Review of the NZTA National Air Quality Monitoring Network

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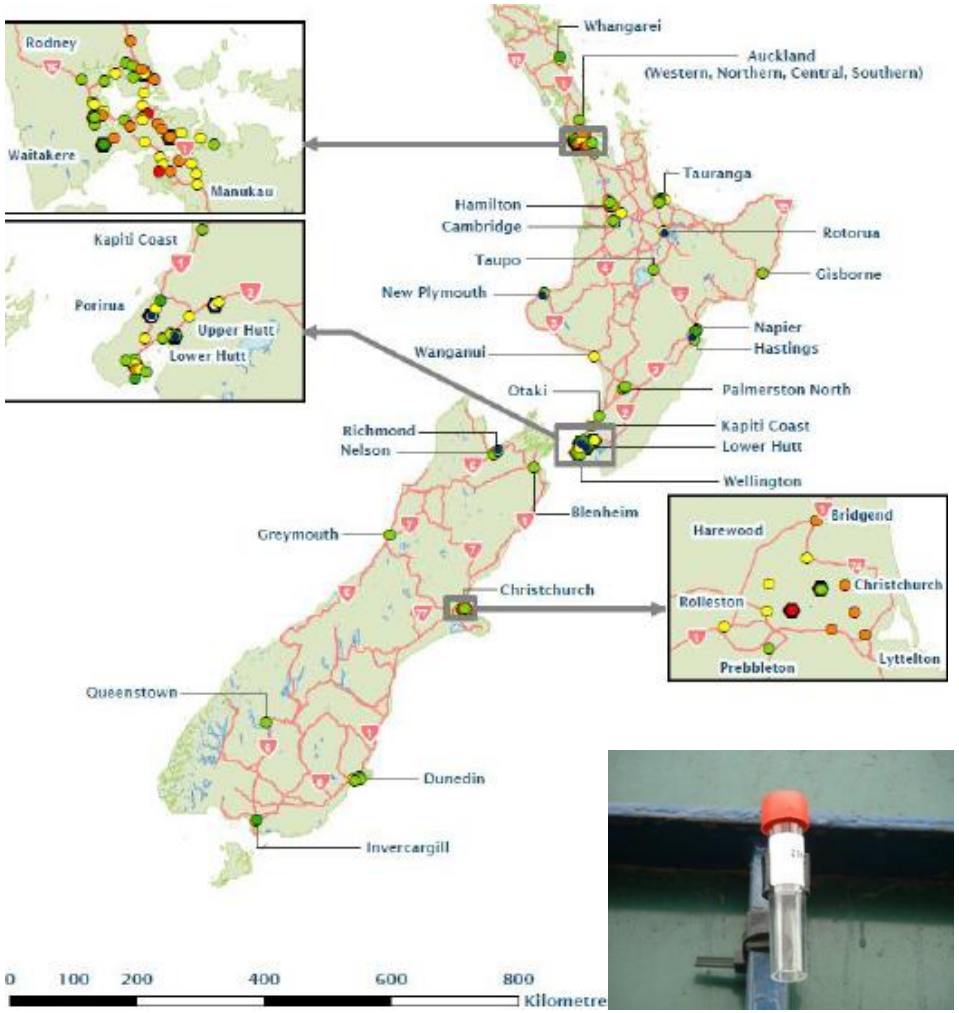
The National Air Quality (NO_2) Monitoring Network



- Established 2007, expanded 2010
- Monthly samples at 135 sites
- 110 sites are “roadside”, 25 are “background”
- NO_2 because low-cost

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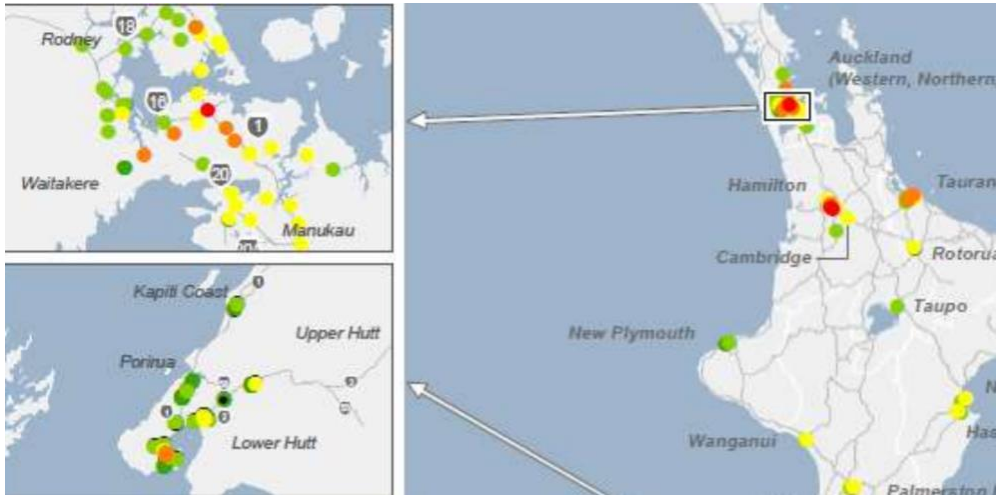
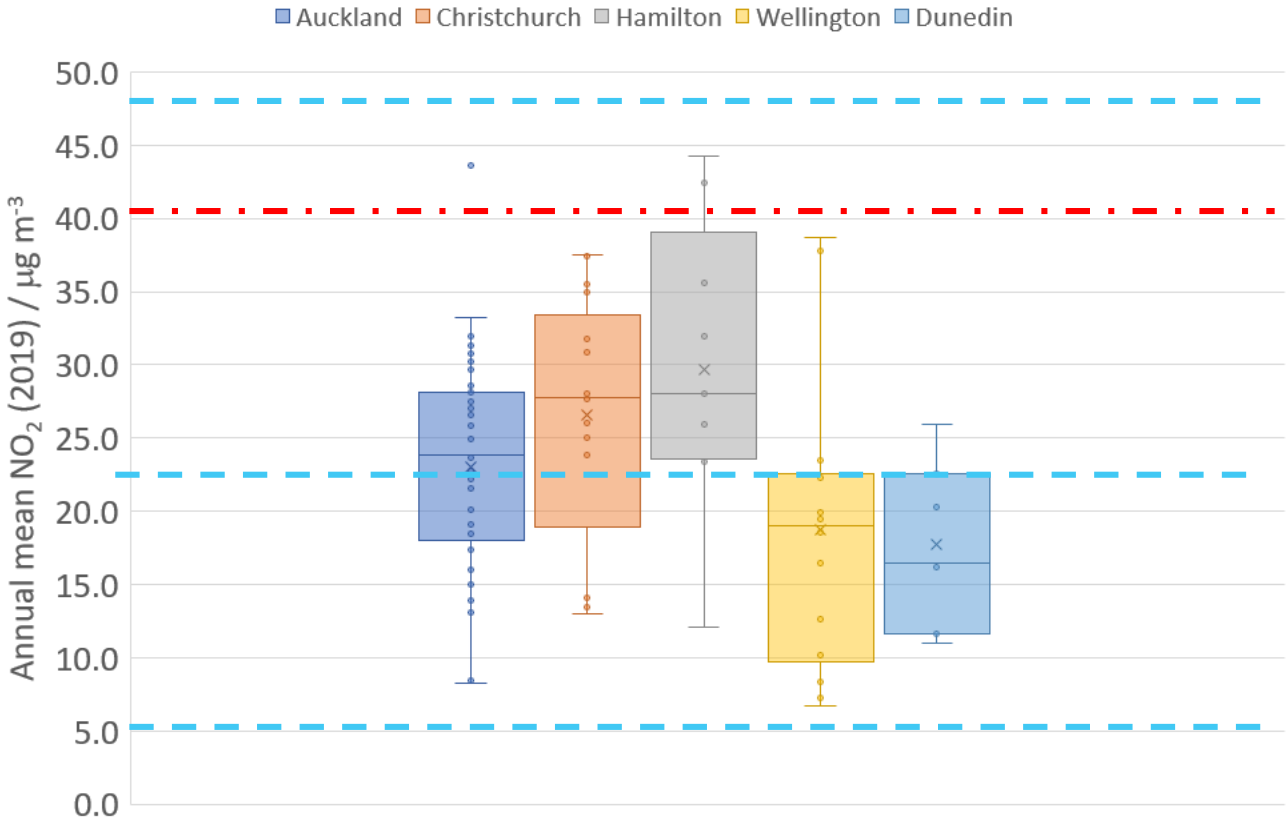
Main learnings from the Network (1)

