

Scaling Low Cost Sensing

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1. Low Cost Ambient Air Quality Monitoring
2. Monitoring at Scale
3. Projects
4. Standardisation
5. Conclusions



Low Cost Ambient
Air Quality
Monitoring

1

Local Air Quality Concerns are National Issues



“Low Cost” Monitoring Equipment ..



AirThings

Bettair

emtop

Luocute

Ionmax

Eacam

Bonoch

...etc ...



.. to Suit Diverse Needs

Measurements	Quality	Power	Data	Procurement	Price
PM1, 2.5,4 and 10	“Educational”	Battery powered	Visualisers	Purchase outright	\$500 \$10k
NO2	“Indicative”	Mains powered	Reporting	Subscription	
NOx		Solar + Battery	Alerting	Installation services	
SO4	Sensor tech		Analytics	Calibration services	
O3	Housing design		Data portal	Local support	
Black Carbon	Ventilation		Data access APIs	Remote support	
Temp, RH	Mounting options	Comms	Granularity	Warranty	
Wx	Data processing	Wifi	Raw / processed	Data ownership terms	
Noise, vibration	QA	Celluar NB-IoT	Device management and troubleshooting		
etc		LoraWAN (Sigfox)			

Challenges for “Non Expert” Users

Skills gaps – air quality understanding, sensor selection, deployment, maintenance, data interpretation

Technology Driven Projects – not always linked to policy, community outcomes or business case

“Low Cost” – Hardware Cost << Project Cost

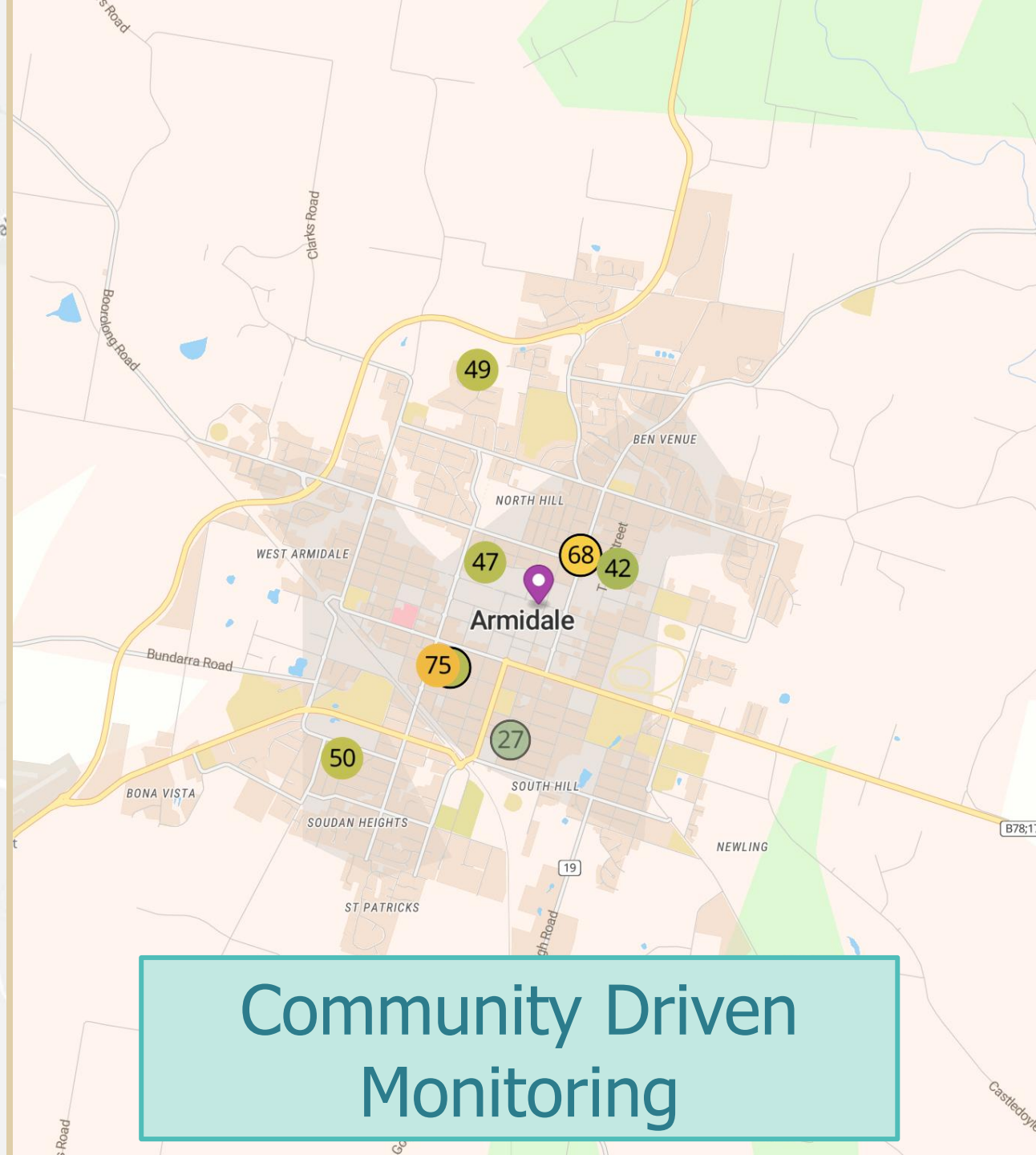
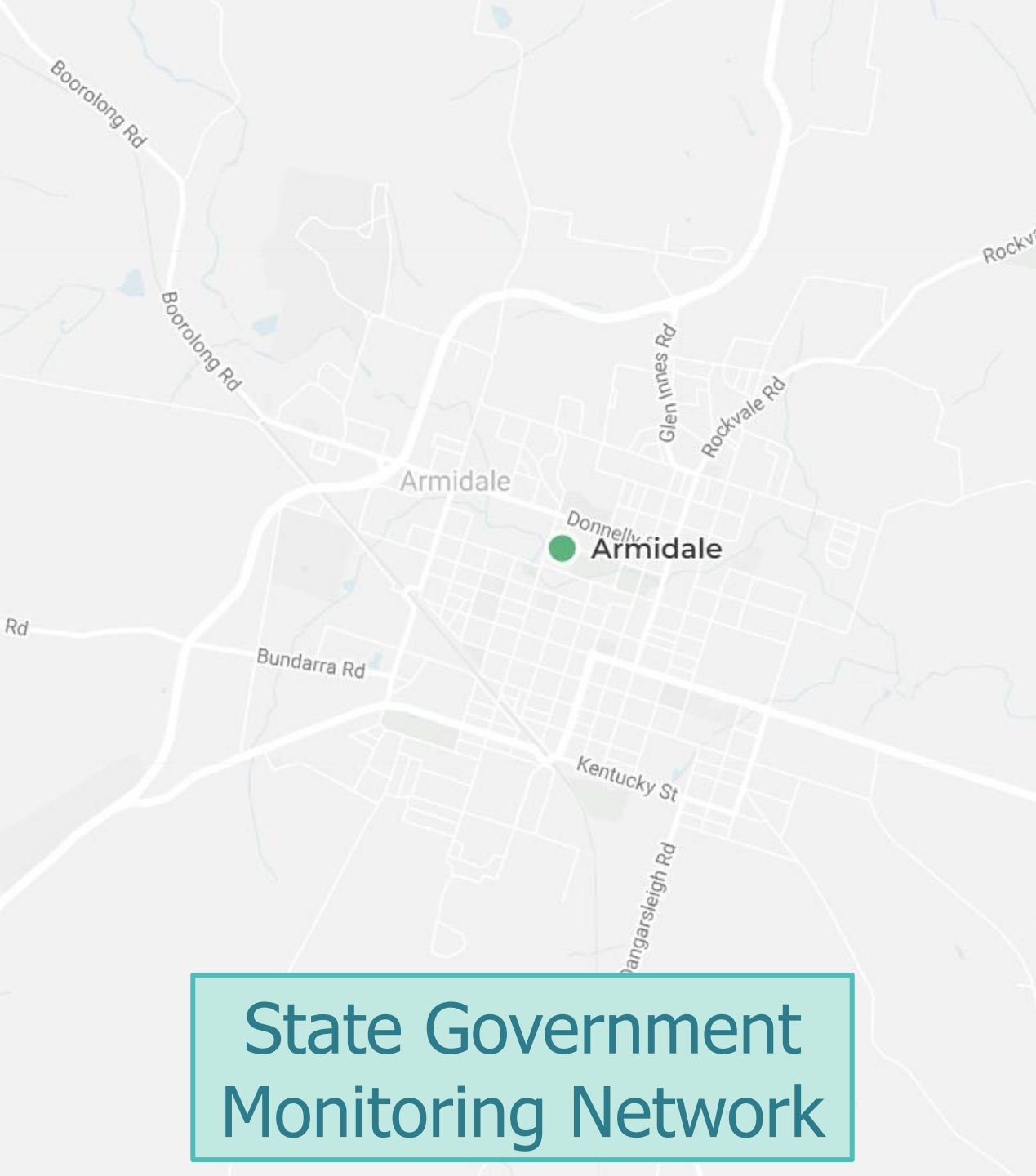


