Are we monitoring in the dark?

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To minimise the potential adverse ecological effects of roads, a good understanding is required of how roads affect fauna populations and how negative effects can be managed. Until recently, monitoring undertaken in New Zealand was not designed rigorously enough to quantify road effects or the effectiveness of mitigation on bats well. The resulting lack of understanding of whether mitigation had succeeded or failed has meant that we have remained largely in the dark when it comes to managing the effects of roads on bats. If monitoring continues to be poorly designed, it will not address knowledge gaps, and will continue to be undervalued.

BARRIERS TO EFFECTIVE MONITORING - WHAT ARE THEY?

Soundly-based monitoring associated with roading projects can help to address knowledge gaps and ensure that cost-effective mitigation delivers good ecological outcomes. However, this frequently does not occur.

The following are considered barriers to effective, well-designed, monitoring of bats and evaluation of the effects of roading projects:

1. Monitoring is not always a legal requirement and, even when it is required, effective monitoring is not guaranteed;
2. Monitoring is seen as too costly and resource- or labour-intensive;
3. Limited experience and understanding can result in poorly designed monitoring that does not address knowledge gaps; and
4. Methodological challenges of implementing monitoring because bats are a cryptic, fast-moving species.

FRAMEWORK GUIDANCE

In this paper, we show how the development of a national framework guidance document has helped to address barriers to well-designed monitoring. We also show how the framework has been used to guide bat monitoring design for a current roading project.

Wildland Consultants Ltd, AECOM New Zealand (NZ) Ltd, and Landcare Research were commissioned by the NZ Transport Agency to consolidate information on the effects and

management of transport activities on vertebrate species focusing on indigenous bats species[1]. The commission included developing a national framework to guide the management and monitoring of the effects of linear transport infrastructure on bats (which are listed in New Zealand as 'Nationally Threatened'[2]).

The framework provides guidance to address some of the barriers to effective, well-designed monitoring, as summarised in the table below.

Potential barriers to effective well-designed monitoring of effects on bats	Framework content to address barriers
Not always a legal requirement	Demonstrates: • Value of monitoring to project managers and indicates when monitoring should occur. • Importance of collecting data in advance of awarding contracts.
Well-designed monitoring does not always occur, even when required in consent conditions.	Provides: • Draft conditions for use within the consenting process; guidance on preparation of monitoring and management plans. • Guidance on design and implementation of monitoring such as ensuring sample sites used and the length of sampling will yield a statistically significant result. • Guidance on measuring the effectiveness of mitigation.
Cost- and/or resource-intensive	Demonstrates: • How monitoring methods can address specific questions, potential constraints, effort requirements, and reliability. • Implementation of appropriate monitoring can lead to cost savings during construction as mitigation is well focused. • Promotes sharing data and resources and suggests how this could be approached nationally.

Limited experience and understanding can result in poorly designed monitoring that does not address knowledge gaps;	• Provides monitoring design principles, including:
	  - Optimal timing.
	  - Survey design.
	  - Selection of appropriate personnel.
	  - Importance of measuring consistent variables.
	• Presents the competencies that a bat ecologist should have, to aid in the appointment of appropriate ecologists.

Methodological challenges of implementing monitoring because bats are a cryptic, fast-moving species	• Promotes collaboration and adaptive management.

[1] https://www.nzta.govt.nz/resources/research/reports/623/

[2] C.F.J. O'Donnell, J.E. Christie, B. Lloyd, S. Parsons and R.A. Hitchmough 2012. NEW ZEALAND THREAT CLASSIFICATION SERIES 6: Conservation status of New Zealand bats, 2012

SOUTHERN LINKS CASE STUDY - MONITORING IN PRACTICE

Recently, we have applied the monitoring design guidance presented within the framework to the Southern Links roading project in Hamilton, NZ (*the Project*). Southern Links will be constructed in an area where New Zealand's long-tailed bats (a threatened endemic species) are known to be present;. This is one of the last remaining urban bat populations in New Zealand.

The Project has Designation conditions that require monitoring to fill bat-related knowledge gaps prior to construction of the road network. Hamilton City Council (HCC) and NZ Transport Agency responded to these conditions by commissioning baseline monitoring that will enable well-designed long term monitoring to be completed.