- Understanding **range** of concentrations





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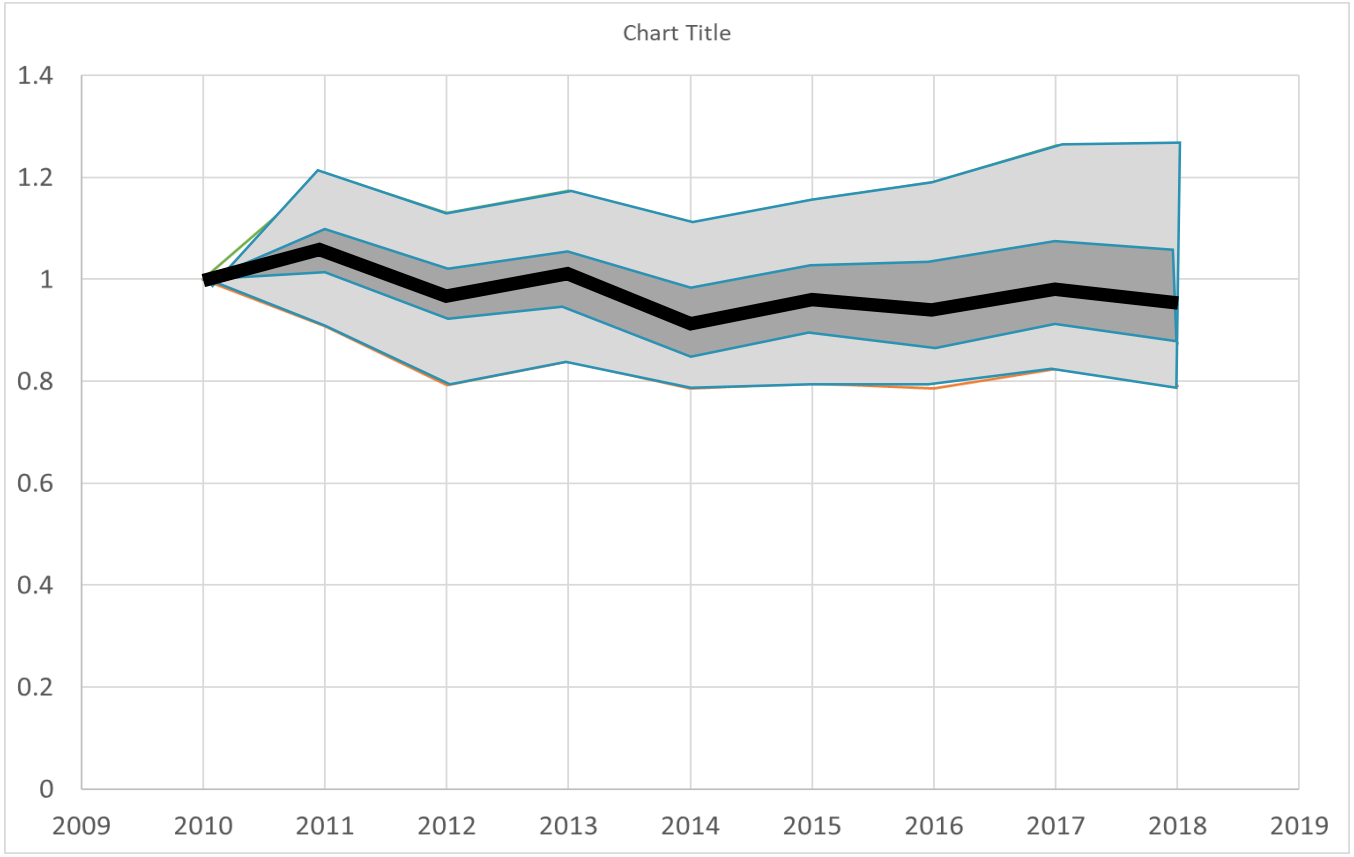
Main learnings from the Network (2)



