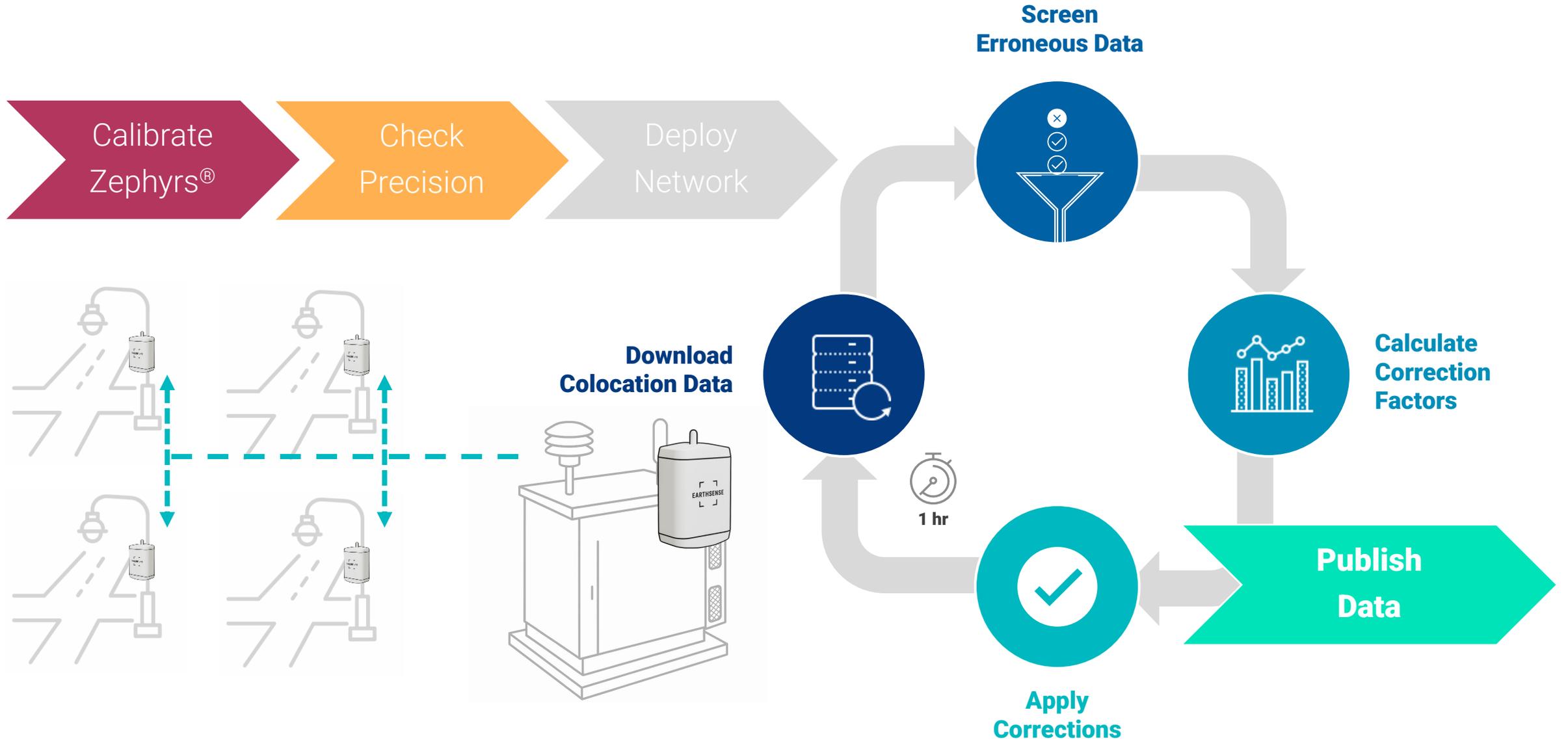
Real-Time QAQC



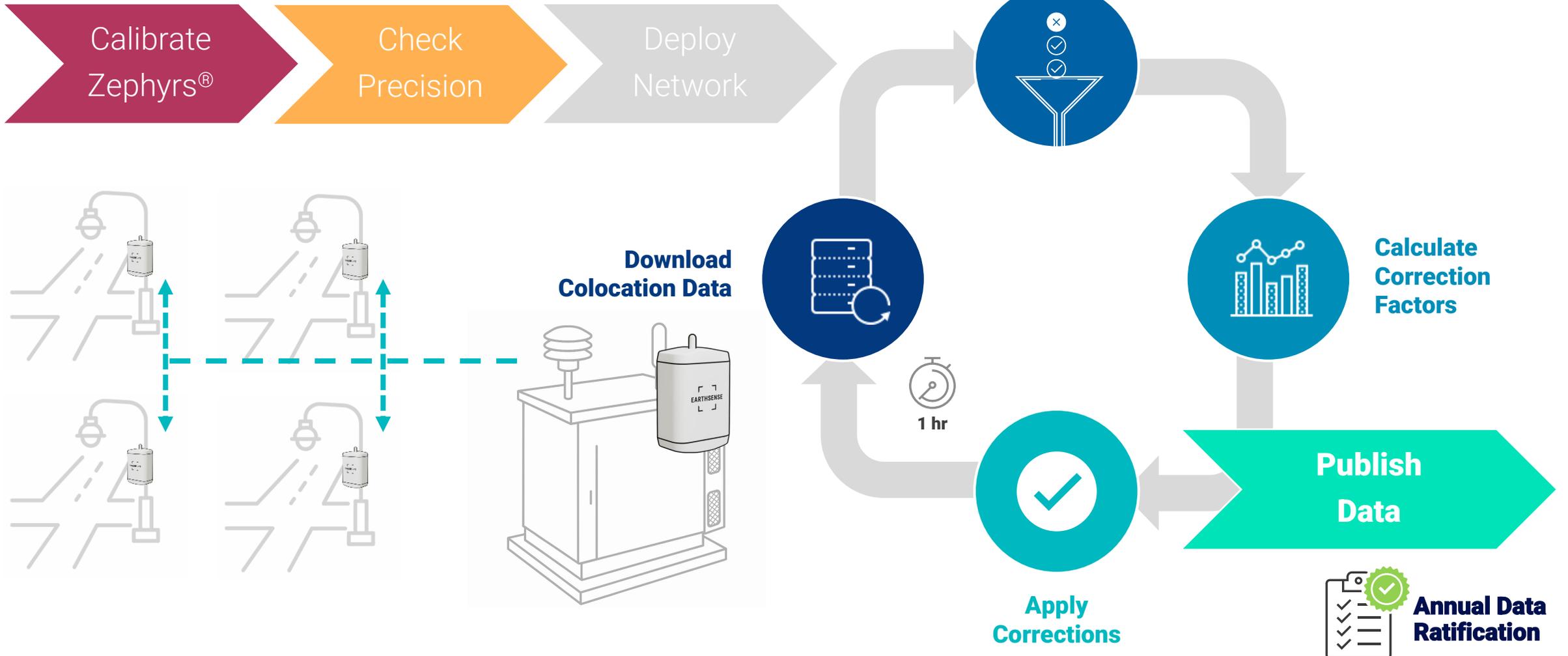
Real-Time QAQC



Real-Time QAQC



Real-Time QAQC



Network Precision

Table 3. Co-location between sensor uncertainty cohort results for each pollutant

Pollutant	Pass Criteria	Between Sensor Uncertainty ($u(bs, s)$)
Ozone (O3)	$\leq 8\mu\text{g}/\text{m}^3$	$2.56 \mu\text{g}/\text{m}^3$
Nitric Oxide (NO)	$\leq 5\mu\text{g}/\text{m}^3$	$2.32 \mu\text{g}/\text{m}^3$
Nitrogen Dioxide (NO2)	$\leq 7.6\mu\text{g}/\text{m}^3$	$2.34 \mu\text{g}/\text{m}^3$
Particulate Matter (PM _{2.5})	$\leq 5\mu\text{g}/\text{m}^3$	$0.34 \mu\text{g}/\text{m}^3$
Particulate Matter (PM ₁₀)	$\leq 5\mu\text{g}/\text{m}^3$	$0.64 \mu\text{g}/\text{m}^3$

Standard:



**CEN.TS 17660-
:2021**



IAPM MCERTS

Monthly Reports

Data Capture Rates

Consistently delivering well above 85% KPI.