Monitoring objectives were established in the Designation conditions. These conditions require monitoring to be undertaken pre-construction, during construction, and post-construction, to identify potential effects of roads on bat activity and behaviour. Potential effects are associated with lighting and noise, and barriers to movement. Identification of key roosting sites and foraging areas is also required. These objectives were used to formulate questions that the monitoring was then designed to answer. The monitoring design was the subject of power analyses (statistical review) to ensure that the number of monitoring sites used and the duration of sampling would allow changes to be detected, should they occur. The monitoring design included pairs of 'treatment (road)' and 'control (no road)' sites.

A number of different bat monitoring techniques are being used in the project as each provides slightly different information about bat activity and behaviour. The monitoring design takes into account seasonality, evolving monitoring technology, experience of effectiveness of monitoring techniques, and the costs of survey approaches. Radio-tracking and thermal imaging were considered as possible options to monitor bat behaviour. Taking into account the factors detailed above, thermal imaging was chosen in combination with traditional acoustic monitoring techniques using Automated Bat Monitoring units (ABMs) to answer the monitoring questions.

To ensure the effective use of thermal imaging in the Project, AECOM drew on its global network of specialists. This approach was taken because the use of thermal imaging in NZ is a new technique, with no established monitoring methodology. AECOM provided a high specification thermal camera and an experienced surveyor (Dr Kayleigh Fawcett) from the UK to train Wildland Consultants staff prior to survey implementation. Dr Kerry Borkin, from Wildlands, oversaw the first year of monitoring, and, with Dr Fawcett's assistance, established the thermal surveying methodology that would be implemented during long term monitoring.

HCC and NZ Transport Agency are currently in year one of two years of baseline monitoring for the Project. The thermal imaging and ABM monitoring have provided new information on long-tailed bat behaviour within Hamilton, New Zealand. It is anticipated that the monitoring will build upon our knowledge of long tailed bat activity and behaviour. This will provide evidence to support the development of mitigation that is well directed and cost-effective.

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Fiona Davies and Sarah Lindberg

October 2017

Presentation outline

I. Monitoring barriers: What does good look like and what are some of the barriers to effective monitoring?

II. Bat framework – can this help?

III. Framework and monitoring in practice – Southern Links case study

What are the barriers to effective monitoring?

Bat ecological impacts from transport/road projects

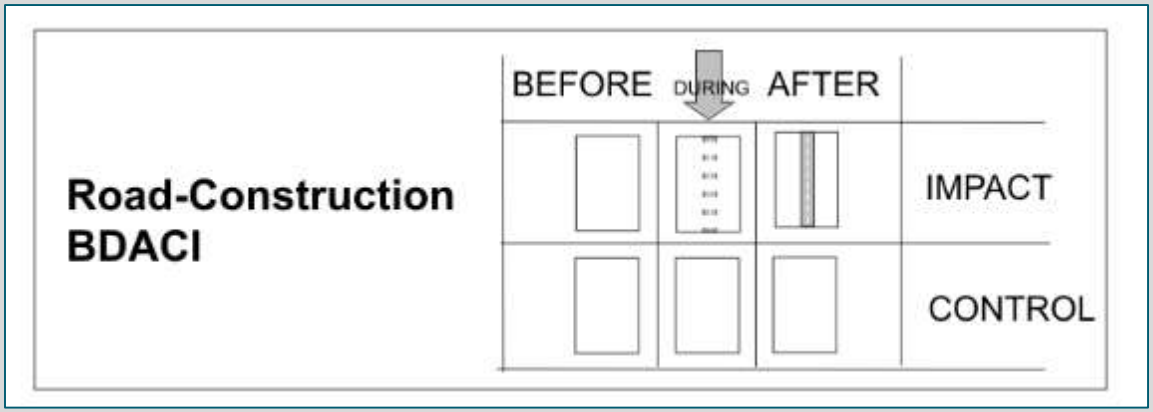
Ecological monitoring

- What is it?
- Why do it?
- Why does it matter?

"Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted"

Albert Einstein

- Objectives
- Statistical power
- Control sites / before during after measurements



- So why aren't we doing this?