- Trends are slow
- Mainly downwards to 2014
- Weakly upwards after 2014
- Year-to-year fluctuations

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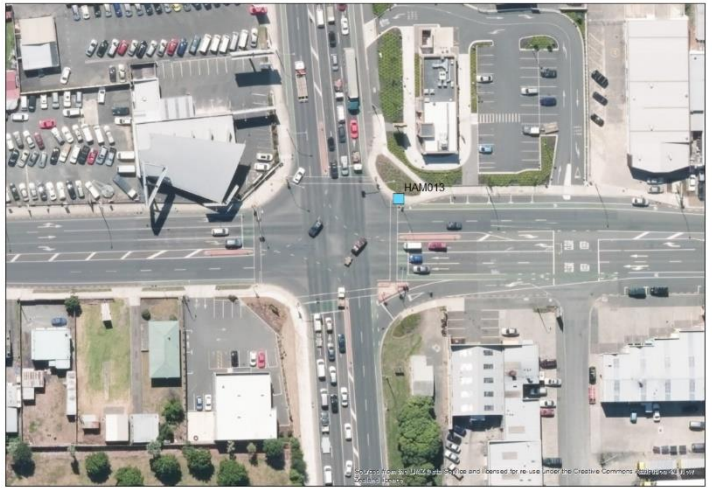
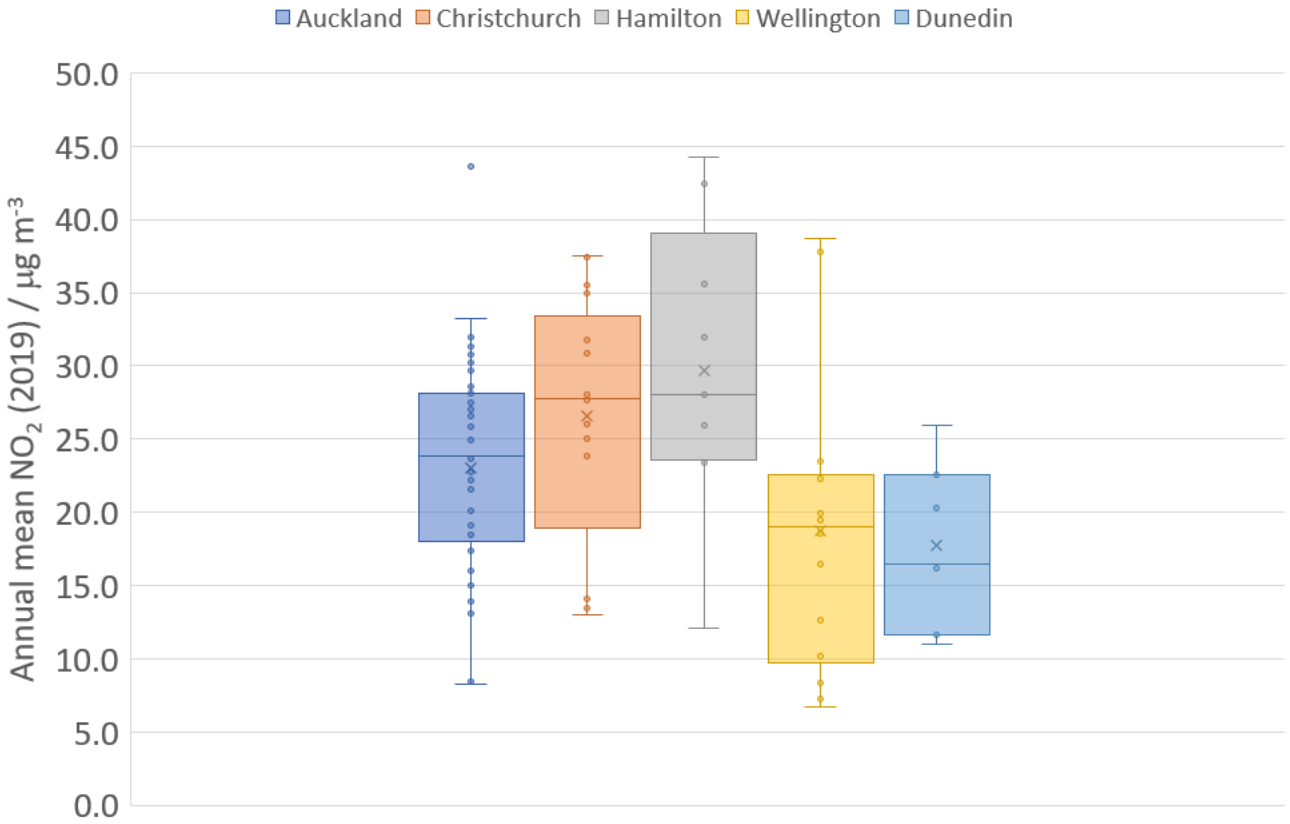
Main learnings from the Network (3)

- Highest concentrations measured at intersections



Weaknesses of the Network (1)

- Sampling location biases
- Within-city variation bigger than between-city
- Interferes with Inter-city comparison



