



NIWA

# WILL WATER SENSITIVE URBAN DESIGN RESULT IN MEASURABLE IMPROVEMENTS IN THE ECOLOGICAL HEALTH OF URBAN STREAMS?



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**Stormwater 2024**  
15–17 May | Takina Wellington Te Whanganui-a-Tara

# Context

Evidence of urban streams ecological health degradation in NZ (Larned et al. 2020)

Water Sensitive Urban Design (WSUD)/Nature Based Solutions (NBS) offers a solution

Lack of :

- NZ case studies on how well WSUD performs both at
  - device scale
  - catchment scale
- Design/planning guidance at catchment scale

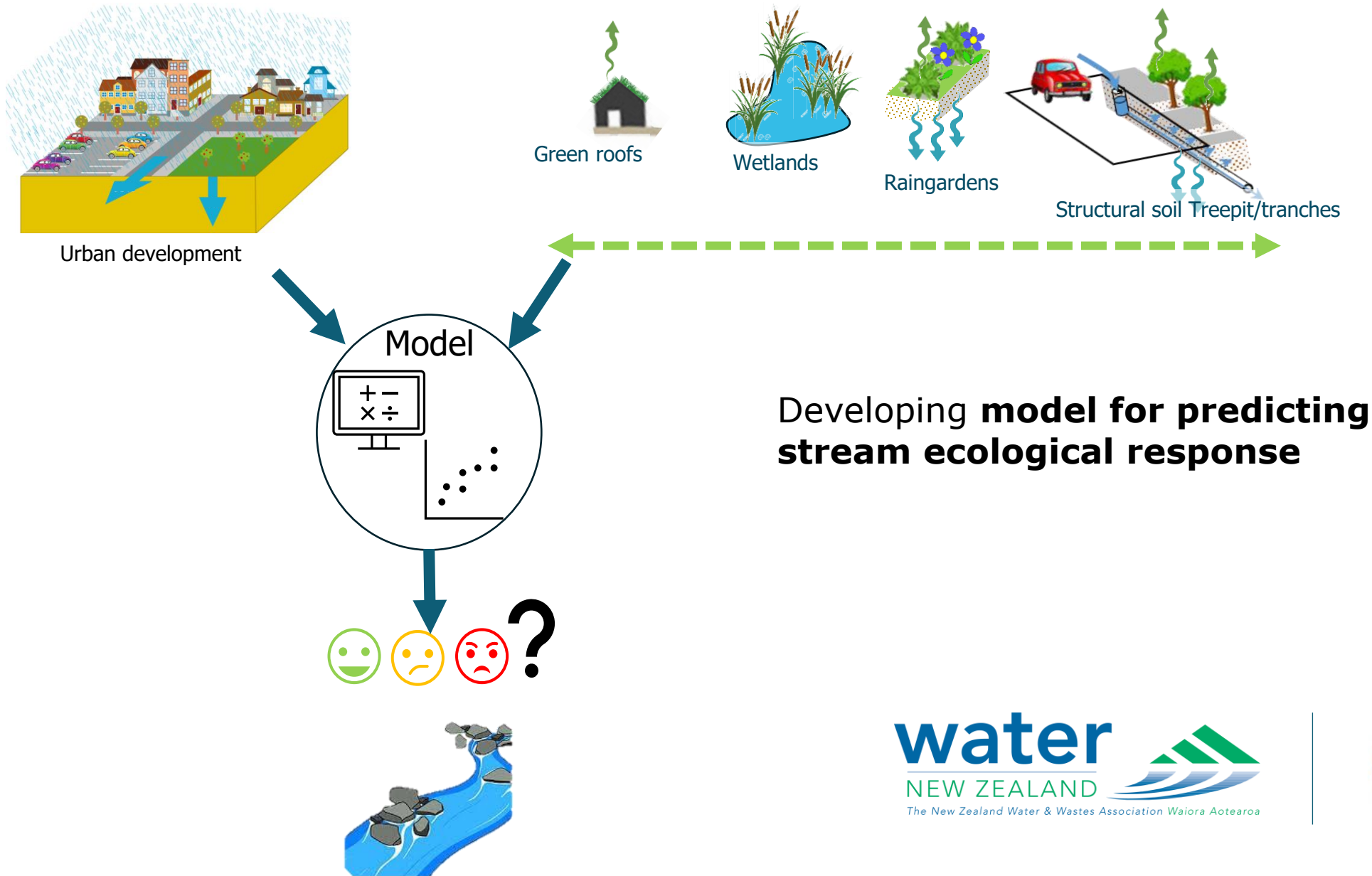


# Science needs

- 1) Improved **understanding of performance** of stormwater treatment systems and **predict performance**
- 2) **Understand the cumulative effects of multiple stressors** acting on urban stream ecosystems
- 3) **Predict effects of urban land use (with varying degrees of WSUD)** on stream ecosystems