Compared to State AQ Monitoring Networks

- Focused on specific, often localised AQ concerns
- Diverse mix of monitoring equipment
- Varying design / implementation / operation quality
- Many owning organisations and stakeholder groups
- Not easy to re-use measurement data beyond individual projects

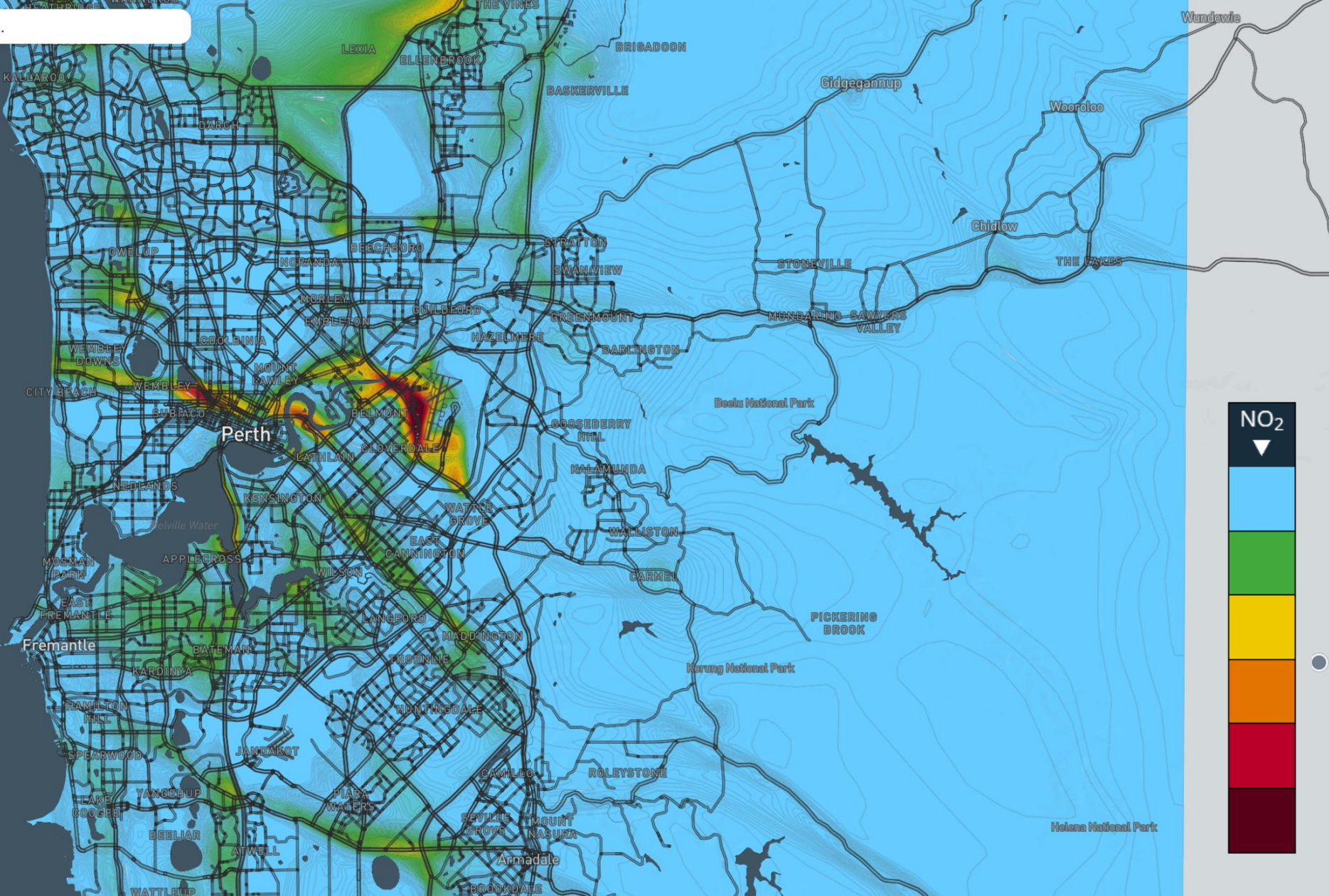
Monitoring at Scale

2



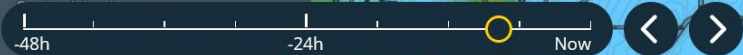
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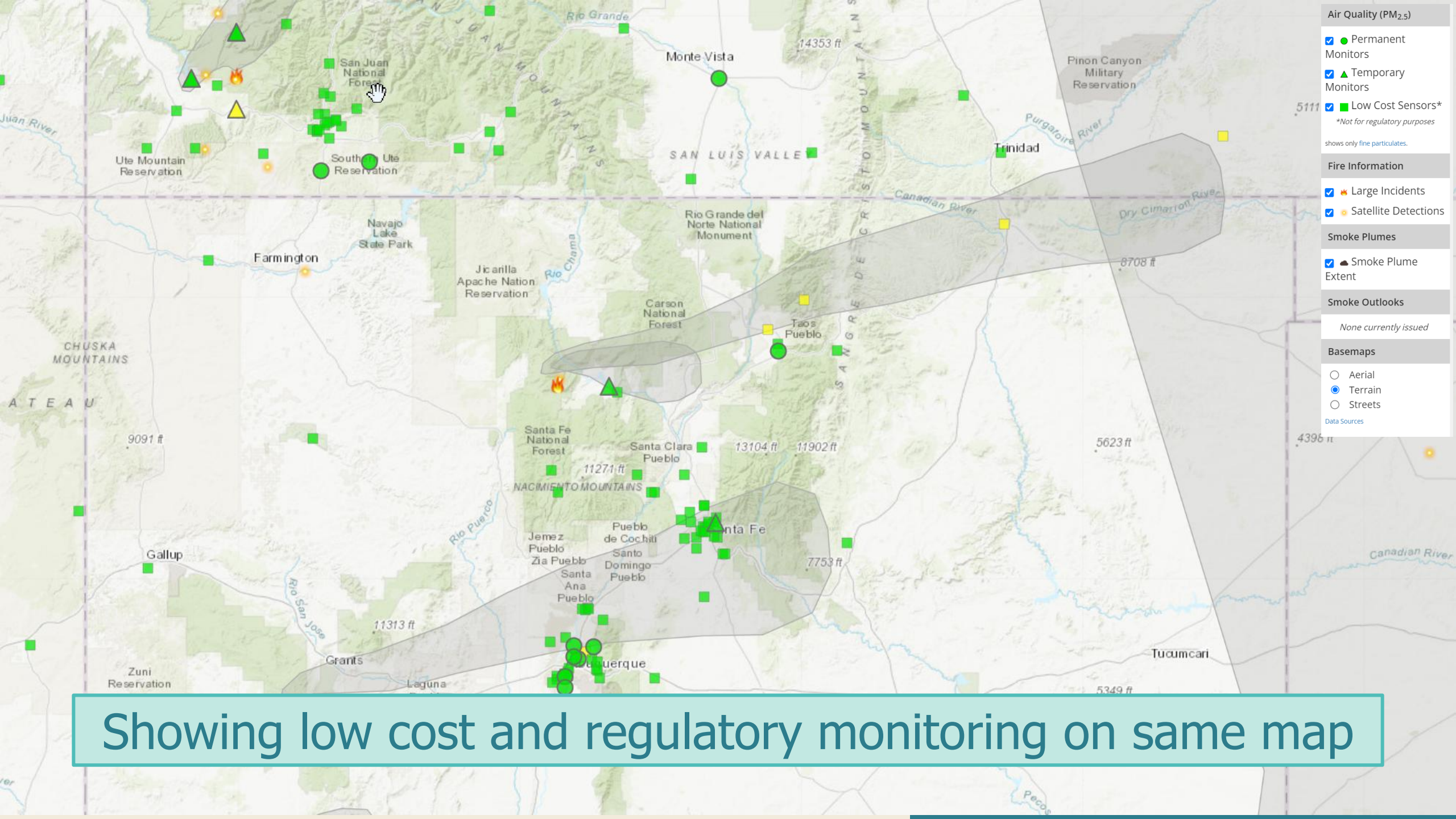
MODE: Nowcast



200 Devices – City Wide

Aug 21 2026, 7:00 am AWST





Air Quality (PM_{2.5})

- ☒ ● Permanent Monitors
 - ☒ ▲ Temporary Monitors
 - ☒ ■ Low Cost Sensors*
- *Not for regulatory purposes
shows only fine particulates.