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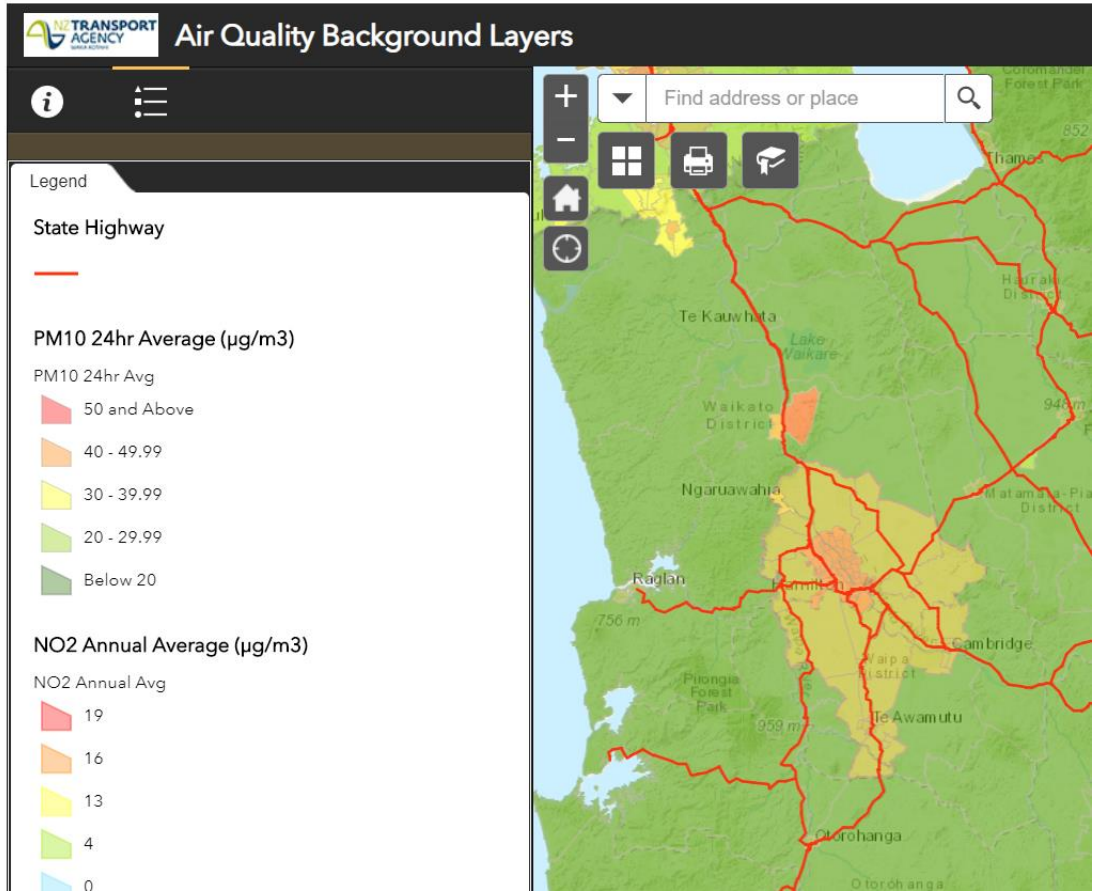
Weaknesses of the Network (2)

- Large uncertainties in extrapolating to unmonitored locations
- Uncertainty in project assessment
- Uncertainty in health risk assessment



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Weaknesses of the Network (3)

- **Explaining** trends – metadata is insufficiently detailed and ‘fixed’
- Impacted by regional or localised traffic (step) changes?

Site Name
Te Atatu Rd

Site Code
AUC048

Region & Monitoring Zone
Auckland - Western

Area
Te Atatu

Site Type
SH

Source
North Western Motorway

Site Location
Te Atatu Rd - Near On Ramp
Te Atatu, Waitakere

Map Reference

	Easting	Northing		Easting	Northing
NZMG	2657695	6481567	**NZTM**	1747262	5919849

Nearest Sensitive Receptor & Location
Residential Housing
Titoki St

Distance (m)
40

Nearest SH & Local Road (m) with Direction

SH 16	2	W	LR	2	W

National Network
Y

Intersection
N

Other Site Information
Te Atatu Rd on ramp 2m. SH1 150m.

Height Above Ground (m)
3.0

Nearest Tree (m)
30.0

Monitoring Note(s)
Apr-09 Commissioned

Weaknesses of the Network (4)

- **Limited to NO_2** - trends could be different for other species
- **Limited to monthly data** – cannot separate peak hours

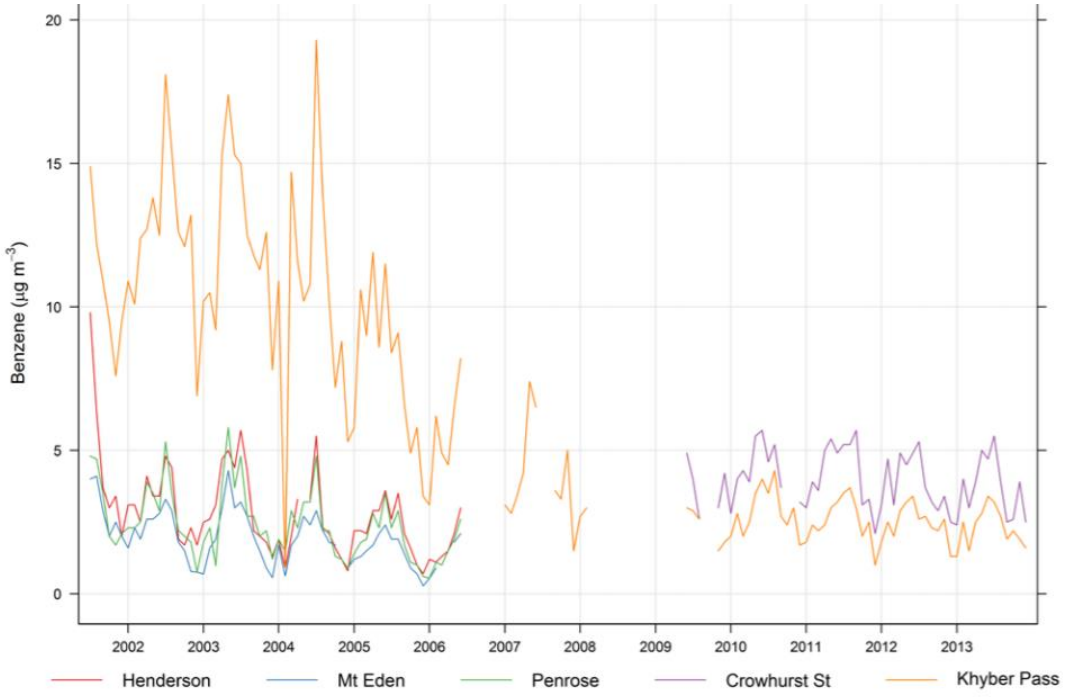
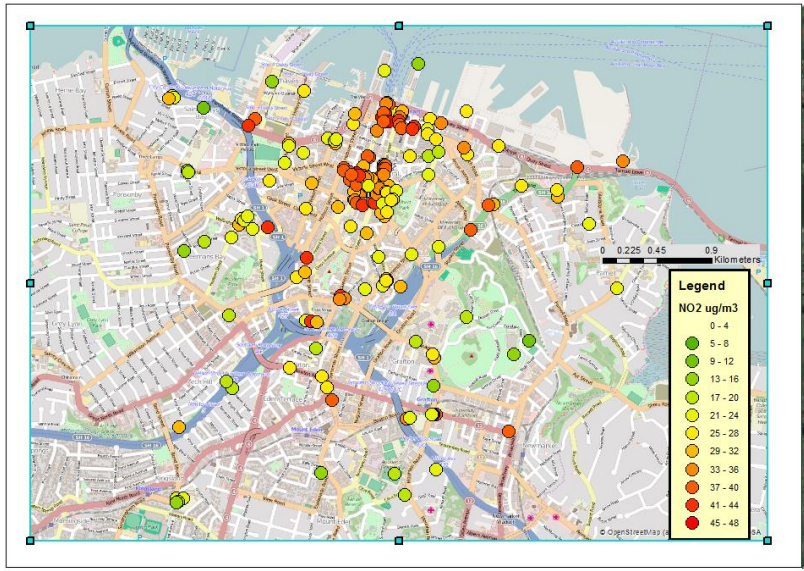