Potential barriers to monitoring of bats and evaluation of the effects of roading

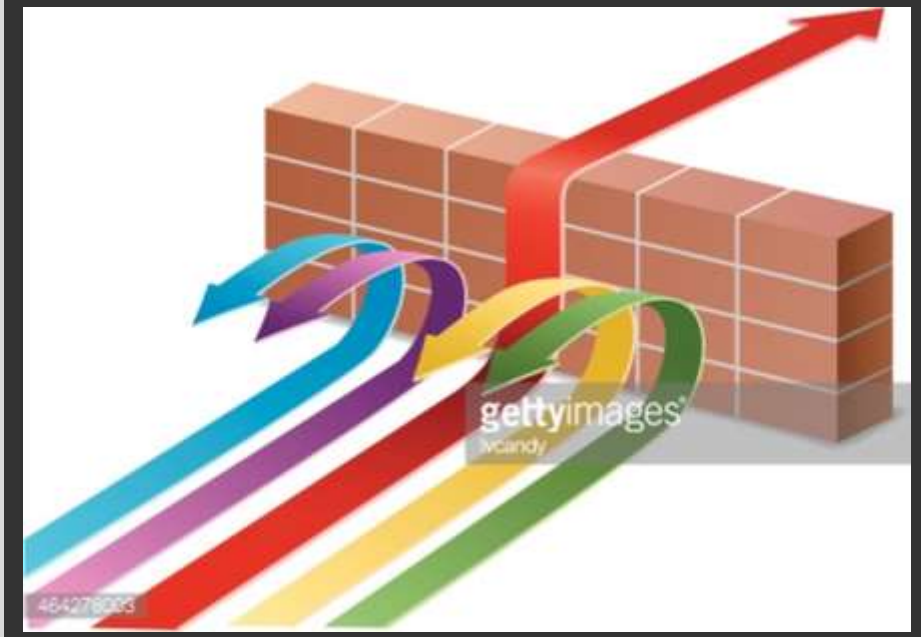
1) Not always a legal requirement

   Even when it is this effective monitoring is not guaranteed

2) Costly and resource- or labour-intensive

3) Limited experience and understanding