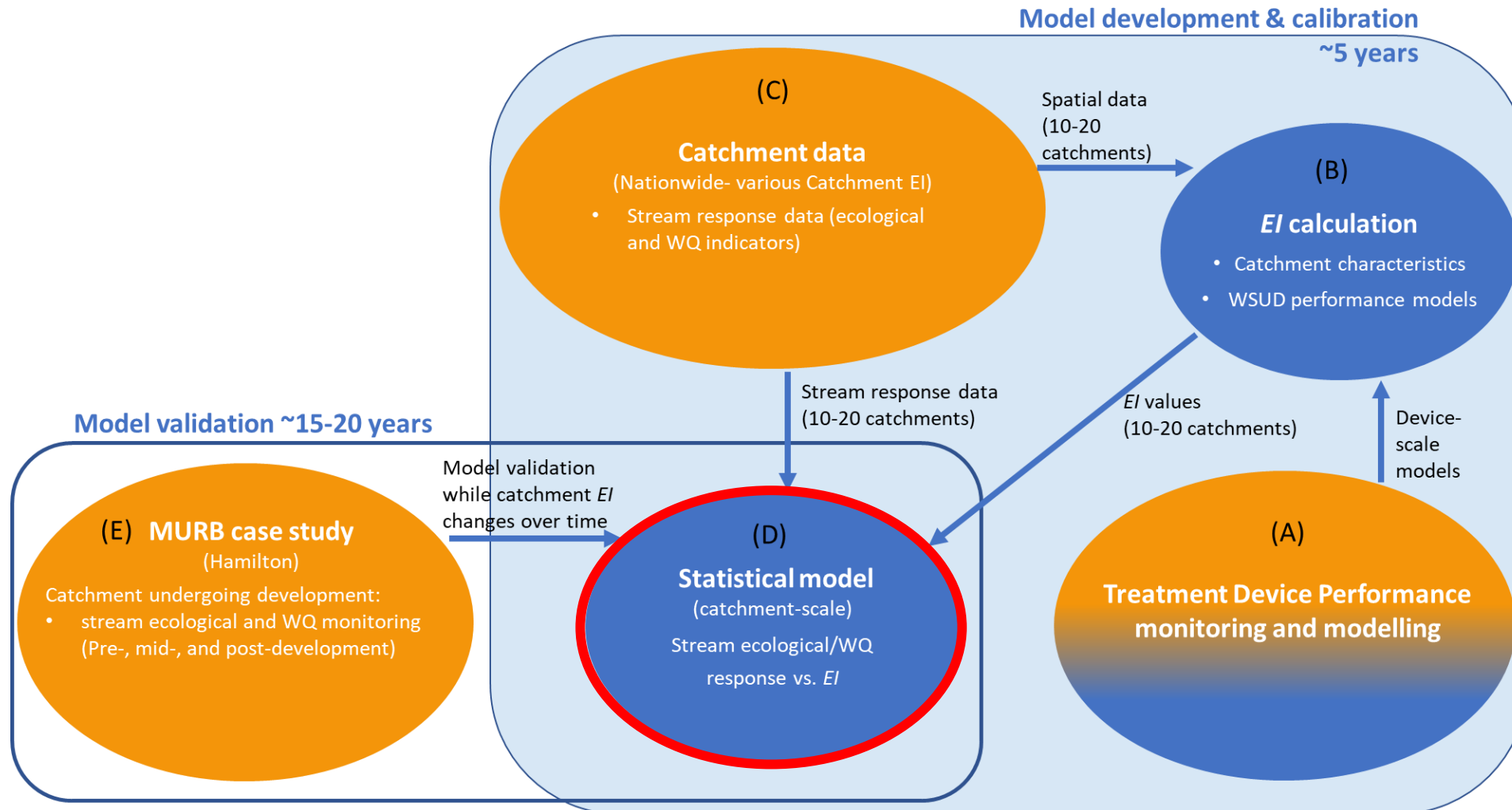


# Wai āwhā project's aim

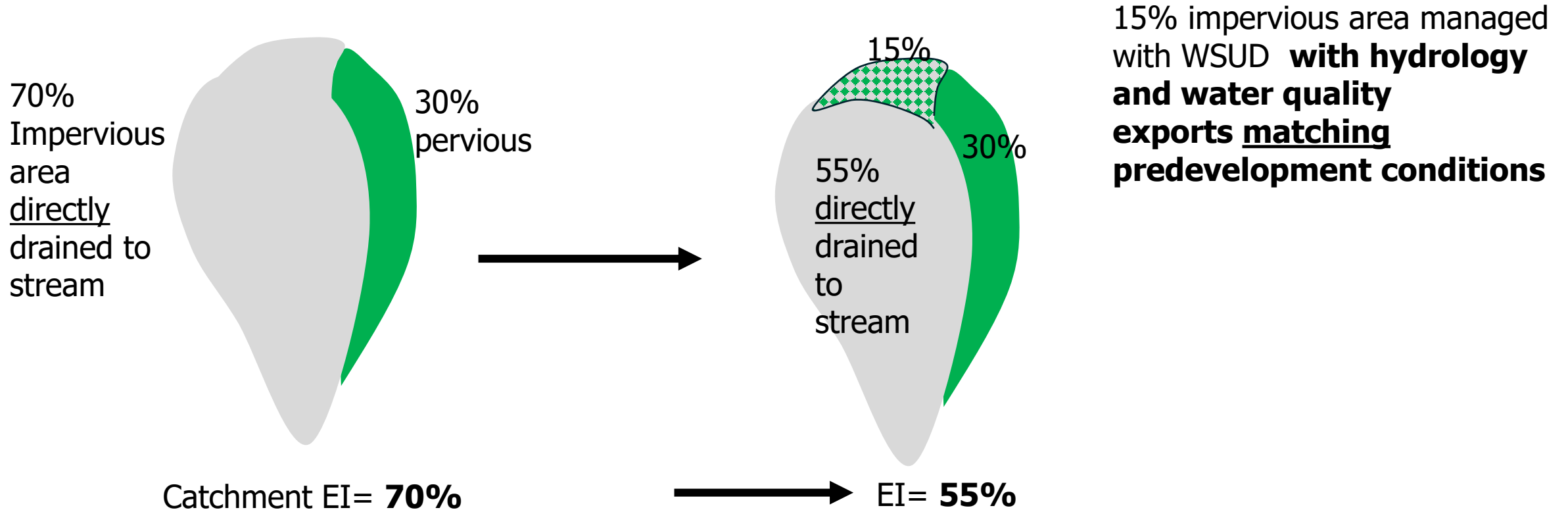




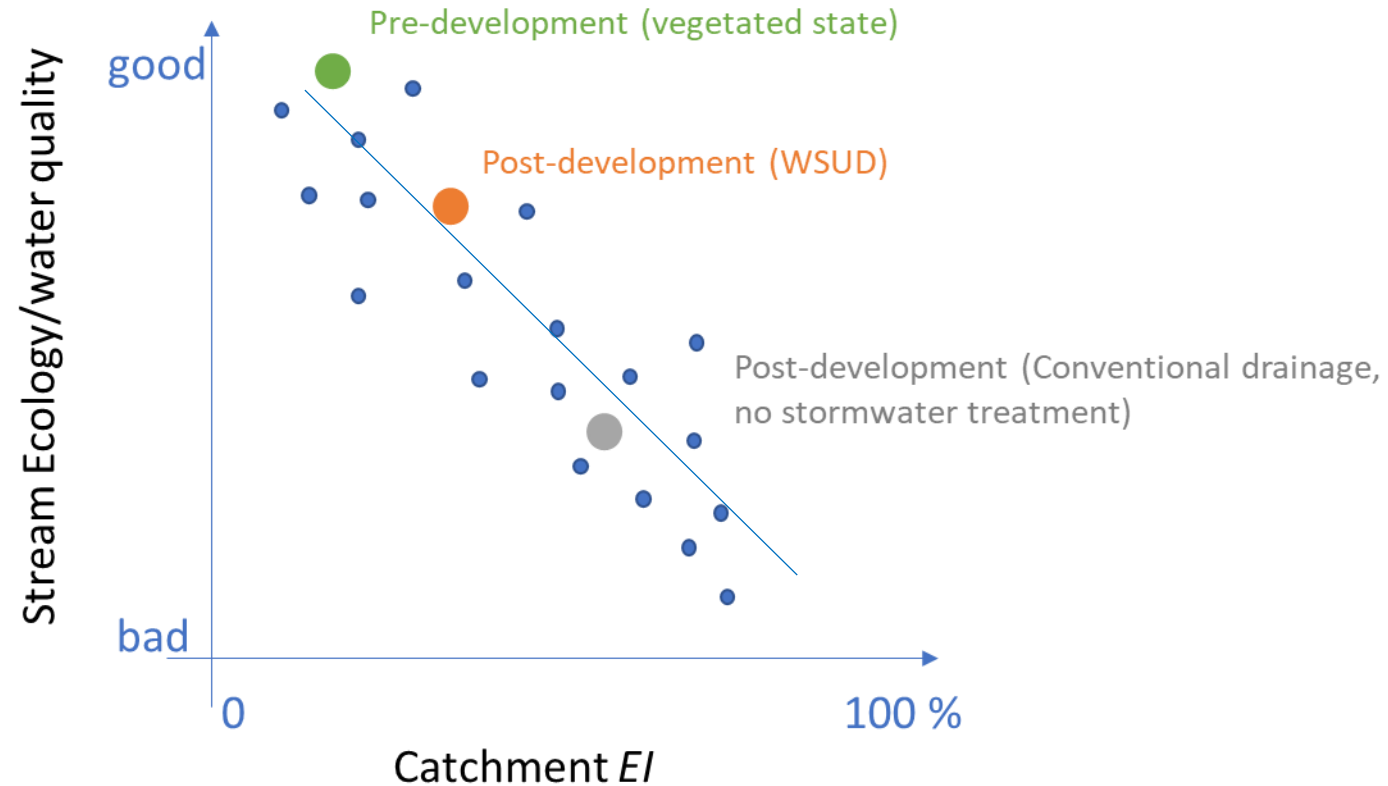
