Ecological impact assessment guidelines

WAKA KOTAHI
NZ TRANSPORT AGENCY

Te Kāwanatanga o Aotearoa
New Zealand Government

WAKA KOTAHI
NZ TRANSPORT AGENCY

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More information

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Front cover photo: Carol Bannock

Back cover photo: Carol Bannock

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1 Introduction

A hoverfly pollinating
the native clematis species
Clematis paniculata.
Photo: Robyn Simcock

Biodiversity provides the life-supporting systems that enable all organisms, including humans, to survive, and New Zealand's indigenous biodiversity has deep intrinsic value. However, land use, invasive pests and diseases have caused New Zealand's indigenous ecosystems and species to be in a state of rapid decline. The biodiversity crisis and importance of biodiversity for human wellbeing in a changing climate has been recognised by government in plans and strategies including Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy (ANZBS), the emissions reduction plan[1] (ERP) and the national adaptation plan[2] (NAP).

Waka Kotahi activities have the potential to affect New Zealand's indigenous biodiversity. Construction of new infrastructure and the maintenance, improvement and use of existing infrastructure may all negatively affect biodiversity values. However, Waka Kotahi projects and transport network can also benefit biodiversity, where opportunities are realised and managed appropriately.

Waka Kotahi is committed to protecting and enhancing the natural environment, including biodiversity values, through its Environmental and Social Responsibility (ESR) Policy, Z/19 Taumata Taiao – Environment and Sustainability Standard and Toitū Te Taiao – Our Sustainability Action Plan. This will be achieved in part through implementation of the Waka Kotahi ecological impact assessment guidance provided in this document.

Ecological impact assessment (EcIA) is an independent, stand-alone and specific technical process of identifying, quantifying and evaluating the potential effects of defined actions on habitats, species and ecosystems. For Waka Kotahi EcIA provides an indication of ecological risk and opportunities during early stages of project development and later to support the assessment of effects on the environment (AEE) as part of the consent process. EcIA sets the foundations for appropriate ecological effects management, recognising opportunities to support biodiversity and achieving Waka Kotahi policy obligations.

This document refers to the ecological impact assessment process (EcIA) as well as 'detailed EcIA'. When referring to 'EcIA' or 'EcIA process' it means the entire EcIA approach, including early components (for example the environment screen). Reference to 'detailed EcIA' means a specific level of EcIA assessment, generally undertaken for the preferred option.

1. Te hau mārohi ki anamata – towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's first emissions reduction plan. Ministry for the Environment, 2022.

2. Urutau, ka taurikura: Kia tū pakari a Aotearoa i ngā huringa āhuarangi – adapt and thrive: building a climate-resilient New Zealand – New Zealand's first national adaptation plan. Ministry for the Environment, 2022.

1.1 Purpose and audience

The purpose of these guidelines are to support and promote good ecological impact assessment practices on Waka Kotahi projects. Specifically, these guidelines:

- provide specific guidance for land transport project development in relation to ecological matters
- describe how EcIA works within, and supports, Waka Kotahi project development/delivery frameworks, including statutory processes (Resource Management Act 1991 (RMA) and/or Wildlife Act 1953)
- provide guidance to ensure compliance with Waka Kotahi strategic environmental objectives and outcomes, supporting Z/19 Taumata Taiao – Environment and Sustainability Standard
- ensure EcIA for Waka Kotahi projects is consistent in approach as well as fit for purpose.

These guidelines are intended for ecologists undertaking EcIAs. Information applicable to the wider project team involved in preparing, implementing, and supporting the EcIA process and the subsequent management of ecological effects is indicated in figure 1.

1.2 Document scope

This document provides guidance on EcIA through different project life stages. EcIA can be used to assess projects of any scale. It may be applied to all Waka Kotahi state highway construction and improvements, walking and cycling improvements, or any given programme or policy relating to infrastructure improvements of the transport system where an EcIA is required. This includes work undertaken within the existing transport designation. Specific information regarding maintenance and operation contracts is provided in appendix A.