4) Methodological challenges



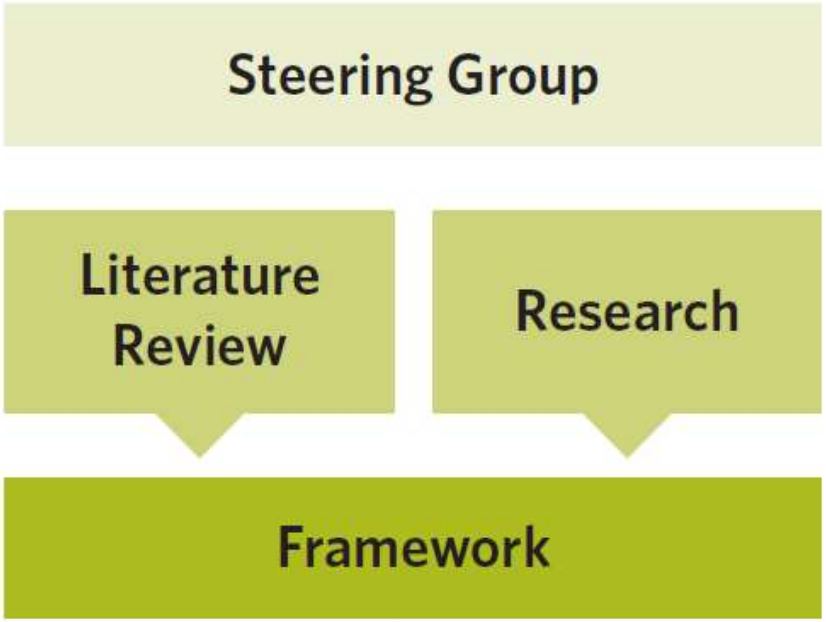
Bat parents

Bat framework

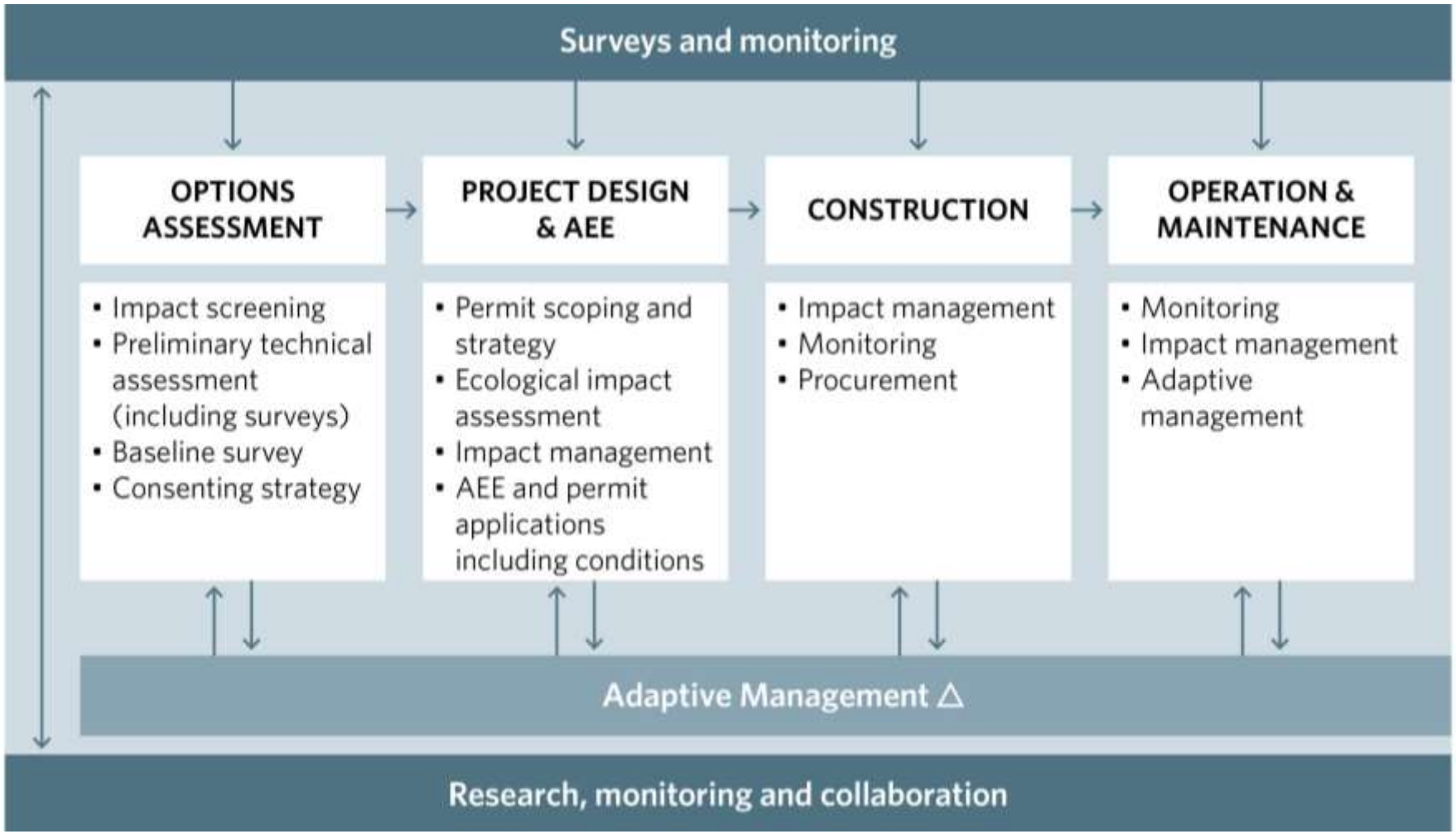
Can it help?

Bat framework - What is it?

- National framework guidance
- Research Report 623: Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature.