Fire Information

- ☒ 🔥 Large Incidents
- ☒ ● Satellite Detections

Smoke Plumes

- ☒ ☁ Smoke Plume Extent

Smoke Outlooks

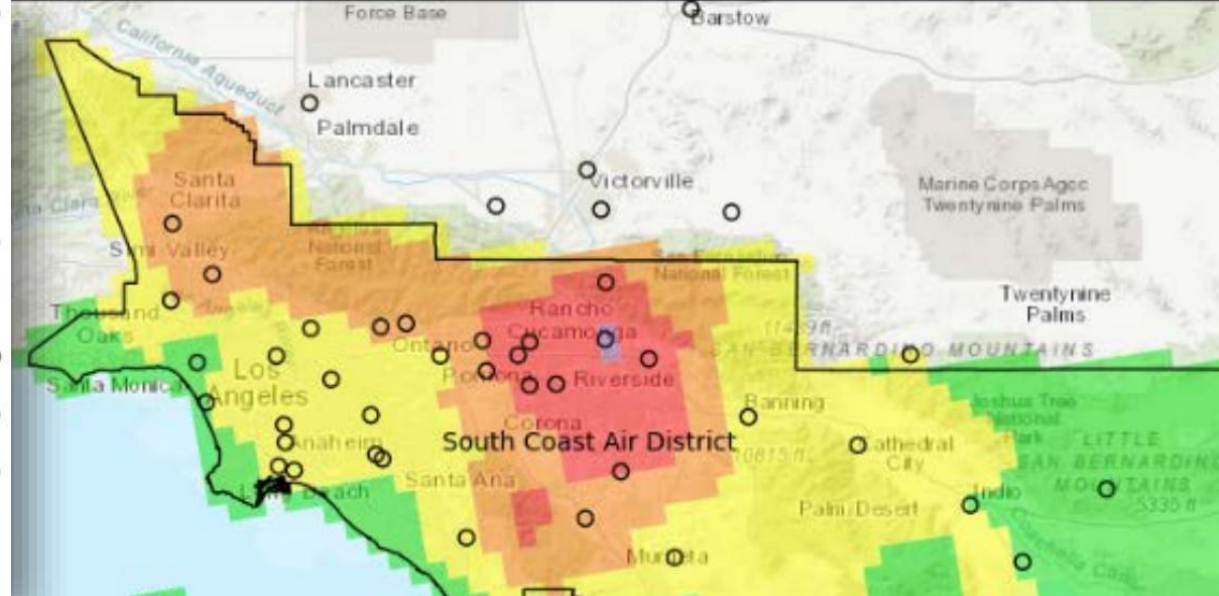
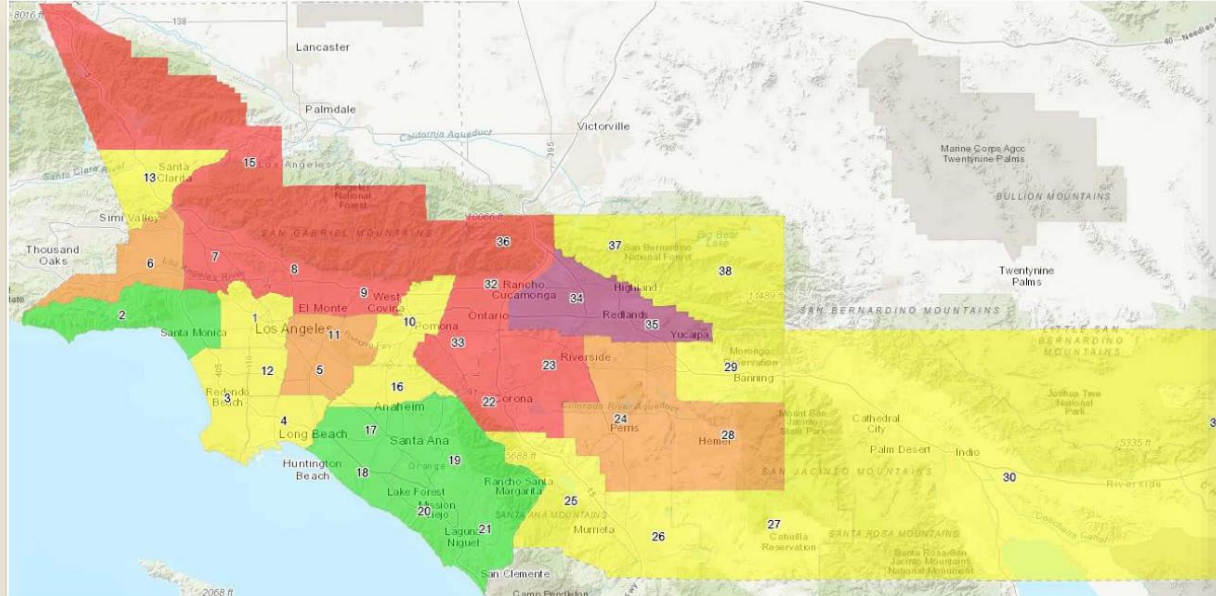
None currently issued