Document structure

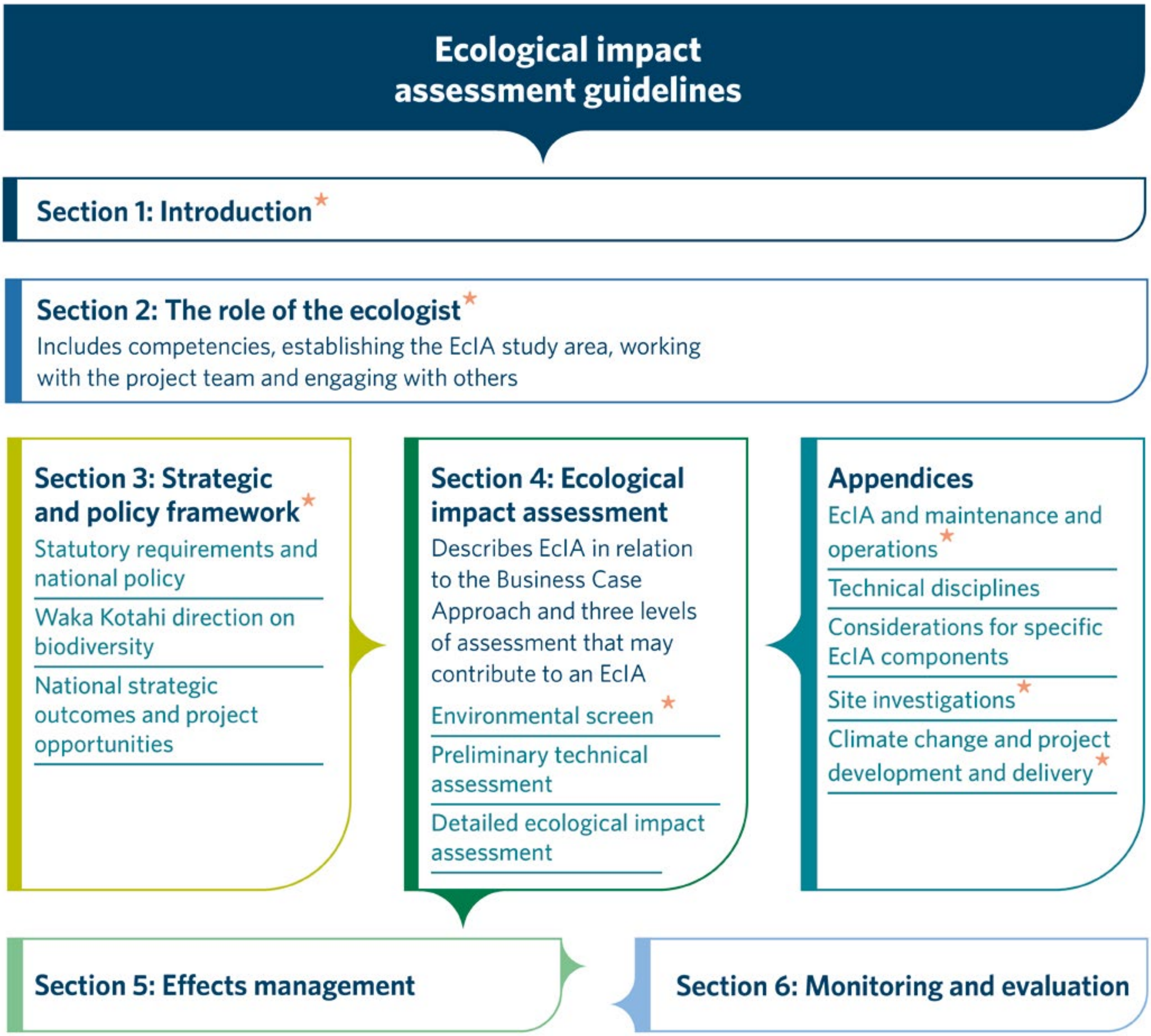

Figure 1. Document structure with sections relevant to the wider team indicated with an astrisk *