PM_{2.5} and PM₁₀ Accuracy & Uncertainty

Provided for both corrected and uncorrected data.

NO₂, NO and O₃ Accuracy & Uncertainty

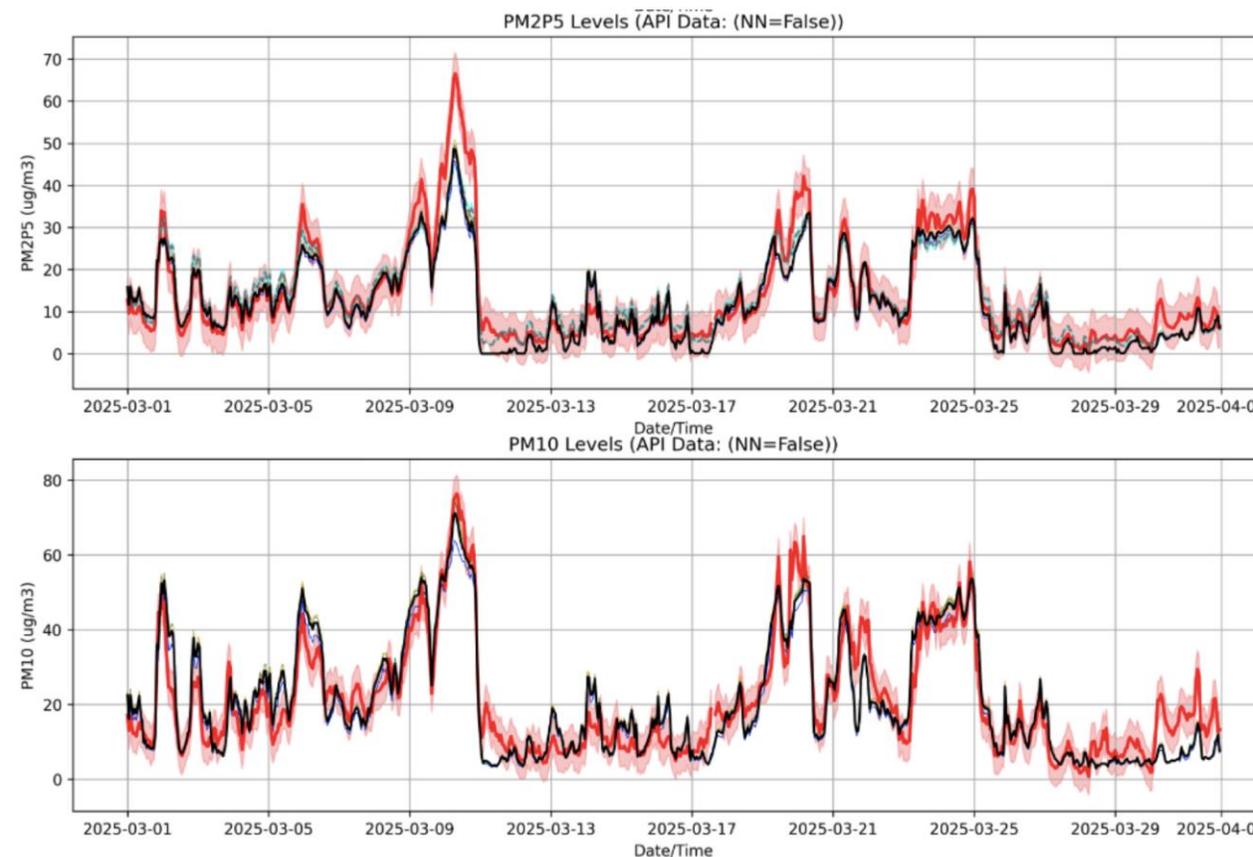
Provided for both corrected and uncorrected data.

API Uptime Statistics

Is the data available when it needs to be.

Support Tickets

Details of support interventions and resolution times.



Challenges / Things to consider

- ✓ Budget time for project coordination.
- ✓ Ensure QAQC method supports desired outcomes.
- ✓ If using a colocation, do your homework.
- ✓ Good data is just the beginning.