Basemaps

- ☐ Aerial
- ☒ Terrain
- ☐ Streets

Data Sources

Showing low cost and regulatory monitoring on same map



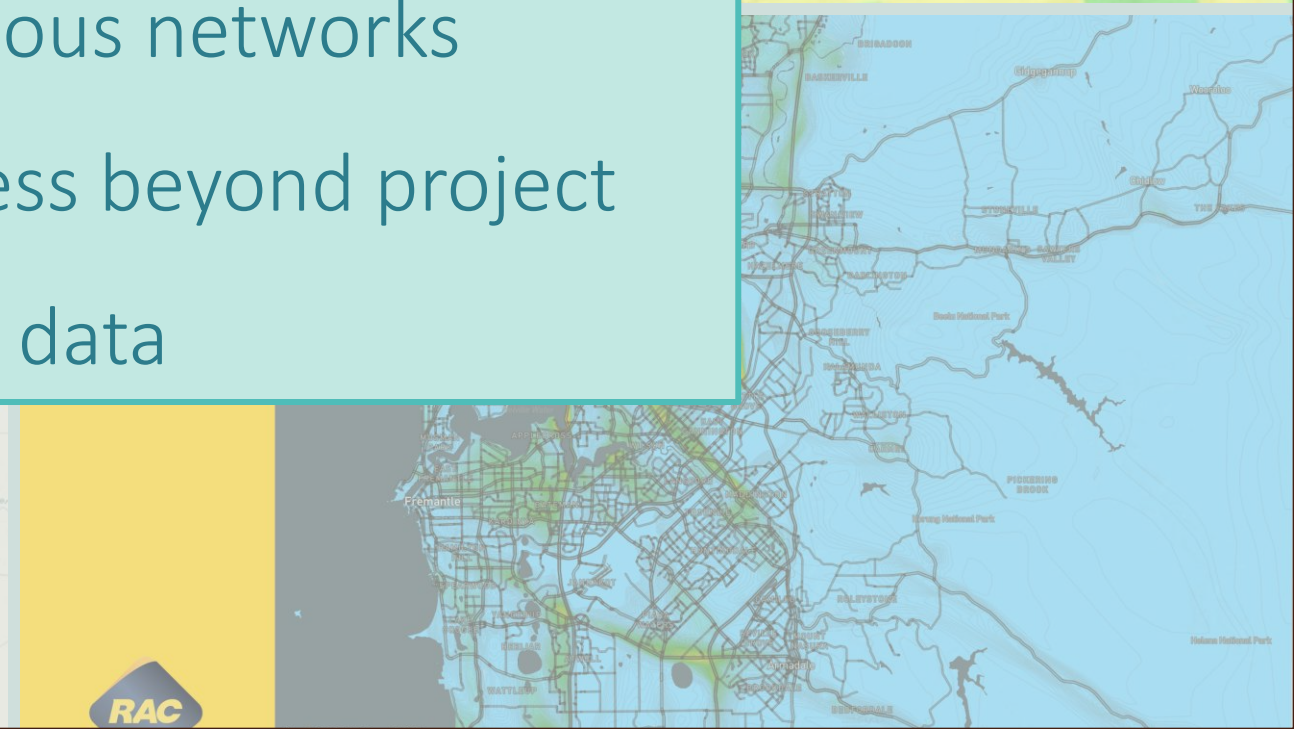
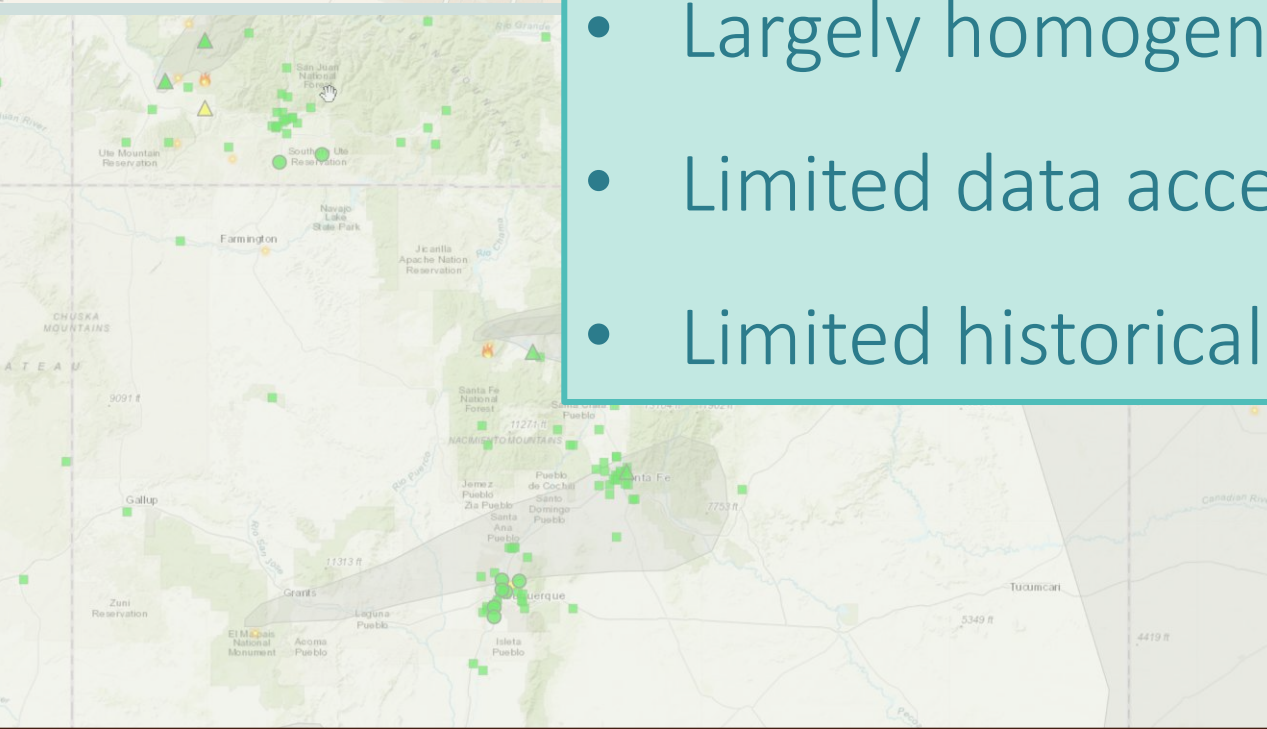
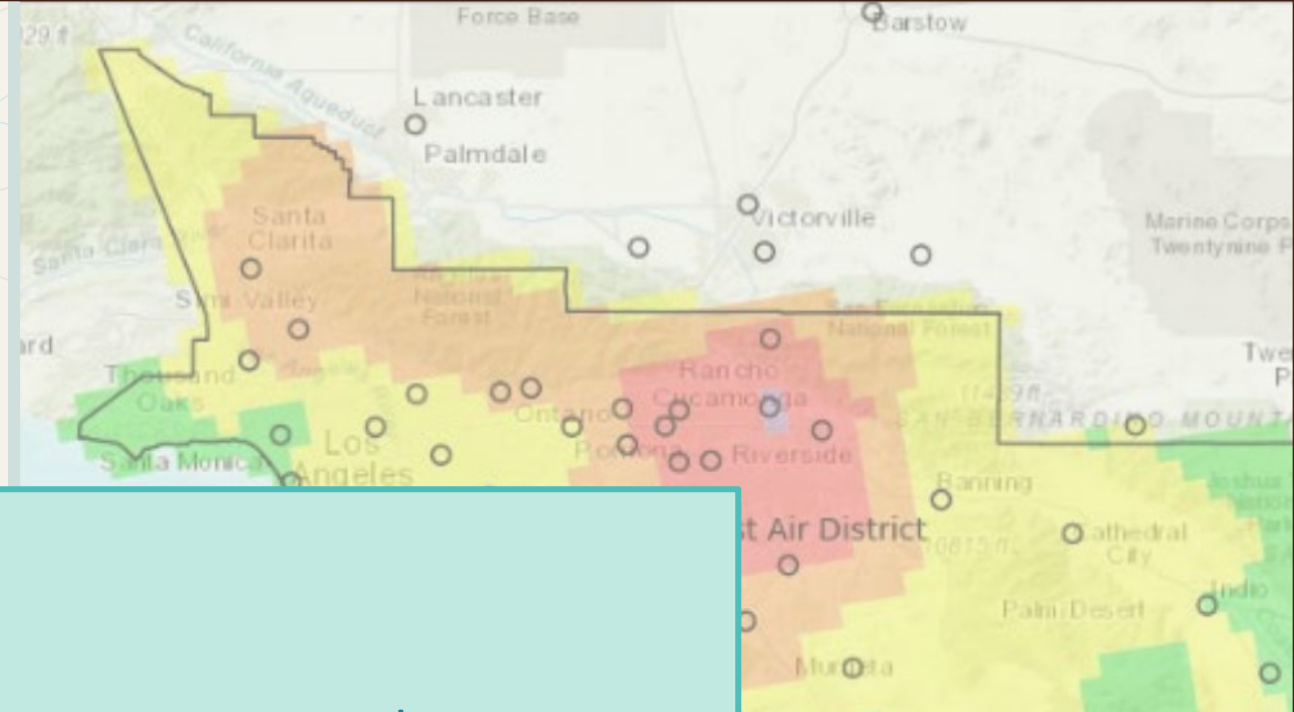
Traditional AQI Map