1.3 Connection with EIANZ guidance

This document should be used in conjunction with the Environment Institute of Australia and New Zealand's Ecological impact assessment guidelines for New Zealand (EIANZ 2018). EIANZ uses matrices and tables to guide the ecologist in the assessment process. The ecologist needs to apply their knowledge and experience to the EIANZ approach, allowing for project-specific aspects such as ecological, landscape and statutory context. Appropriate use of scale(s) is necessary for an accurate, rigorous and transparent EcIA. This document makes clear Waka Kotahi expectations regarding EcIA and use of EIANZ. Considerations when using the EIANZ matrices are provided in section 4.3.1 and must be applied to Waka Kotahi EcIAs.

The scope of these guidelines is broader than EIANZ, as ecological impact assessment for Waka Kotahi projects often starts before statutory approvals are sought. This is illustrated in figure 2, showing where EIANZ and these guidelines sit within the project lifecycle, including the Waka Kotahi Business Case Approach (BCA).

Aligning with EIANZ guidance, this document is entitled ecological 'impact' assessment, while the RMA refers to effects. An impact is a project action that results in changes to an ecological feature, whereas an effect is the outcome to an ecological feature from that impact. For example, the impact from construction is the removal of a row of trees, while the effect of removing those trees on native bats would be the disruption/loss of connectivity between their roost site and foraging area. These guidelines covers both impacts and their effects.

Photo: C Bannock

1.4 Waka Kotahi research and other guidance and resources

Waka Kotahi undertakes research and develops guidelines and standards to improve environmental knowledge, performance and biodiversity outcomes. For current material that may be of relevance to a project's EcIA visit the Biodiversity page on the Waka Kotahi website.

1.4.1 Land transport investment benefits and ecological information

An early source of information for the EcIA that may be available to the project team is information gathered as part of a project's investment benefits management process. This is only if biodiversity measures have been selected as a non-monetised benefit. Investment benefits management starts earlier in the project lifecycle than EcIA and shares a similar approach of identifying ecological features and valuing them (figure 2). The project team should ascertain whether biodiversity benefit measures have been selected and share any ecological information collected with the project ecologist (appendix C1). Information on benefits management is available on the Waka Kotahi website.