Figure 2 Monthly passive benzene data, 2001 – 2013. Gaps in traces indicate that no sampling was done. Results below Limit of Detection (LOD) are displayed as half the LOD.

Other NO_2 datasets

- Auckland
- Hamilton
- Hastings/Napier
- Gisborne
- Gtr Wellington
- Dunedin



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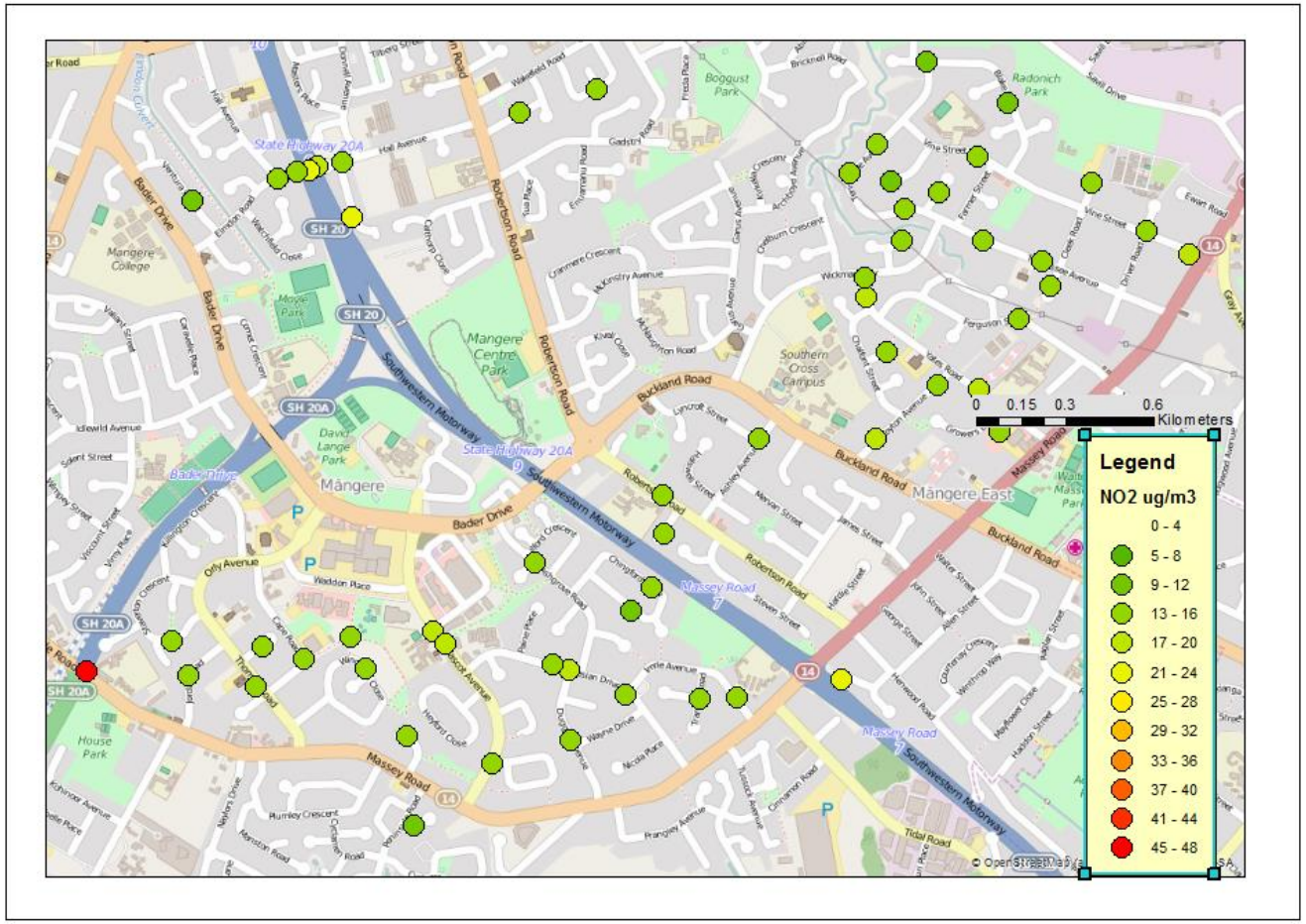
A closer look at peak sites (1)