Bat Framework overview



Bat framework

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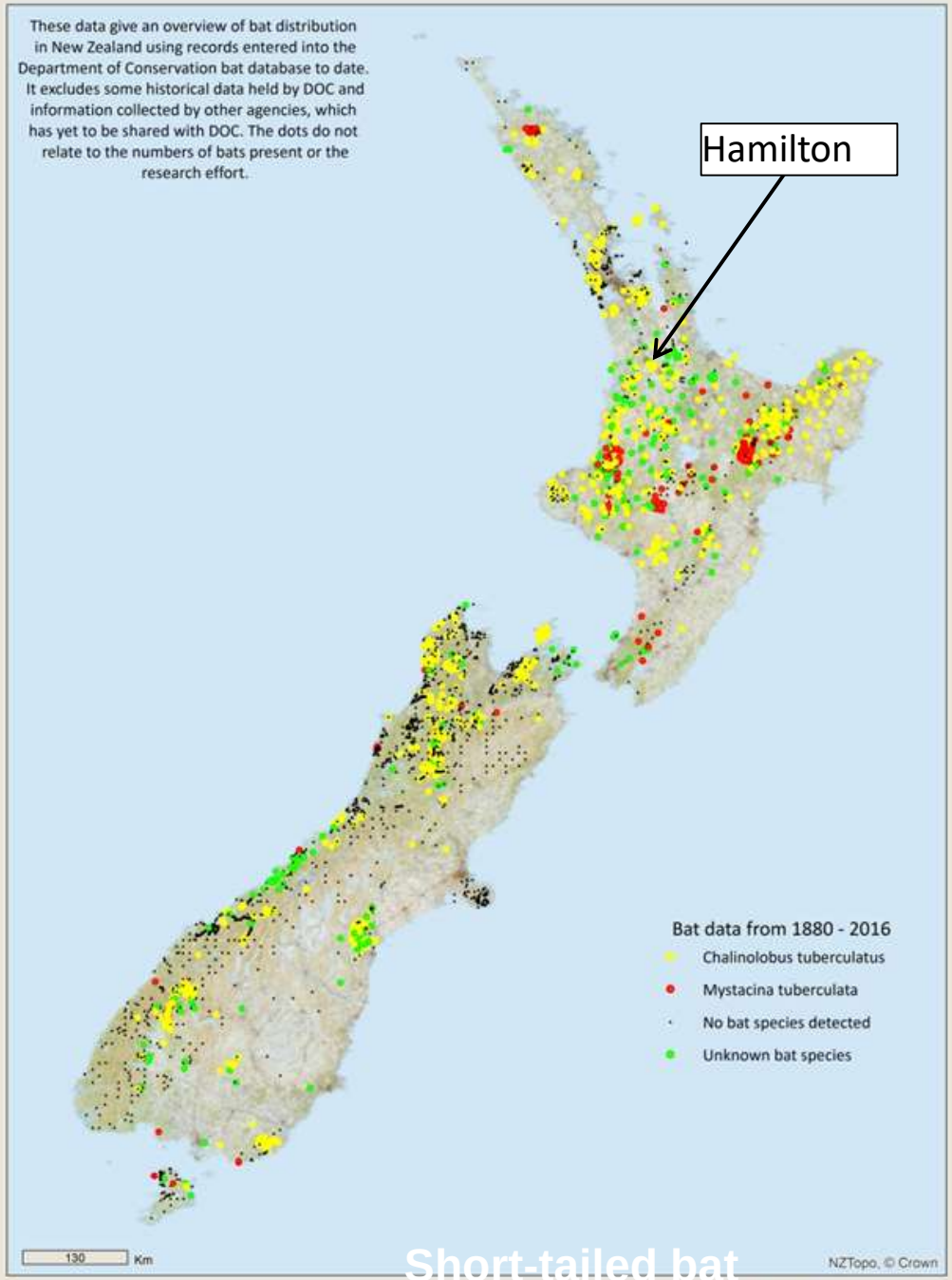
Barrier	Framework
Legal requirement no guarantee	• Promotes value to project managers • Importance of collecting data in advance of awarding contracts • Draft Conditions
Cost- and/or resource-intensive	• Encourages focused monitoring help identify effective mitigation costs • Data and resources sharing
Limited experience	• Clear guidance (design and implementation of monitoring) • Bat ecologist competencies
Methodological challenges	• Collaboration • Adaptive Management

Monitoring in practice

Bat monitoring on the southern links roading project

Southern Links – known population of long-tailed bats



Short-tailed bat

Photo: K Borkin collection

Hamilton and Long-tailed bats

- One of last remaining urban populations – numerous historical surveys/monitoring
- Threatened species under NZ Threat Classification system – more controls
- Unique habitat