# Wai āwhā project tasks



# Wai āwhā – Effective Imperviousness (EI) concept

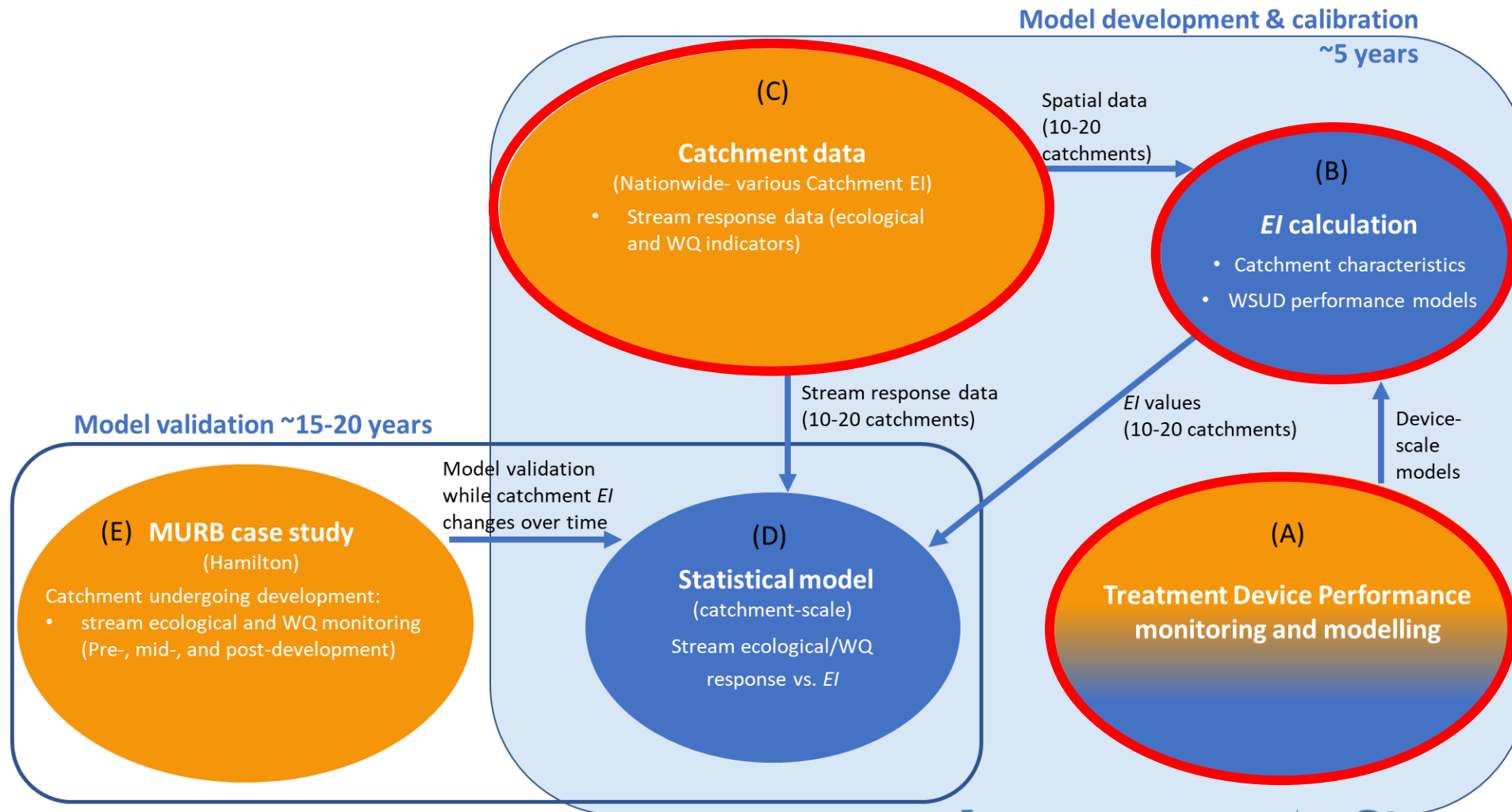


# Wai āwhā – Statistical model



● 10-20 Nationwide catchments

# Wai āwhā project tasks

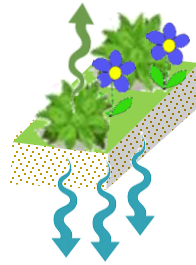




# Wai āwhā – Performance of treatment devices

Targeted devices to monitor:

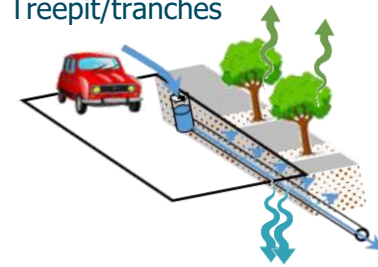
Raingardens



Wetlands



Structural soil Treepit/tranches



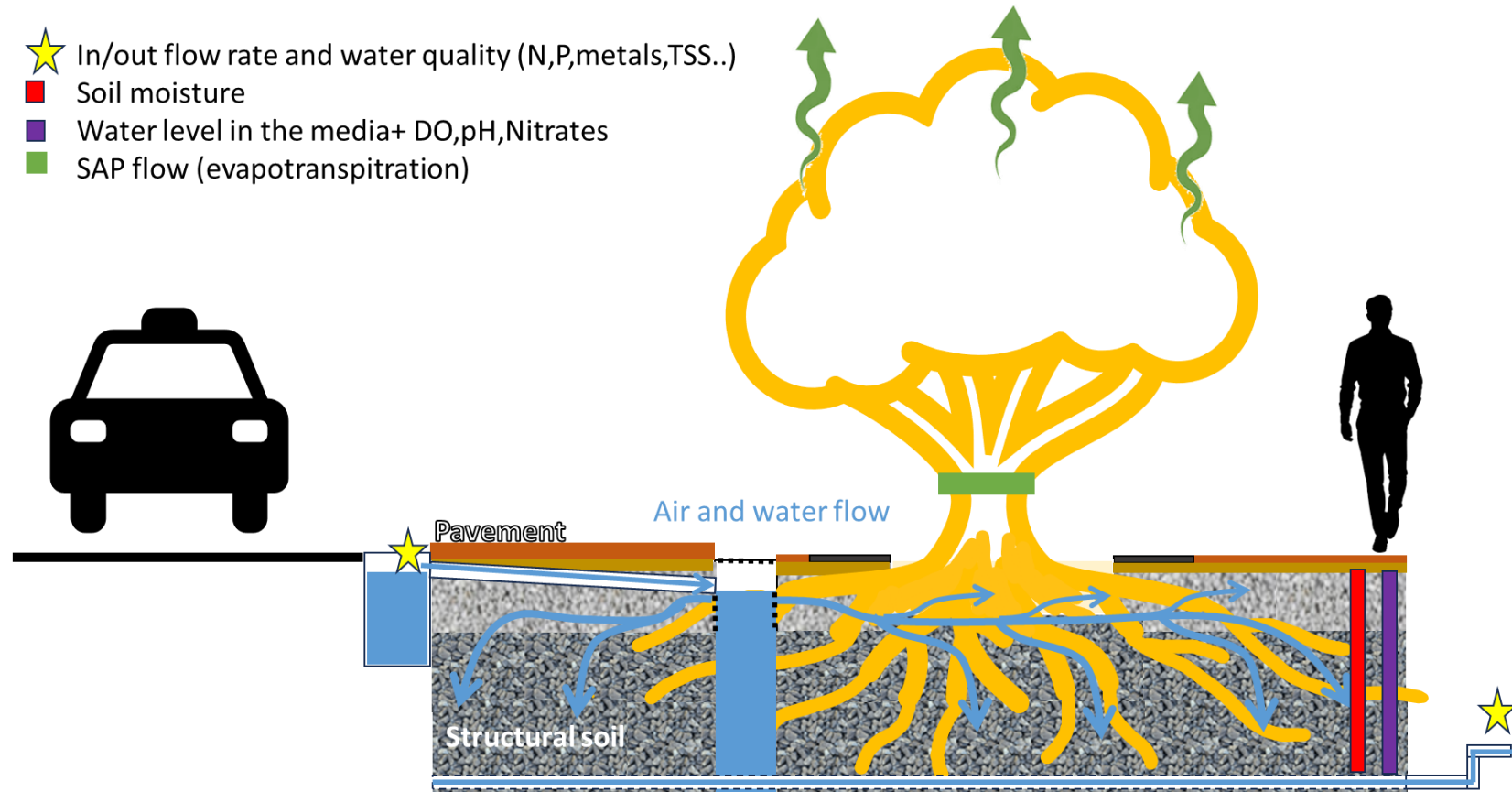
Monitoring objective:

- Assess treatment performance
- Understand treatment processes involved
- Build treatment performance process models -> applicable to various designs