AQ Reference Stations
+ Distance based estimate

With LCS

1km grid cells
Atmospheric Model
+ AQ Reference Stations
+ Low Cost Sensing (average if 3 or more LCS in any given cell)

Combining low cost and regulatory monitoring (Data Fusion)



Some Limitations:

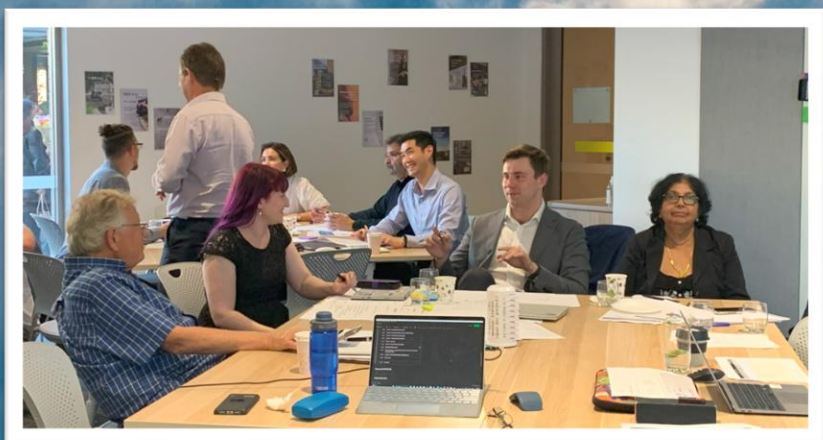
- Largely homogenous networks
- Limited data access beyond project
- Limited historical data

Projects

3

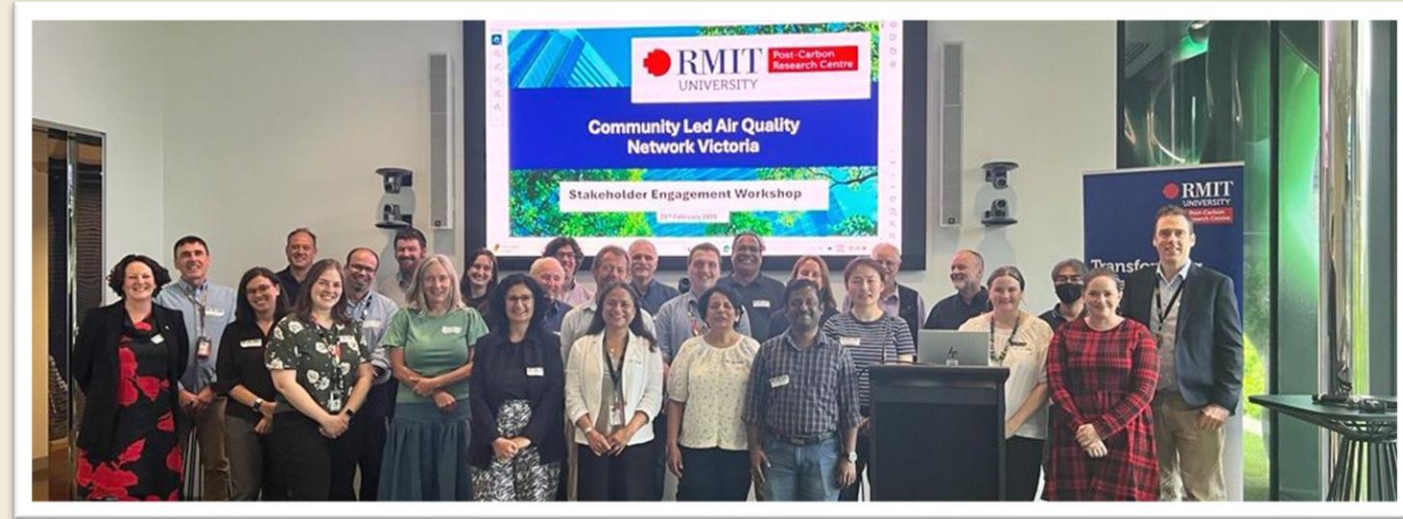


OPENAIR



1. Best practise guidance for local government
2. NSW DCCEEW and researchers provided expertise
3. Harmonised air quality data feed pilot