Site AUC068, Mangere, Auckland



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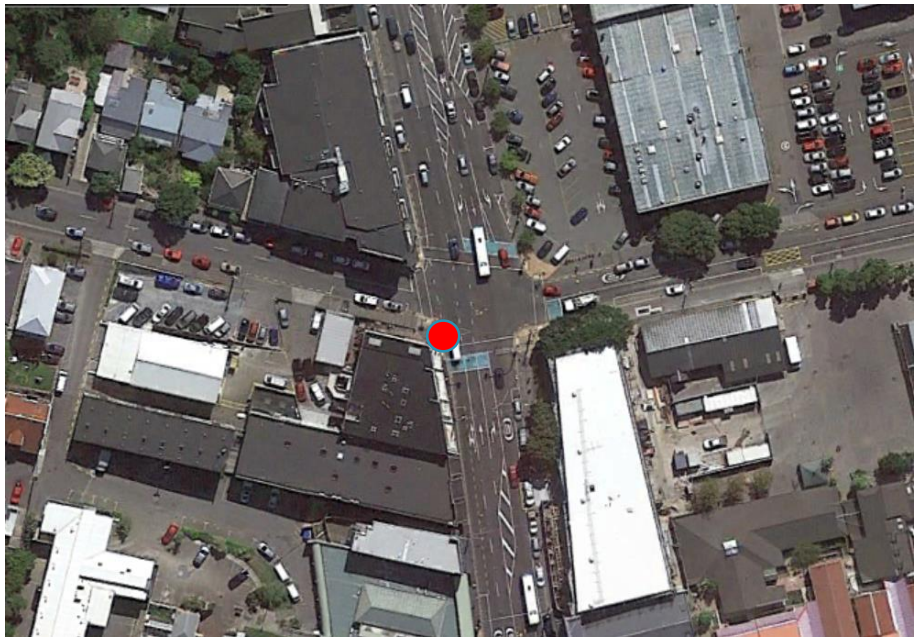
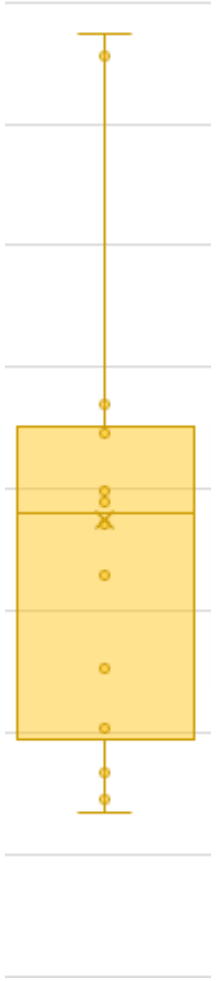
A closer look at peak sites (2)

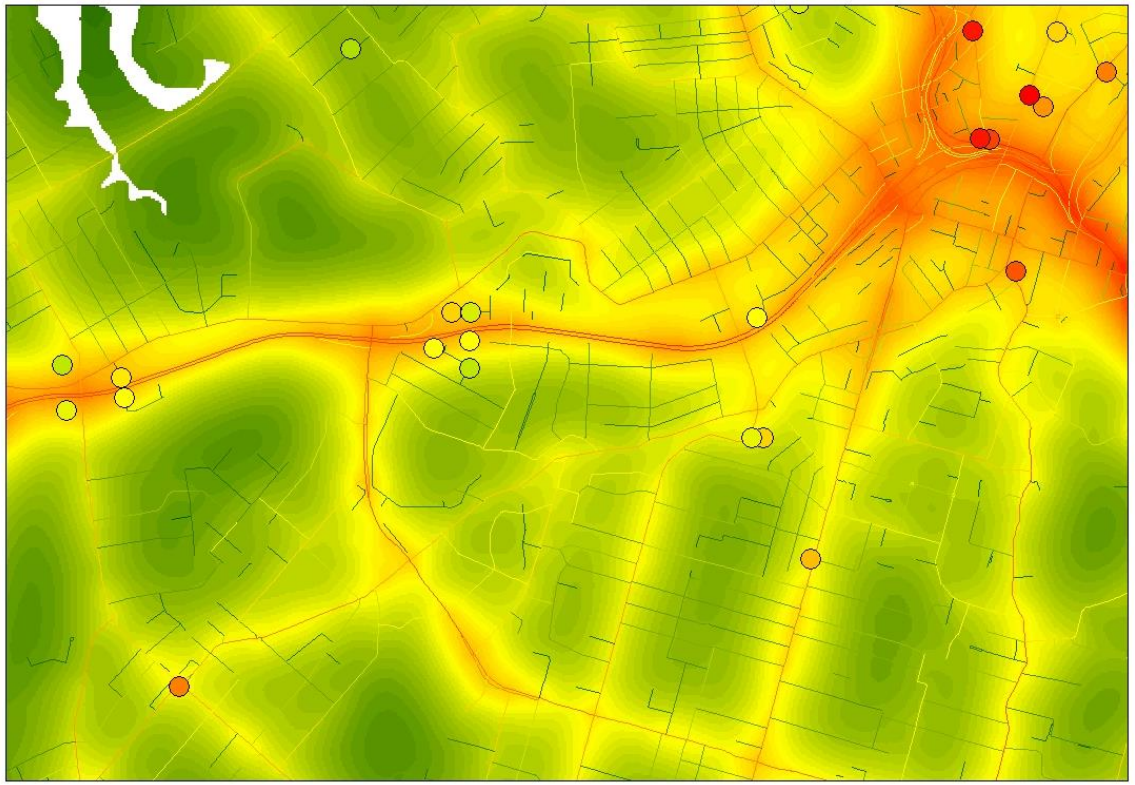


Site WEL049, Newtown, Wellington



NIWA Traffic Impact Model (v3.1)

- Models typical emission/dispersion
- Under-estimates around intersections, street canyons and none-traffic sources
- Now covers all urban areas in NZ
- Model validity varies between cities depending on observational (validation) data available