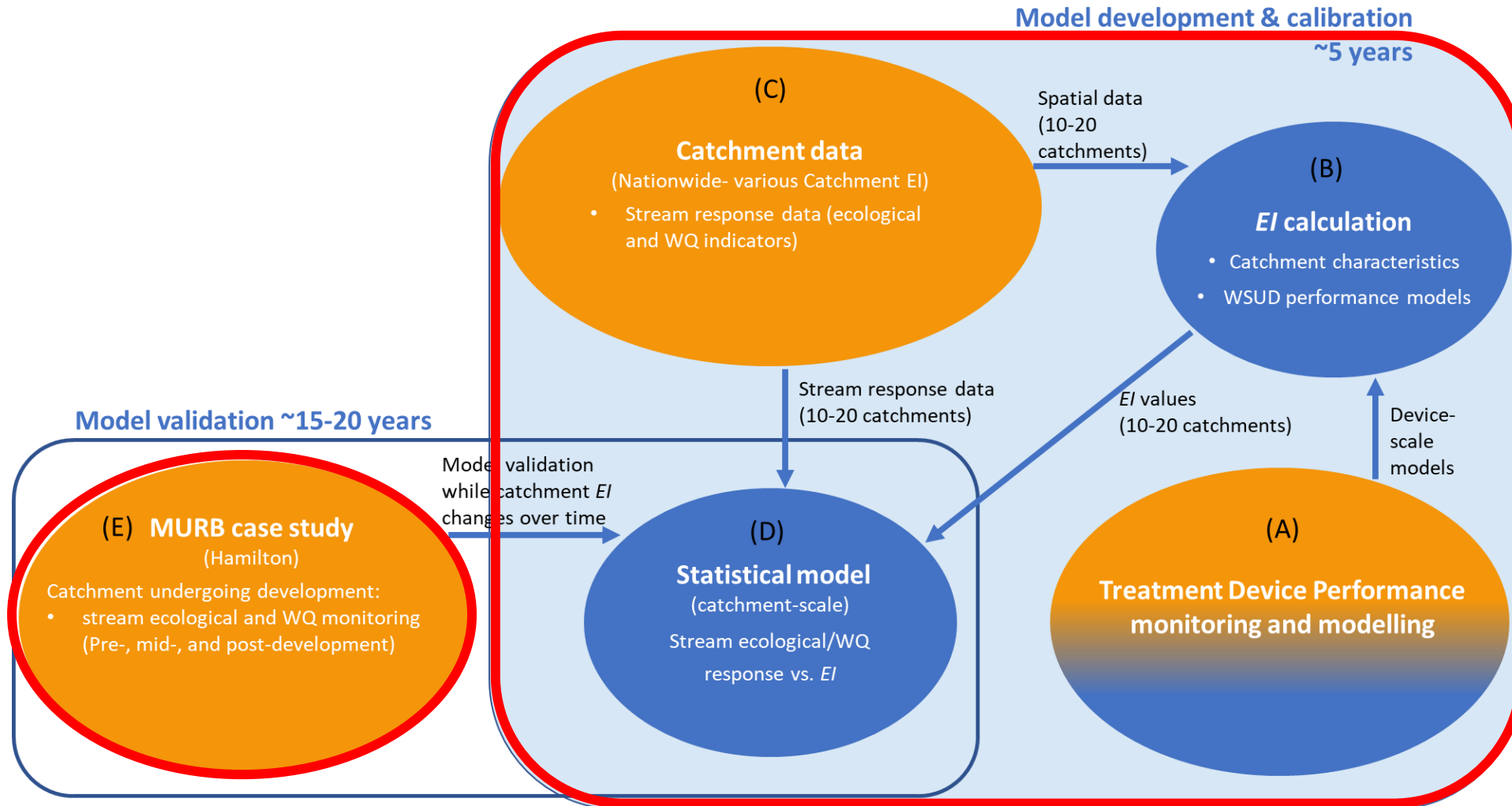
# Wai āwhā – Treatment device monitoring

## Structural soil treepit monitoring

- ★ In/out flow rate and water quality (N,P,metals,TSS..)
- Soil moisture
- Water level in the media+ DO,pH,Nitrates
- SAP flow (evapotranspiration)