CLEAN AIR Victoria



1. Councils addressing transport related air quality issues
2. Vic EPA providing advice and support

NSW Natural Hazard Detection System

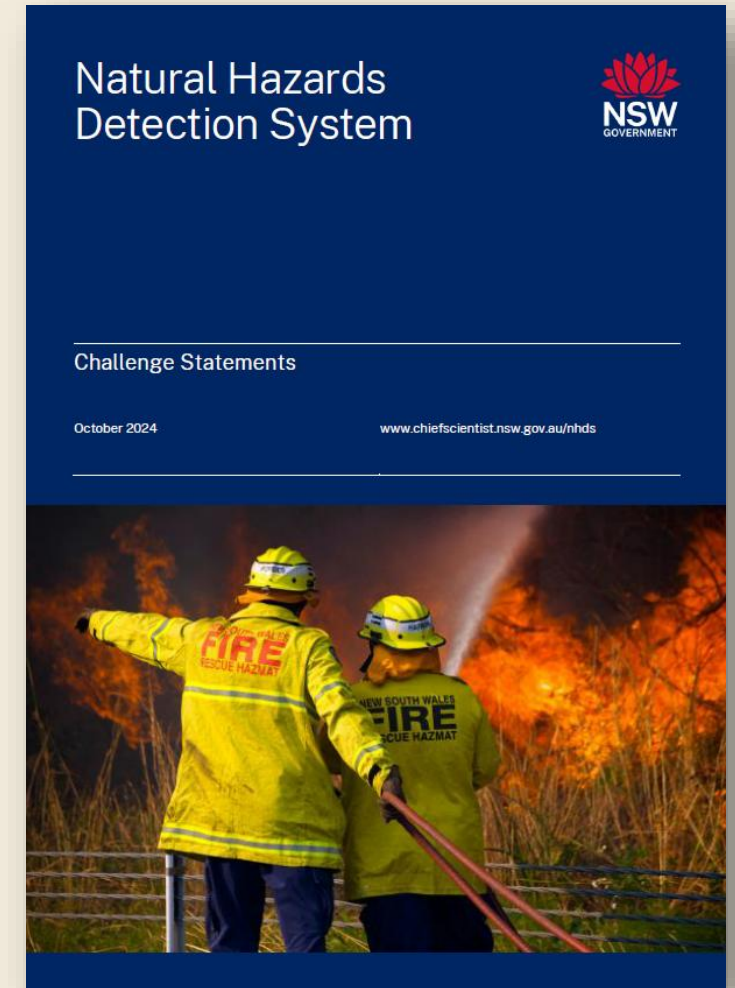
Environmental Measurements

Bushfire, flash flooding measurements (water levels, soil and fuel moisture, rainfall, weather)

Multiple technologies, vendors, products

Data sharing:

1. Standardised measurements
2. Standardised API

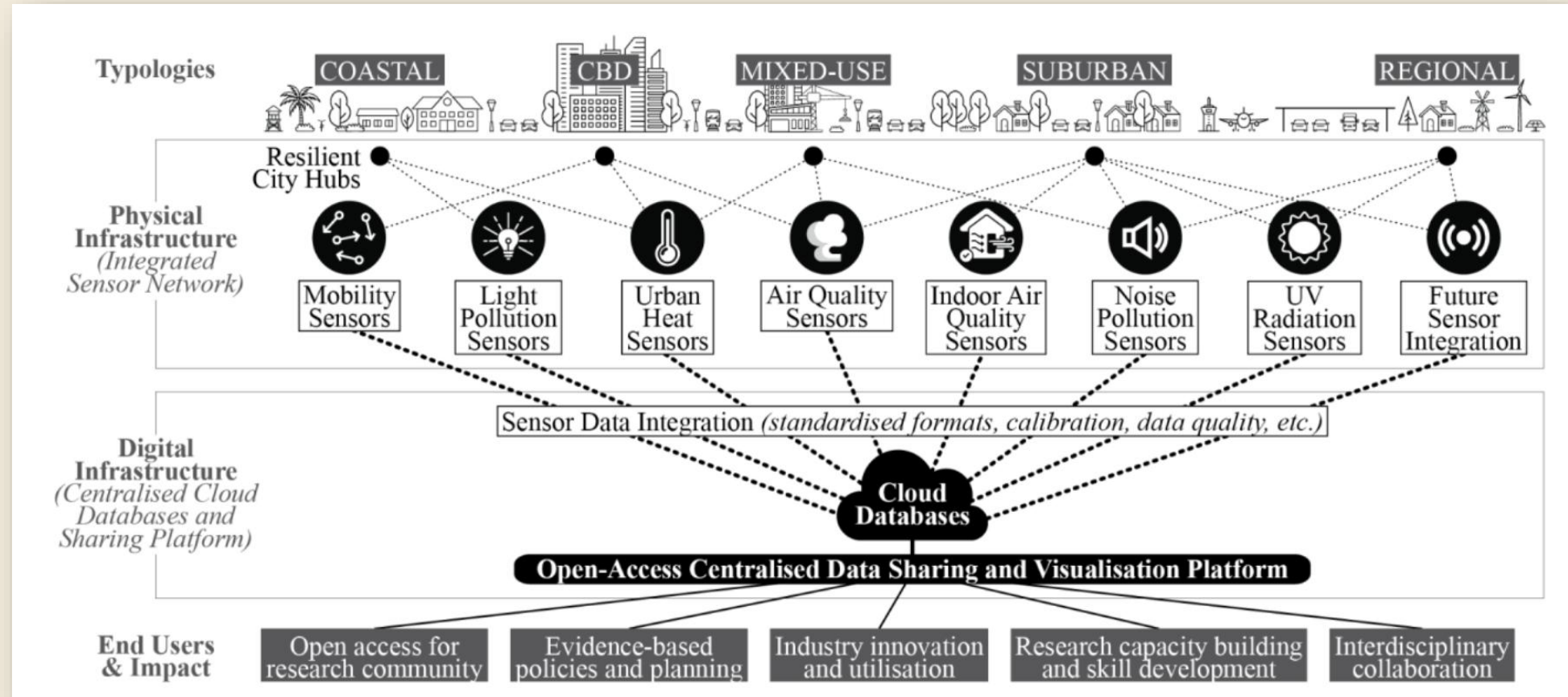


Australian Smart Environmental Observatory

ARC LIEF

14 resilient
city hubs

~500 IoT
sensors



Air quality, heat, noise, light, mobility measurements
Distributed sensing research infrastructure