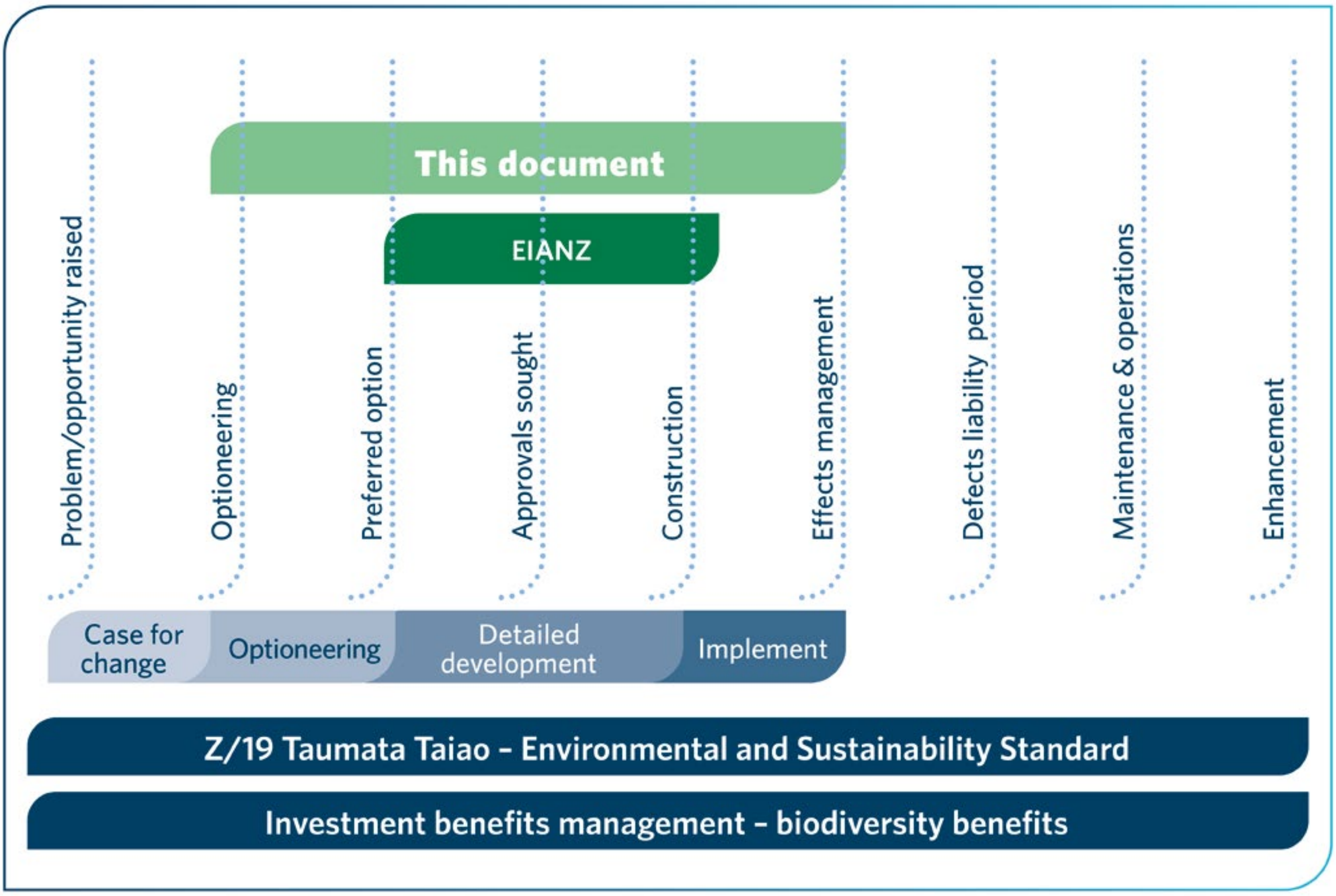

Figure 2. Where these guidelines sit within the project lifecycle.

2 The role of the ecologist

Photo: Jake Ball, Boffa Miskell

Engagement of the ecologist early in the business case development process will enable the project to identify opportunities and constraints more accurately, while the project is flexible enough to alter route selection and/or design more accurately to accommodate these (for example, avoid high ecological values). The ecologist needs to be clear about their role on a project and have the right level of competence as outlined in this section.

2.1 The requirements of the ecologist

A project may need one or more ecologists, possibly including specialist ecologists. All ecologists undertaking EcIA on Waka Kotahi projects must meet the requirements of a suitably qualified and experienced person (SQEP) as outlined in table 1.

The ecology lead is either the sole ecologist on the project or has been appointed as the ecology lead by the project manager when more than one ecologist is required. The ecology lead is responsible for finding and endorsing specialist ecologists with the right level of competence for the necessary task.

The ecology lead must:

- have a good understanding of legislative requirements (and applicable district/regional plans) and other statutory processes that sit behind the EcIA
- consider Waka Kotahi direction on biodiversity in their assessments, as described in section 3.2; and
- ensure the EcIA process is an efficient and economic use of resources, while gathering adequate information to fully inform legislative, policy and organisational requirements.

A specialist ecologist should be engaged when a complex ecosystem or threatened/at risk (TAR) species is potentially present and requires survey and possible management strategies. The scope of their input should include planning ecological baseline surveys in advance (this may be multiple years) to avoid undue impacts on project programmes. Any recommendations in relation to the appropriate specialist ecologist from stakeholders such as Department of Conservation (DOC), councils and mana whenua need to be considered. The specialist may not necessarily be a certified environmental practitioner (CEnvP) in ecology but is preferred.