# Wai āwhā project tasks





# Wai āwhā – MURB case study - rural to urban transition

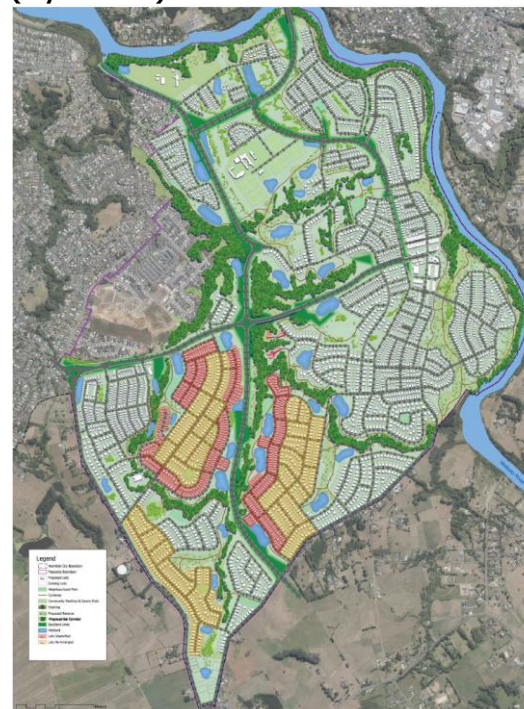
Before development



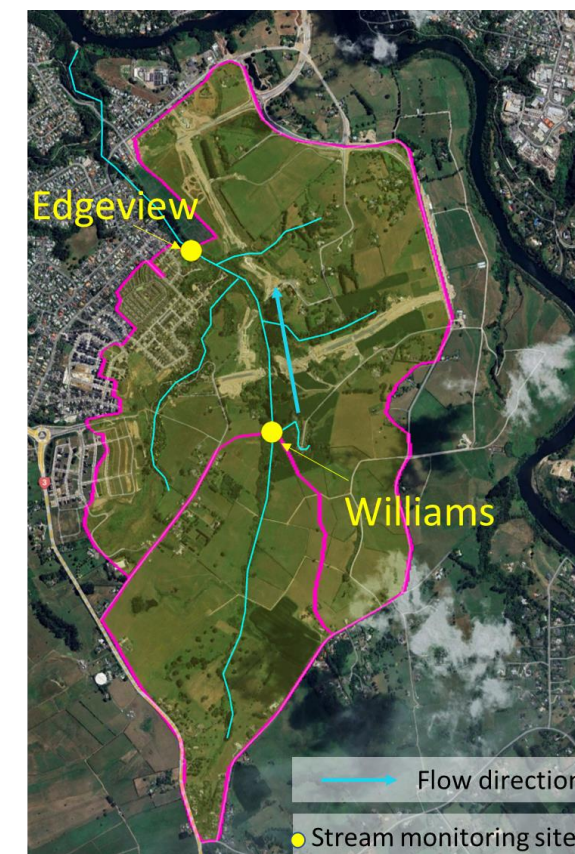
In 2024



Planned Peacocke development (by 2030)

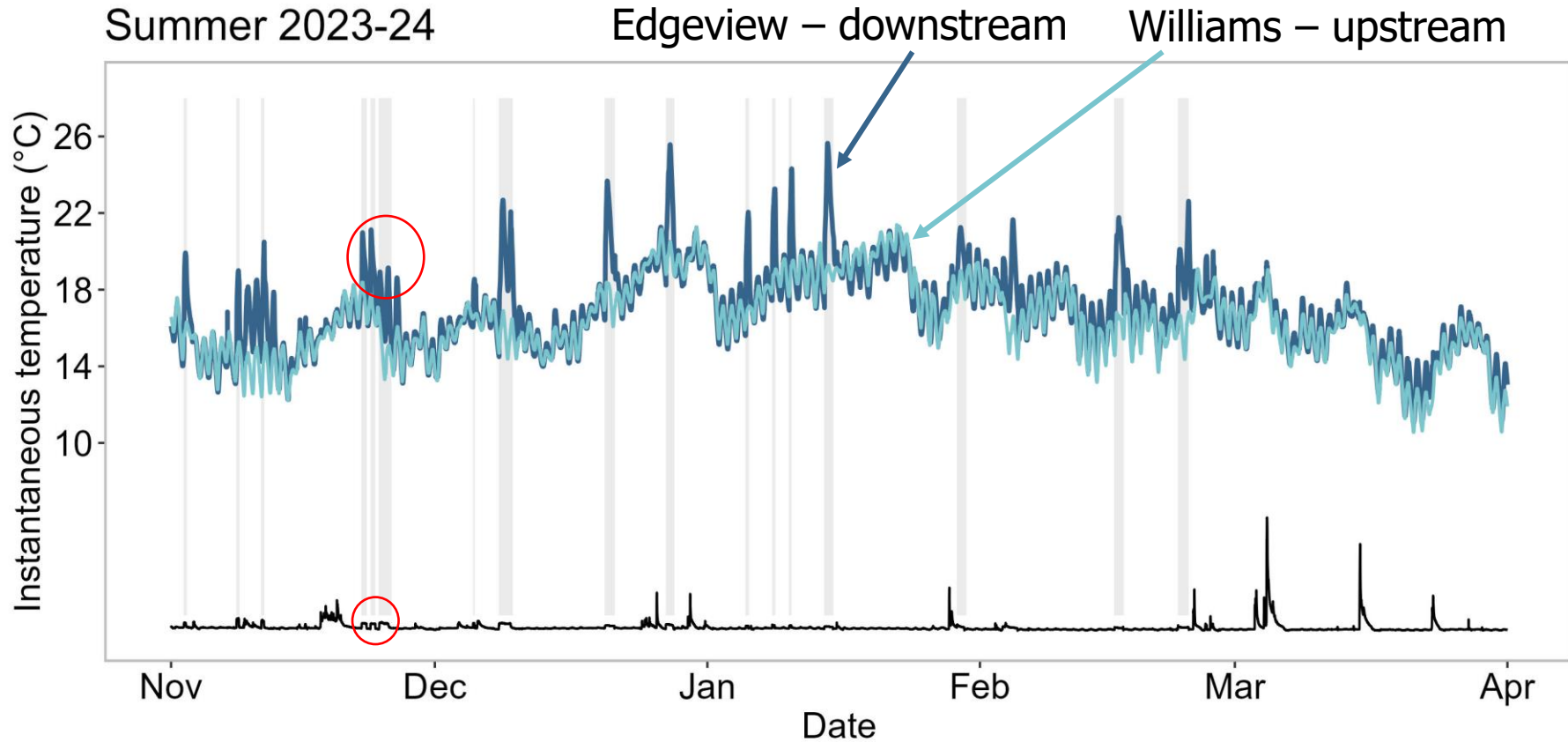


Monitoring sites



- Instrumentation in 2019: **continuous flow, pH, DO, Cond, Temp., Turbidity**
- **Monthly baseflow monitoring** (nutrients, SSC, metals, *E. coli*, visual clarity)
- **Storm event** sampling (same parameters)-1 year of data
- **Annually: Invertebrates, fish** (3 seasons)
- Machine-learning based model for **landcover change identification**