ACCESS-NRI

New National Atmospheric
Observations Collection

Scientific, regulatory and “low
cost” datasets

DOI for “Low cost” dataset

Standardised AQ and WX
measurements extracted
from operational platforms



Standardisation

4

Standardised Practises

MORE DEPLOYMENTS

Stronger business cases
Streamlined procurement
Fewer specialist skills needed

HIGHER IMPACT

More informed participants
Higher quality projects

Standardised Practises and Data

MORE DEPLOYMENTS

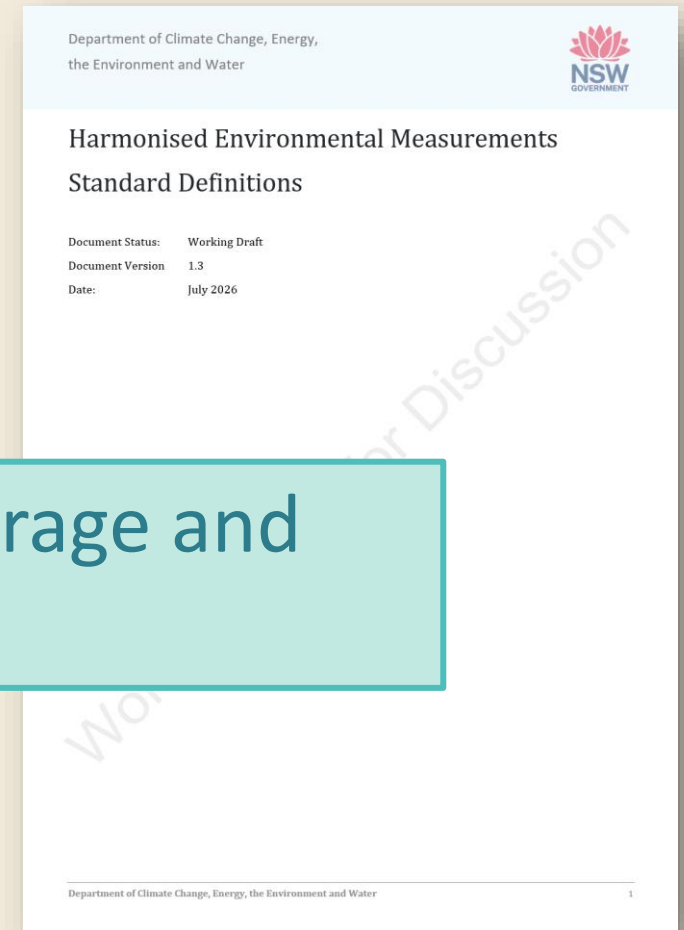
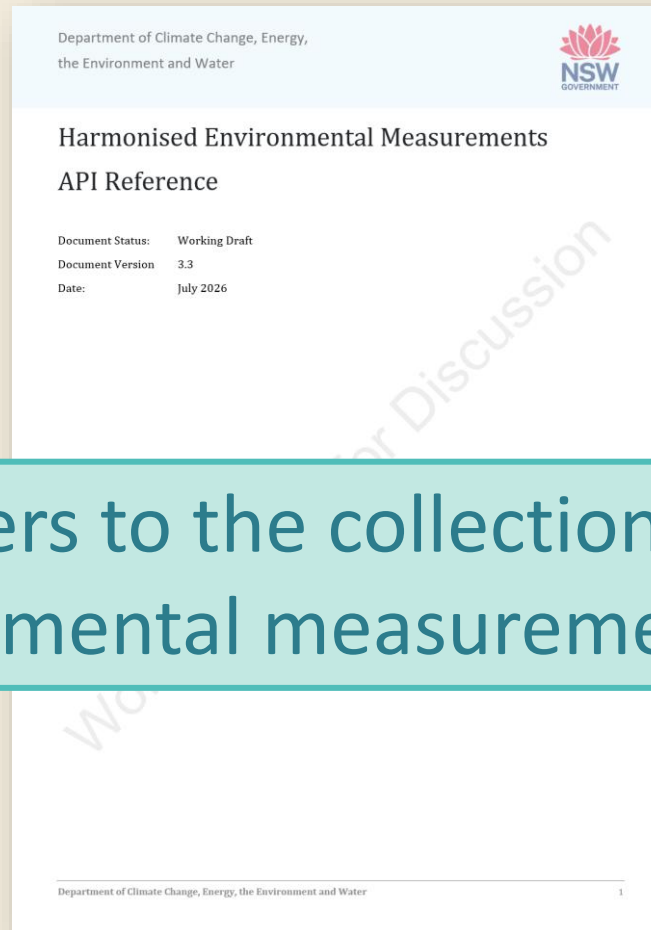
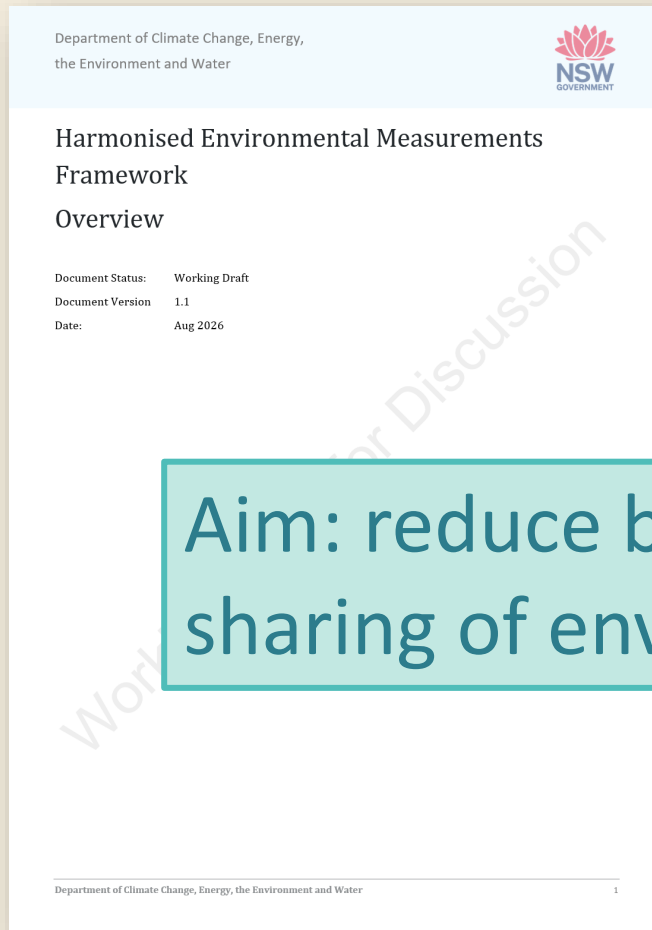
- Stronger business cases
- Streamlined procurement
- Fewer specialist skills needed
- Lower data integration costs
- Easier to add new measurements

HIGHER IMPACT

- More informed participants
- Higher quality projects
- Improved data sharing between collaborators
- Usable data for researchers and policy makers

A decentralised, nationwide, localised AQ data resource

Harmonised Environmental Measurements Framework



Aim: reduce barriers to the collection, storage and sharing of environmental measurements.

Principles

Actionable

“80/20” rule

FAIR Data

Findable, Accessible, Interoperable, Reusable

Technology Agnostic

Future proofed

Federated

Harmonisation – not centralisation

Collaborative

Open source standards

Sovereign

Don't assume international models are suitable

Harmonised Environmental Measurements Framework

Overview

Document Status: Working Draft
Document Version: 1.1
Date: Aug 2026

Working Draft for Discussion

Next Steps:

Form working group - Initial topics include:

- Governance model
- Units of measure
- Data quality
- Timestamping
- Altitude vs height
- Data catalogues

Implementations

Conclusions

5

Local Air Quality Concerns are National Issues



Standardised practises and data sharing enable:

- More monitoring
- Higher quality monitoring
- More policy, research and community collaboration

Q&A

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