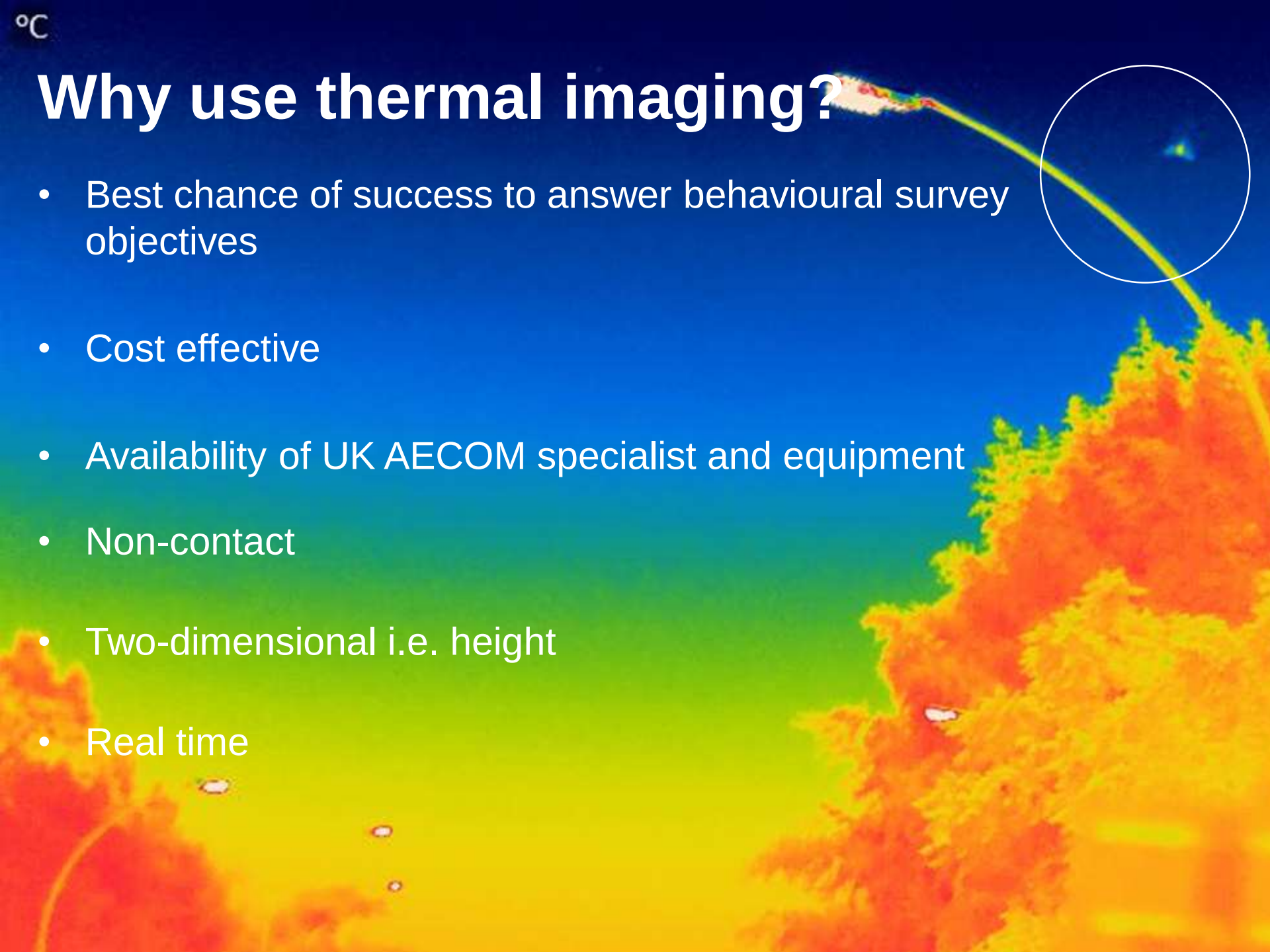



Monitoring objectives

- Set by Designation conditions
- Baseline surveys (2 years prior), during and post construction (5 years) monitoring
- Key questions:
  - What effects will the road have in regards to bat activity and behavioural patterns
  - Specifically, what are the effects of lighting and other barriers, like bridges
  - How effective is pest control?
  - Where are key habitats such as foraging and roosting sites?