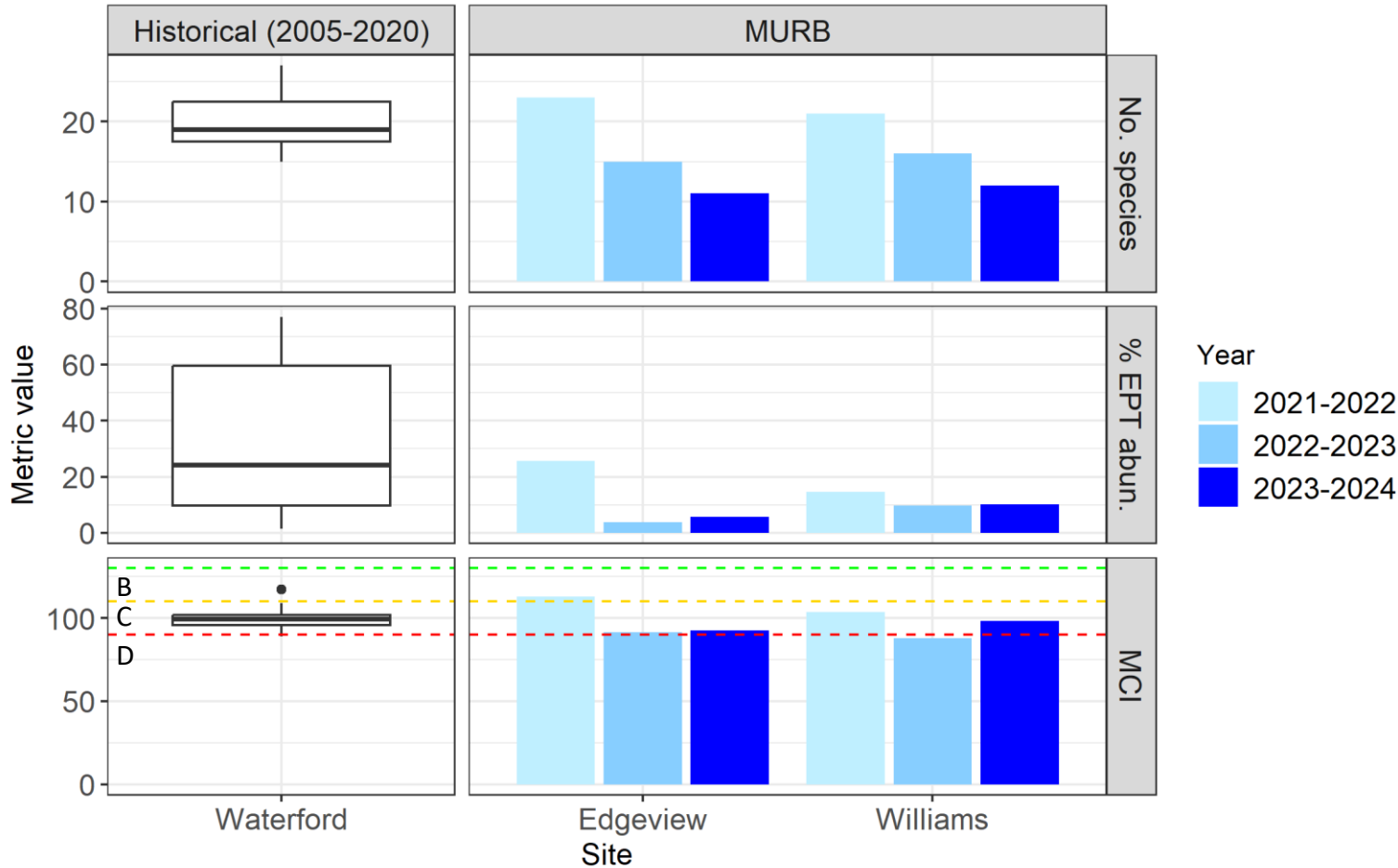
# Wai āwhā – MURB case study – development



- Since July 2023 flow, temperature, specific conductivity anomalies
- Flow increases in absence of rainfall
- Summer temperature surges >1°C in 60 mins 2023-24 was 60 (before mean=18)



# Wai āwhā – MURB case study – stream ecology



- Number of macroinvertebrate species in both sites has declined over 3 years
- Smaller declines in EPT (sensitive taxa) at control site Williams
- Within range of historical variation



# Take home points

Aim of the project:

- **improve our understanding** of the **effects of** multiple **stressors on urban streams** and **how well WSUD can mitigate** these stressors
- develop **model** to predict effects **of urban land use (with varying degrees of WSUD)** on stream ecosystems

# Take home points

We are seeking collaboration for:

- **Information sharing** (existing WQ/ecological data on streams whose catchment includes (or not) WSUD).
- **Co-funding** for treatment systems monitoring, stream monitoring, modelling..
- **Feedbacks** on the project objectives or methodology

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**Thank you!**  
**Questions? Patai?**