Reviewing Network Objectives

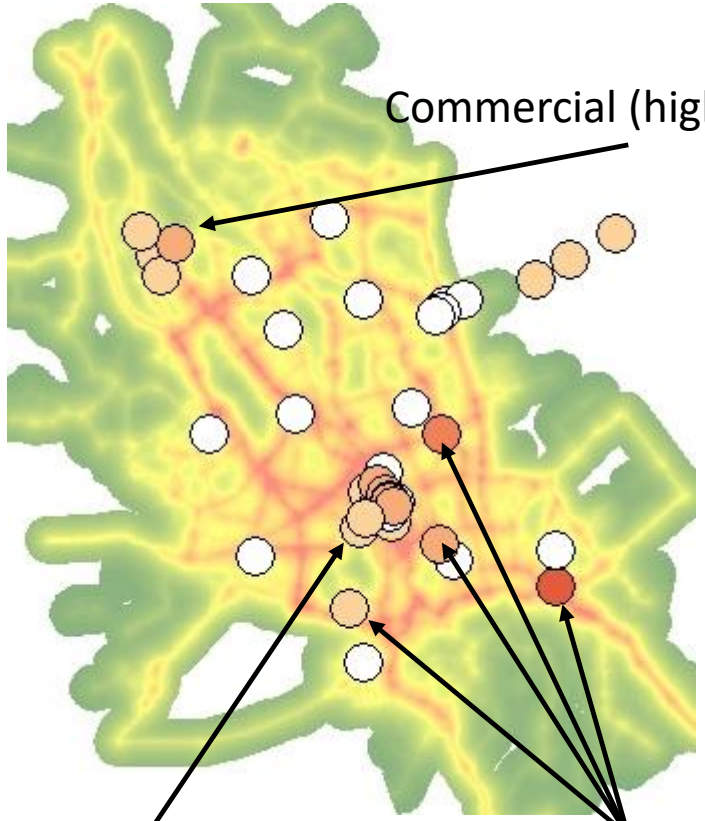
- ORIGINAL:
- Where is biggest impact of road traffic on air quality?
- Is impact increasing or decreasing?
- EMERGING:
- What is the health risk?
- What is the impact of changes in vehicles, fuels, congestion?
- Are local interventions effective?

Method (1)

- Tools – NO_2 data (2018), TIM, SH traffic data (2010-2018) and google earth imagery
- Assess representativeness of sites in terms of NO_2 and traffic trends

Using TIM to attribute spatial representativeness

- Sites which match model predictions are ‘representative’ (white)
- Sites where model under-predicts are locally-influenced sites (orange)
- Sites which are correlated in time are providing duplicate information and could be optimised



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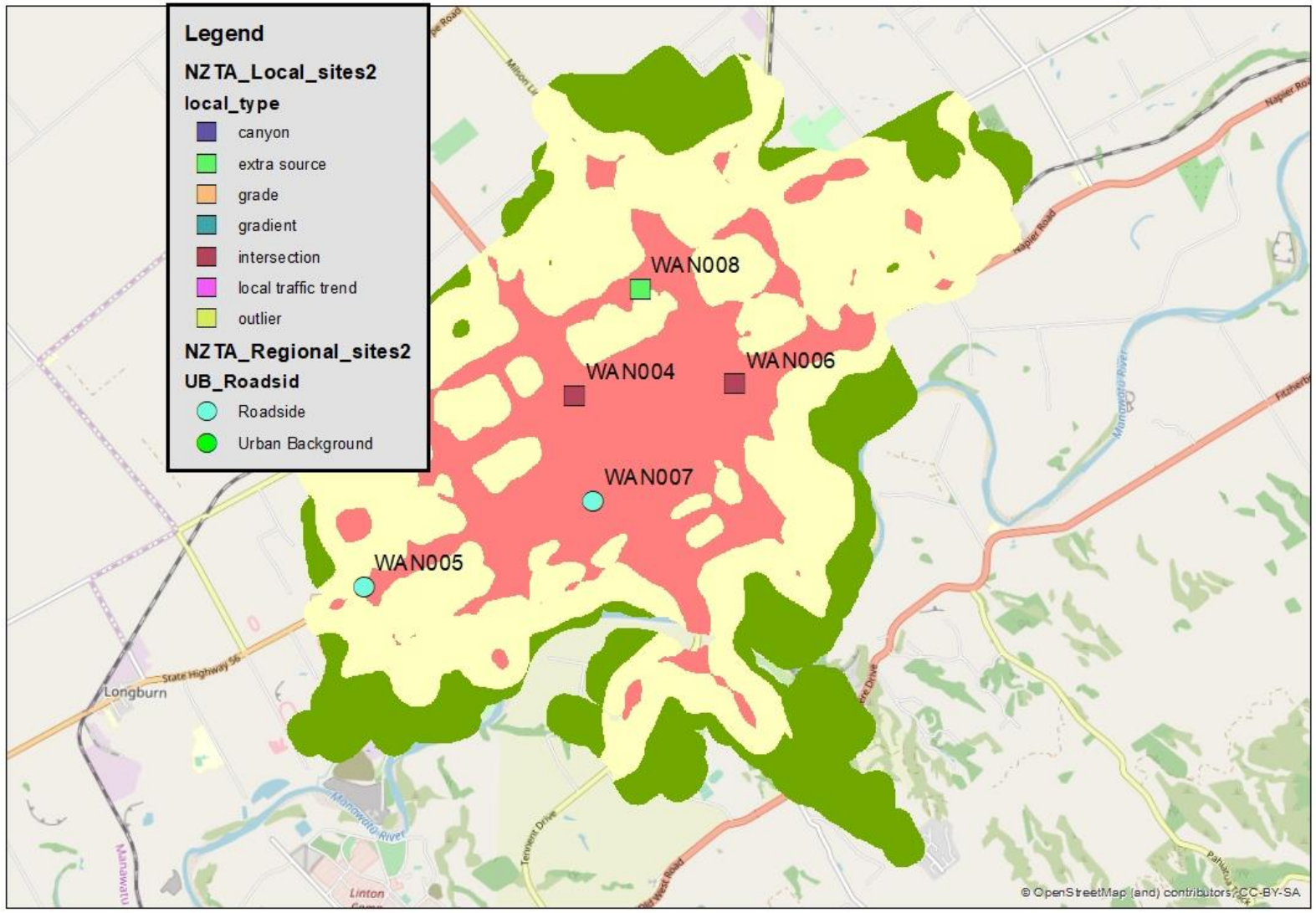
Method (2)