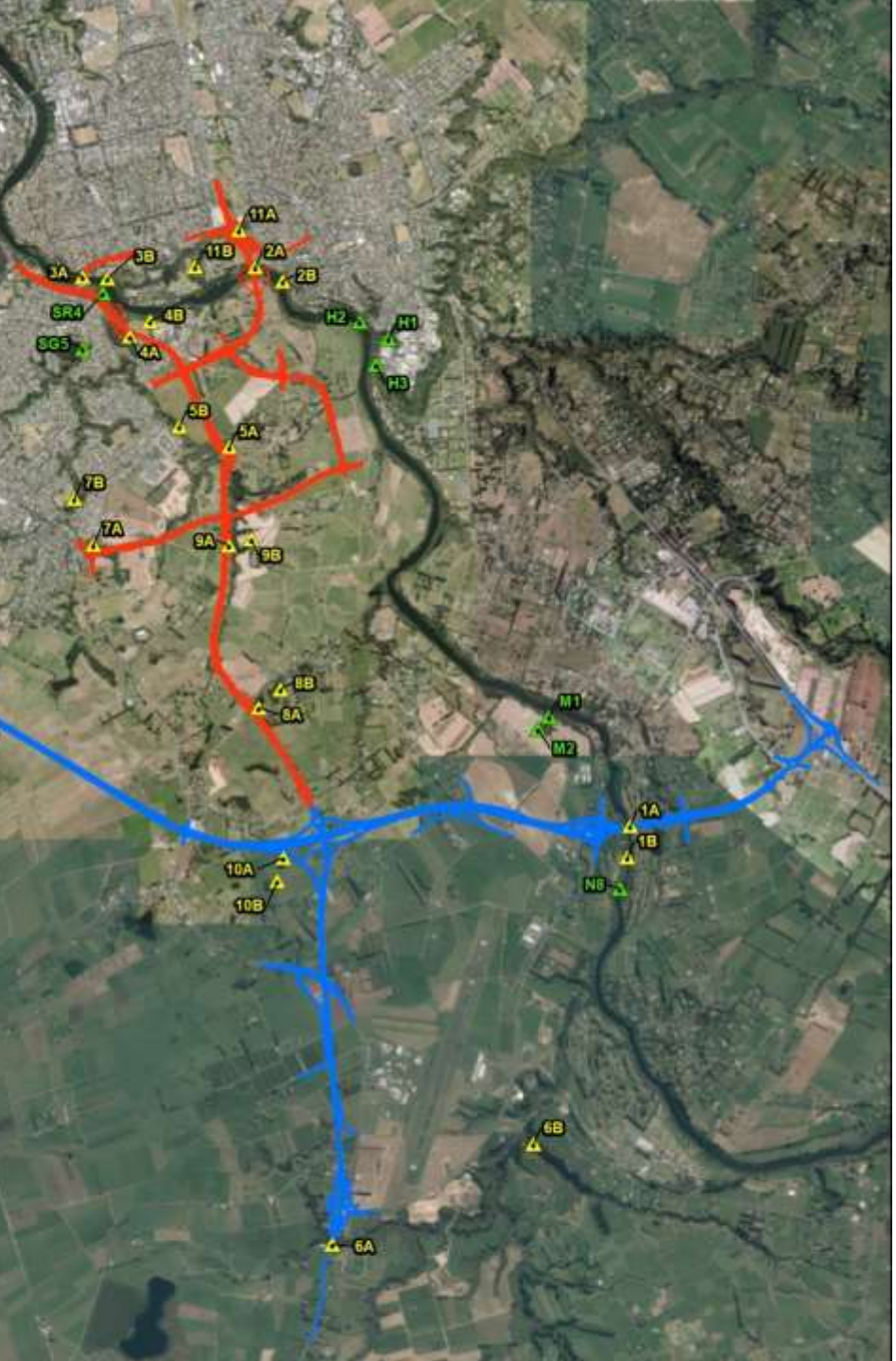
Selection of bat monitoring techniques

Combination of Automated Bat Monitors (ABM's) and thermal imaging camera chosen to address objectives/questions



Why use thermal imaging?