Unblocking the challenges

- ❑ Improved colocation opportunities.
- ❑ Indicative MCERTS scheme for Gases.
- ❑ Regional co-ordination.
- ❑ Long-term thinking.

TECHNICAL SPECIFICATION
SPECIFICATION TECHNIQUE
TECHNISCHE SPEZIFIKATION

CEN/TS 17660-1
December 2021

ICS 13.040.20
English Version

of air quality sensor

Adderley Primary

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels
Ref. No. CEN/TS 17660-1:2021 E

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Engaging the community

- ❑ Simplify the message to improve AQ Literacy – Focus on positives.



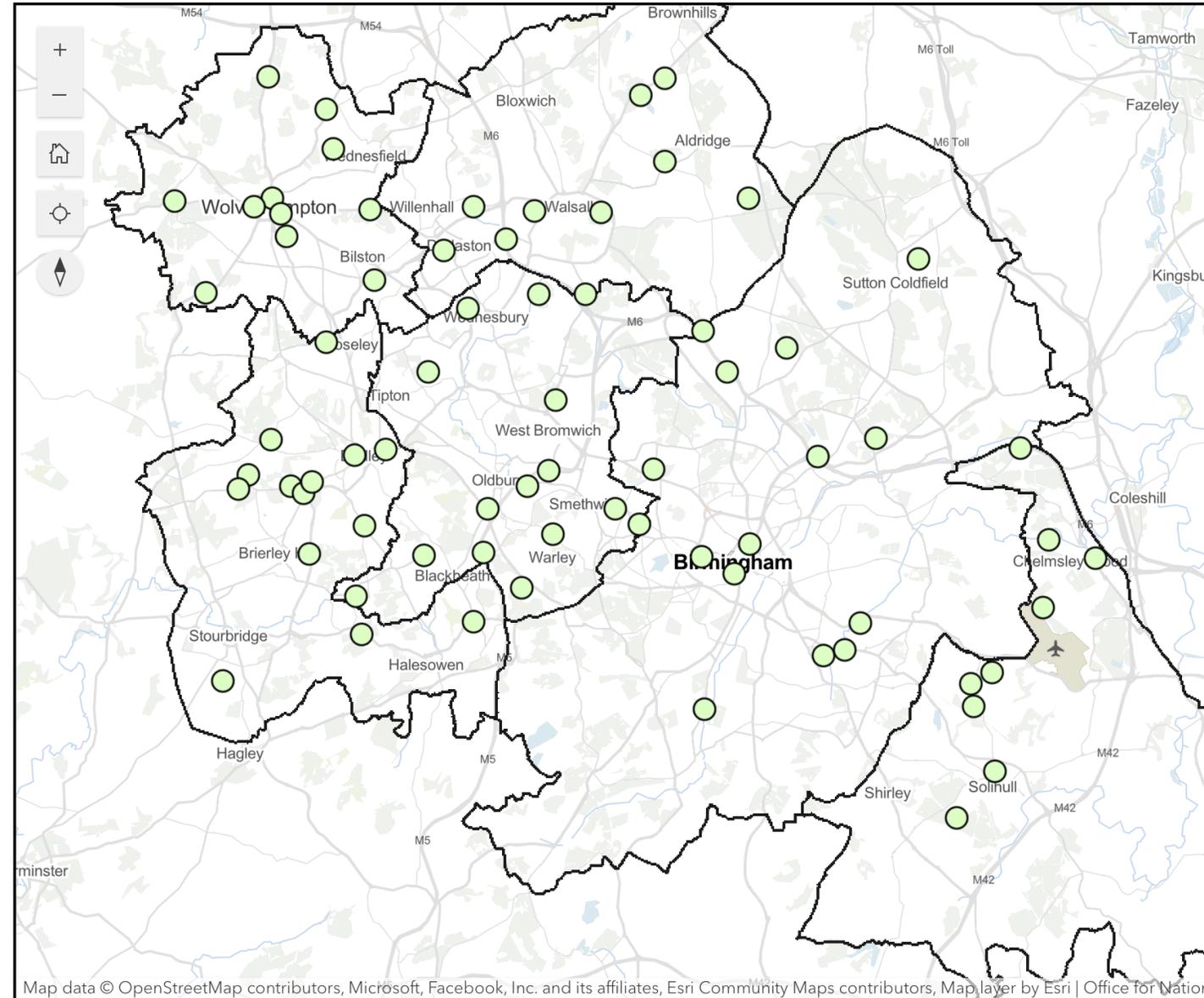
Data Platform

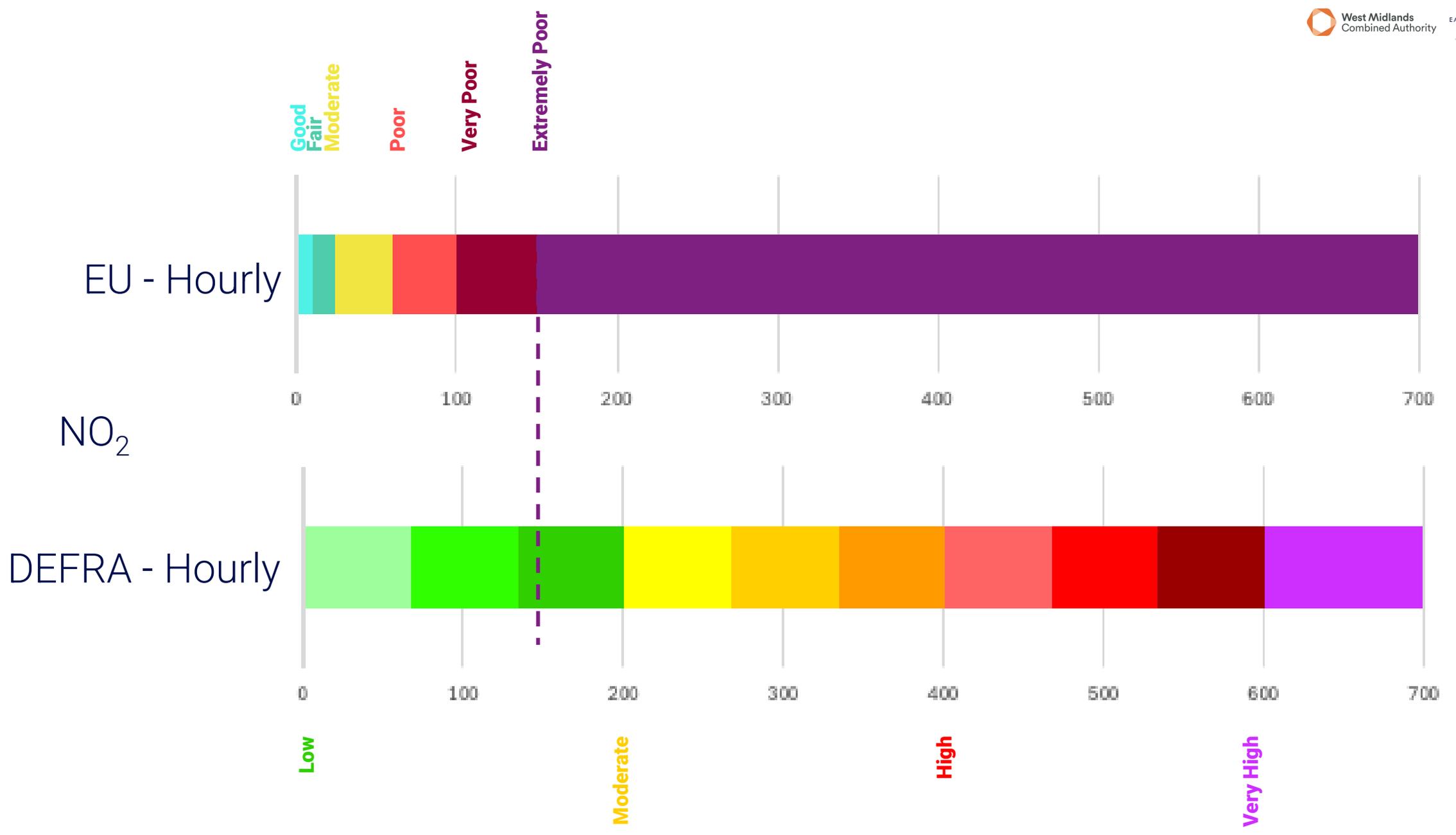
NO2 Hourly

PM10 Hourly

Engaging the community

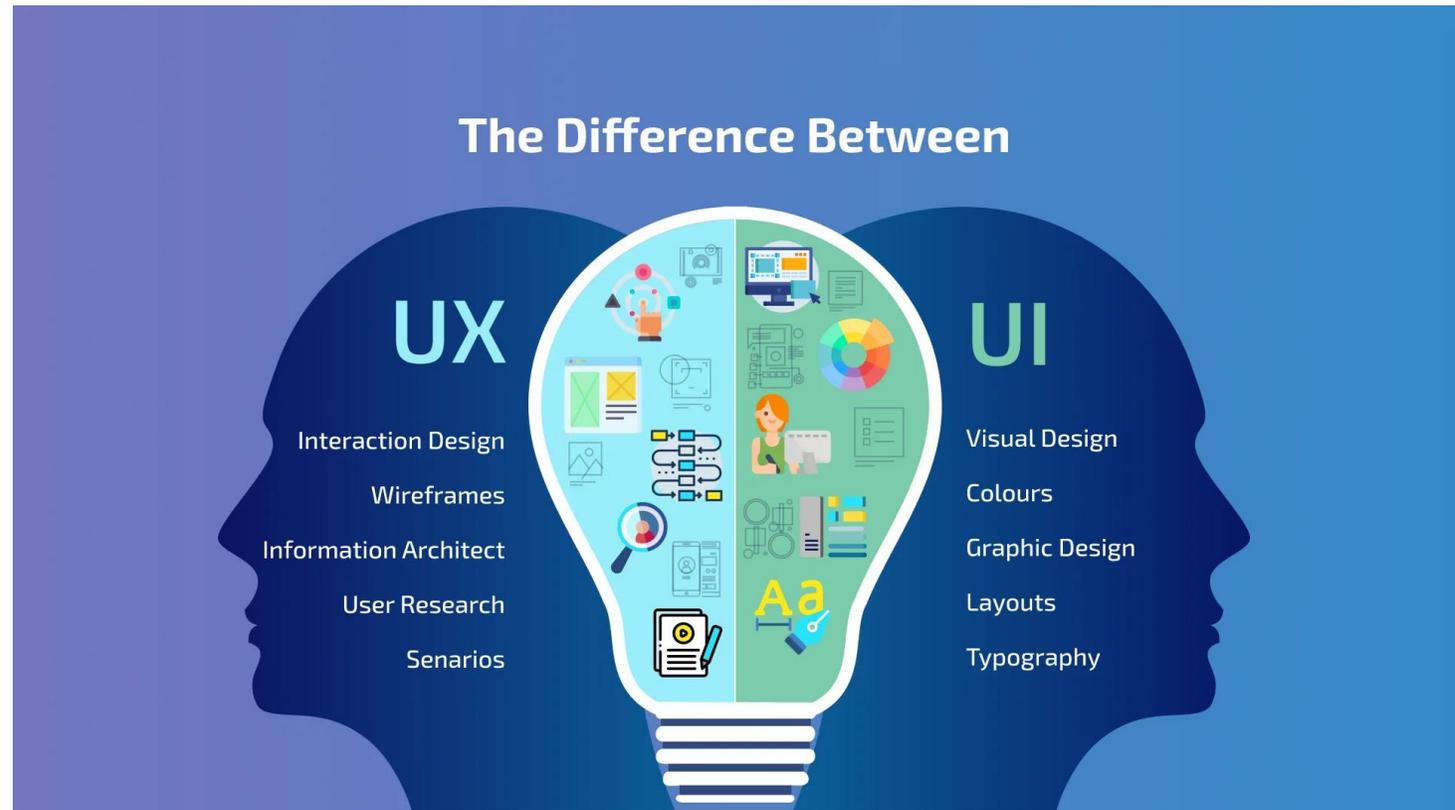
- Simplify the message to improve AQ Literacy – Focus on positives.
- Support AQIs that mean something.