- Re-classify sites
- Assess network coverage and recommend changes
- Report on other pollutants

Example review – Palmerston North



4th quartile	Roadside
3rd quartile	Urban Background
2nd quartile	
1st quartile	

Regional - UB	0
Regional - Roadside	2
Local – Intersection	2
Undetermined	1

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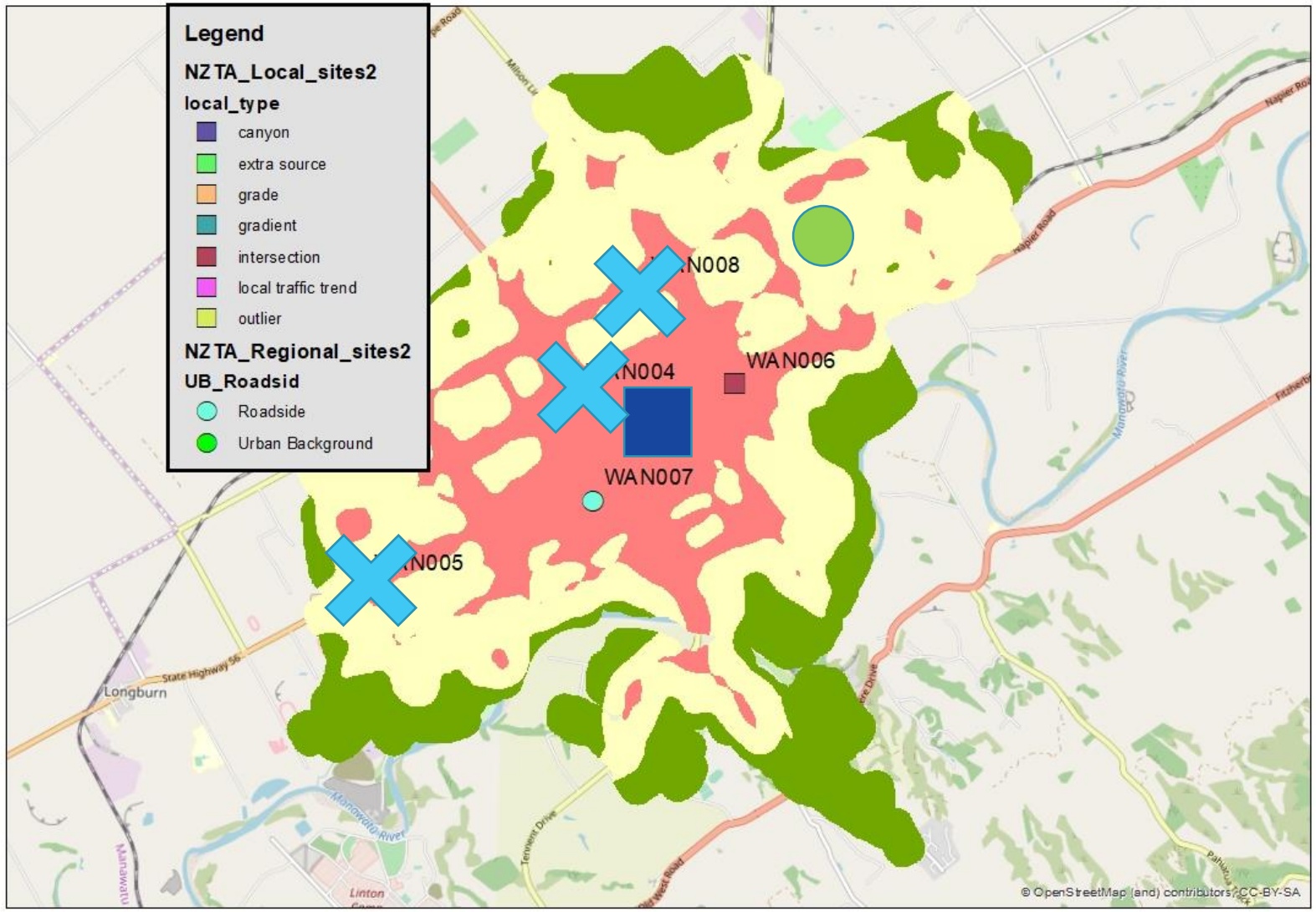
Draft Results – network coverage and re-classification

Regionally representative		53	
	Urban Background		23
	Roadside		30
Locally influenced		68	
	Intersection		45
	Canyon		3
	Extra source		5
	Local traffic trends		12
	Steep road gradients		2
	Grade differences		1
Undetermined		14	
		135	

NIWA High-level Recommendations

	Screening campaigns	Regional Network	Local Networks
Purpose	Calibrate/validate model for each city Establish representativeness of sites	Track regional trends, Climate change, Underpin mapping, unbiased indicators, project assessment, Health risk assessment	Track atypical trends, Monitor peak sites, Monitor peak emissions, Evaluate interventions
Timeframe	Once every 5 – 10 years	Continuous	Reviewed annually
Sites	Wide range	Regionally-Representative Urban Background & Roadside	Locally-Influenced, incl. • Ports • 1+ CBD canyon • 1+ intersections • High diesel • Rapid growth • interventions

Example recommendations – Palmerston North



Regional - UB	1
Regional - Roadside	1
Local – Intersection	1
Local - canyon	1

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Recommendations - overview

- +30 new Regional sites
- ~15 sites could be removed (partial duplicates)
- Minimum 20 new (Local) CBD/canyon sites
- Minimum 9 new (Local) port sites
- Minimum 8 new (Local) intersection sites

Other recommendations

- New Regional Urban Background sites located to represent **median** exposures enabling fair inter-city comparison
- More dynamic and easily-joined metadata (links to climate, traffic, land-use data)
- Data available by API for automated update
- Can same approach be used for noise and odour?

Other pollutants and short-term measures

- BC: Wellington Mini-Aethalometer trial
- BC, PM, NOx: Waterview Tunnel sensor trial
- Results coming soon….
- Downtown Auckland multi-sensor trial – in planning

Acknowledgements

- This work in this presentation was funded by NIWA and the New Zealand Transport Agency.