- Best chance of success to answer behavioural survey objectives
- Cost effective
- Availability of UK AECOM specialist and equipment
- Non-contact
- Two-dimensional i.e. height
- Real time



Monitoring design - ABMs

Road monitoring

- 13 x paired ABM's – impact and control
- 21 nights – repetition (statistical analysis)
- Light (lux), noise (dB) recorded

Roost monitoring

- Historic roosts
- 9 x single ABMs
- 21 nights – repetition (statistical analysis)
- Light (lux), noise (dB) recorded

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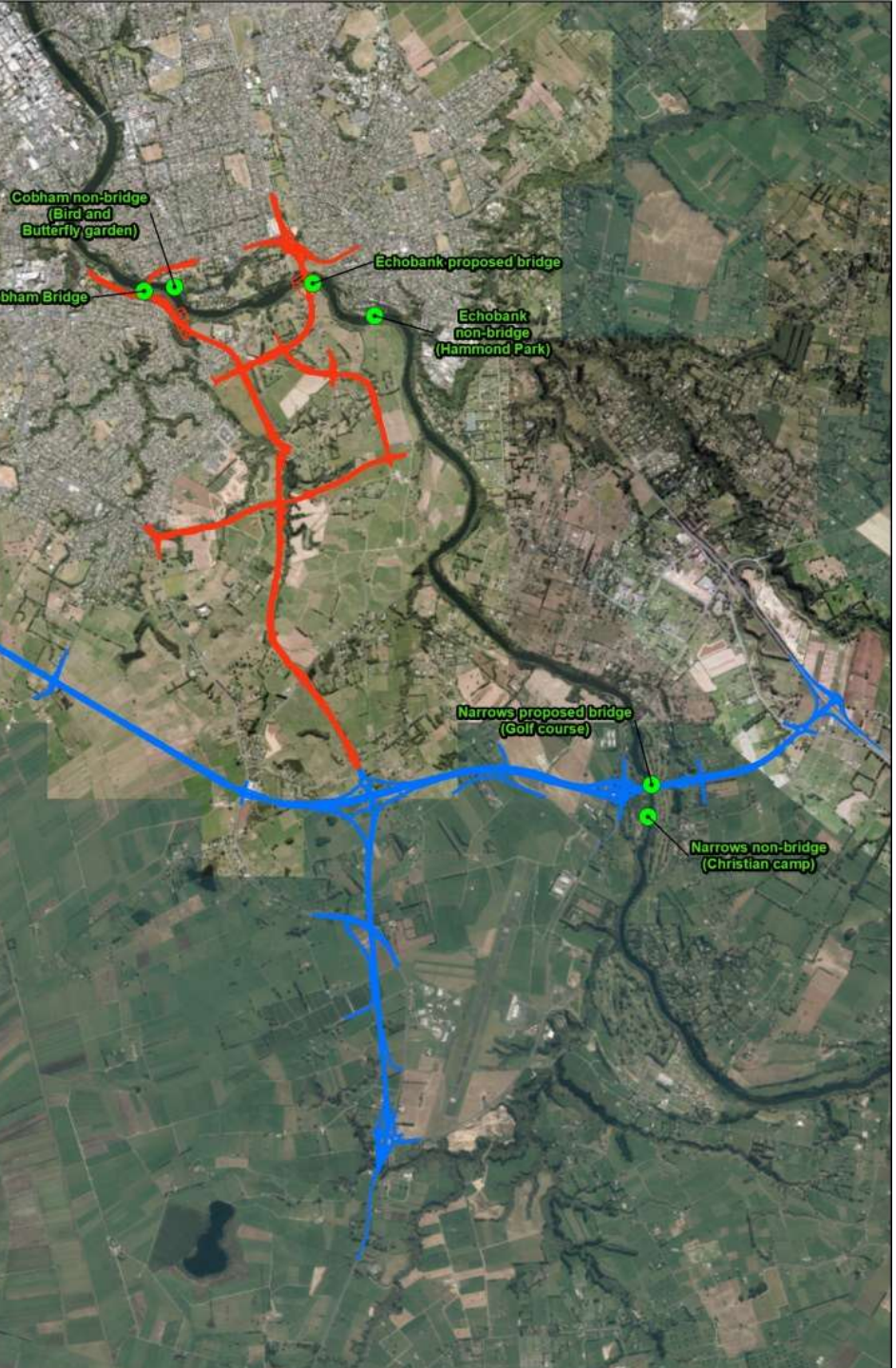

Monitoring design - thermal

- High spec thermal camera - FLIR T1020 28
- Paired sites - three current/proposed bridges and three control sites
- Three nights at each site – repetition for statistical analysis

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Adaptive management in practice

- Review of year one monitoring being undertaken
- Monitoring refinement

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