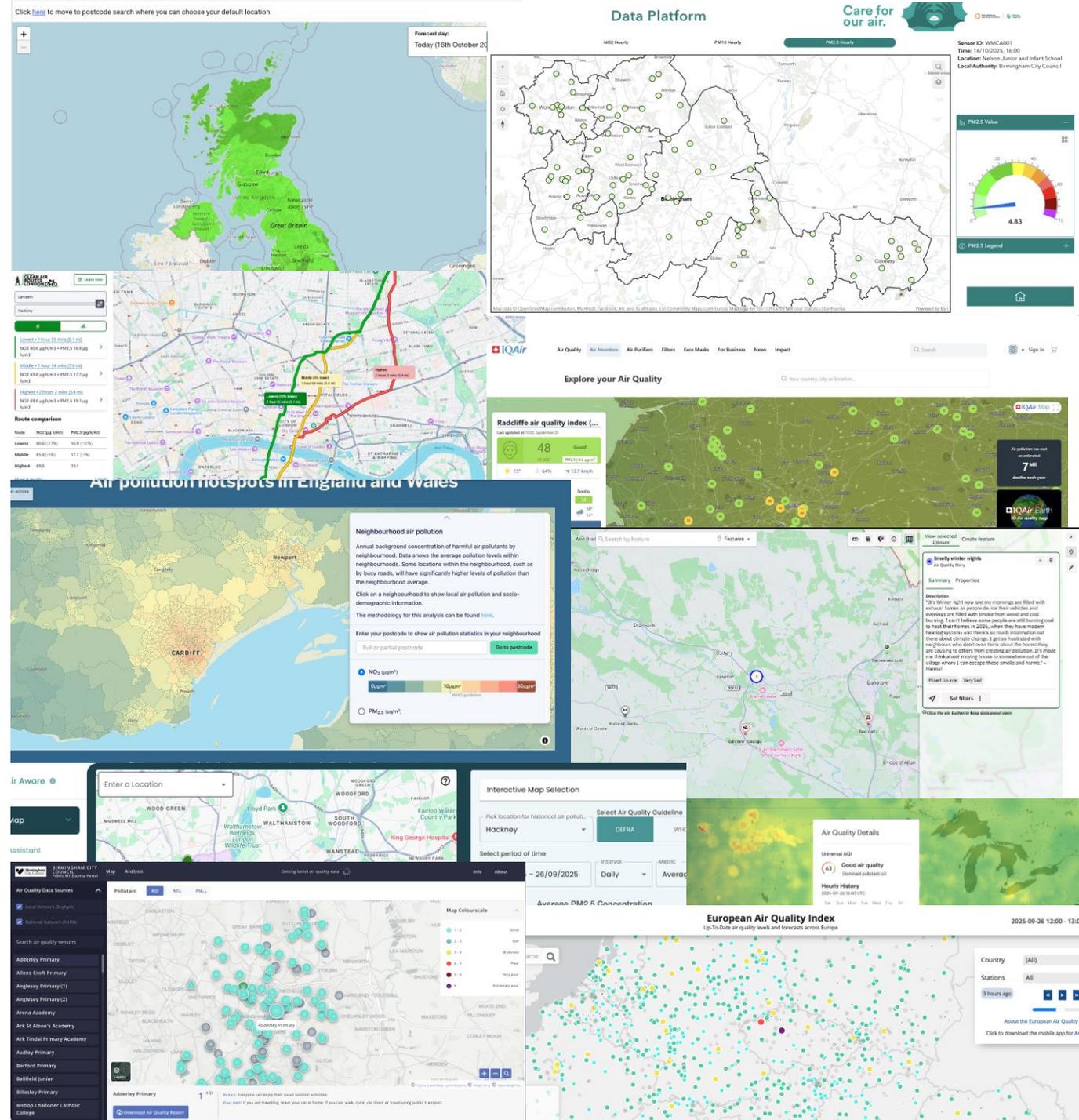
Engaging the community

- ❑ Simplify the message to improve AQ Literacy – Focus on positives.
- ❑ Support AQIs that mean something.
- ❑ Considered UI/UX that engages the user to act.



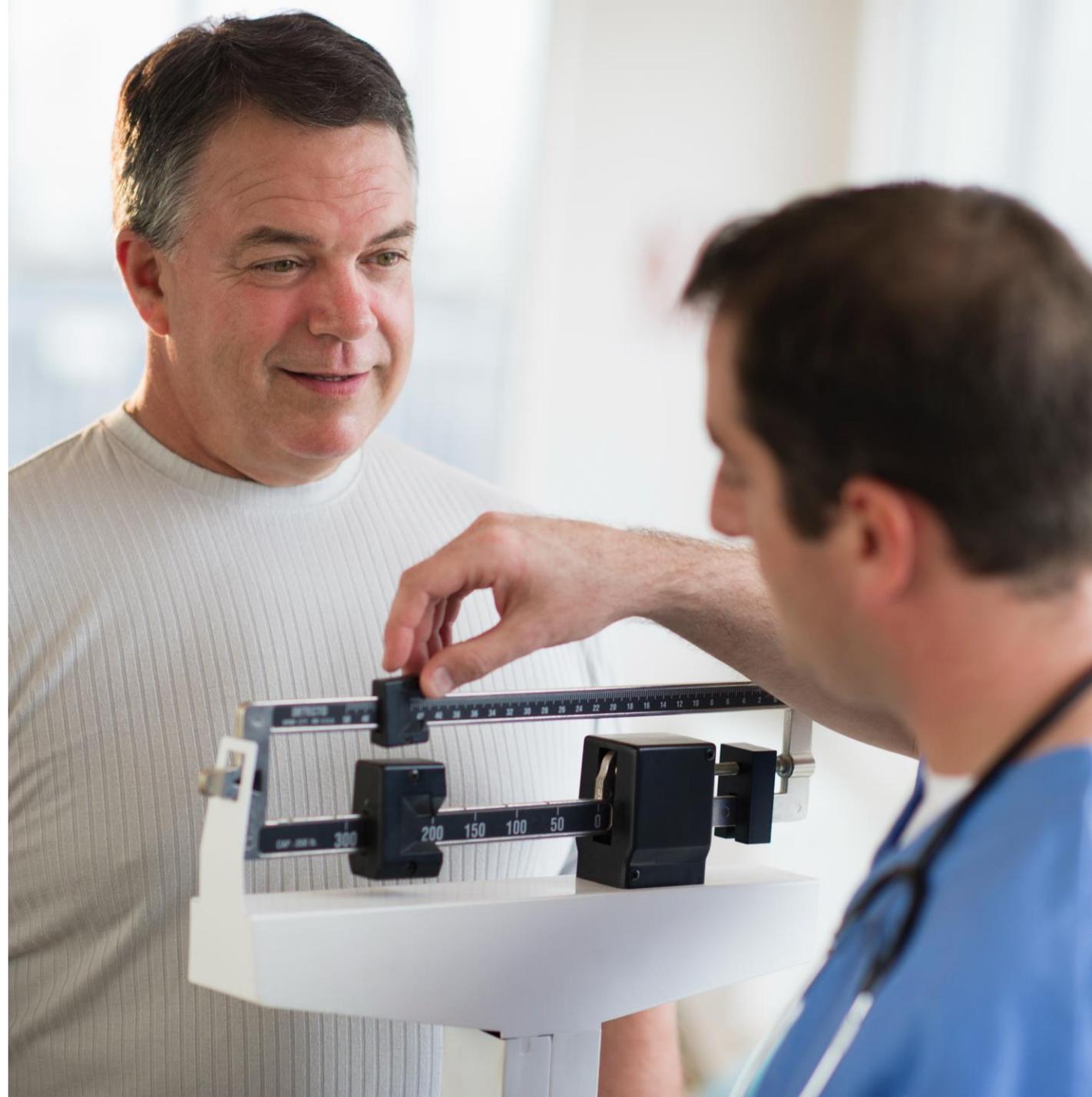
Engaging the community

- ❑ Simplify the message to improve AQ Literacy – Focus on positives.
- ❑ Support AQIs that mean something.
- ❑ Considered UI/UX that engages the user to act.
- ❑ Sufficient budget for marketing and SEO.



Engaging the community

- Simplify the message to improve AQ Literacy – Focus on positives.
 - Promote AQIs that mean something.
 - Design UI/UX that engages the user to act.
 - Sufficient budget for marketing and SEO.
-
- Get the right people in the conversation**





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