A biostatistician may sometimes be needed to advise the project team on the sampling effort needed to address the objectives of the survey programme as effects on species can be difficult to estimate.

The ecologist should be able to communicate and disseminate information at the right time to project teams. Where mitigation measures are required, the ecologist must be capable of assisting in designing such measures.

Role/project type	Qualifications, training, competency and experience requirements
All ecologists on project Includes ecology lead and specialist ecologists	• A degree in either: » ecology (or a degree with a substantial ecological component), or » environmental science, and • at least two years full time practical experience in the field of ecology (can include assisting senior ecologists).
Ecology lead Either the sole ecologist on a project or the ecologist appointed as ecology lead when there is more than one ecologist on the project	The ecology lead must have the above qualifications and at least five years full time practical experience in the field of ecology (can include assisting senior ecologists) and expertise in conducting ecological assessments.. It is preferred that ecology leads have a CEnvP Ecology. For complex projects they need: • at least 10 years of full-time equivalent experience in the field of ecology • to have worked as an ecologist on at least two roading projects or other large multidisciplinary projects that were in complex ecological environments. See the box below as to what qualifies as a complex project.
Specialist ecologist For example, herpetologist, ornithologist, entomologist	The specialist ecologist has: • studied the specialist topic (eg post-graduate focus) plus experience on at least four projects working on that topic, and/or • worked with known specialists supporting professional development related to that topic for a minimum of five years, training and gaining knowledge and experience on at least four projects working on that topic • good knowledge of relevant legislation, policy, guidelines, and standards that apply to the topic and be familiar with the relevant standards and criteria for evaluating and classifying the significance of impacts • considered and acknowledged to be an expert on the specific topic by their peers • meets accepted competencies to undertake the specific tasks if required.

Table 1: Minimum qualifications and experiences of project ecologists

Complex projects

A complex project has one or more of the following:

Ecological features present are cryptic, high-value, and/or particularly vulnerable to project impacts and have regional and/or national value and/or are threatened or at risk.

Sensitive receiving environment with challenging effects management needed, for example rivers, lakes, wetlands, estuaries, harbours and the open coastline.

Project impacted habitats that provide important ecological connectivity and/or integrity (includes ecosystem services) with challenging effects management needed.

Significant residual effects requiring challenging and sometimes multi-component biodiversity offset and/or compensation.

Multiple ecological specialists were needed due to ecological features present.

2.2 Establishing the EcIA study area

The ecologist needs to establish the EcIA study area, which shall cover the full assessment of effects for the project zone of influence (ZOI). The ZOI is defined by EIANZ as the areas and/or resources potentially impacted by the biophysical changes caused by the proposed project and associated activities. Its extent will depend on species, communities, and ecosystems likely to be affected, and the temporal and spatial scale of potential effects on them (figure 3). The study area should not be based on a fixed corridor approach or limited to resource consent requirements. However, the coarseness of the site investigations and subsequent effects assessment may be guided by the type and timing of the consent applications and subsequent construction.

When establishing the ZOI the ecologist should consider the following:

- Ecological effects may extend beyond the project footprint.
- The zone of influence from a particular activity may impact different ecological features at different scales.
- Activities that inform the ZOI should include geotechnical investigations, construction methodologies, access roads, storage yards, likely land take and disposal site locations.
- Potential ecological effects when the project is constructed and when operational need to be considered, including edge effects.
- Include ecological corridors and consider impacts of fragmentation and loss of connectivity across a landscape.
- Consider the ZOI extent in the context of potential climate change for species, habitats and ecosystems that are particularly vulnerable (appendix E).
- The ZOI should adapt as necessary to reflect potential changes as more detailed information comes in and/or the options/project evolves.
- Any potential changes in the project footprint should be accommodated to manage the risk of information gaps later in project development and/or project delivery.

Through the EcIA process it will become apparent which effects will need to be addressed by the project.

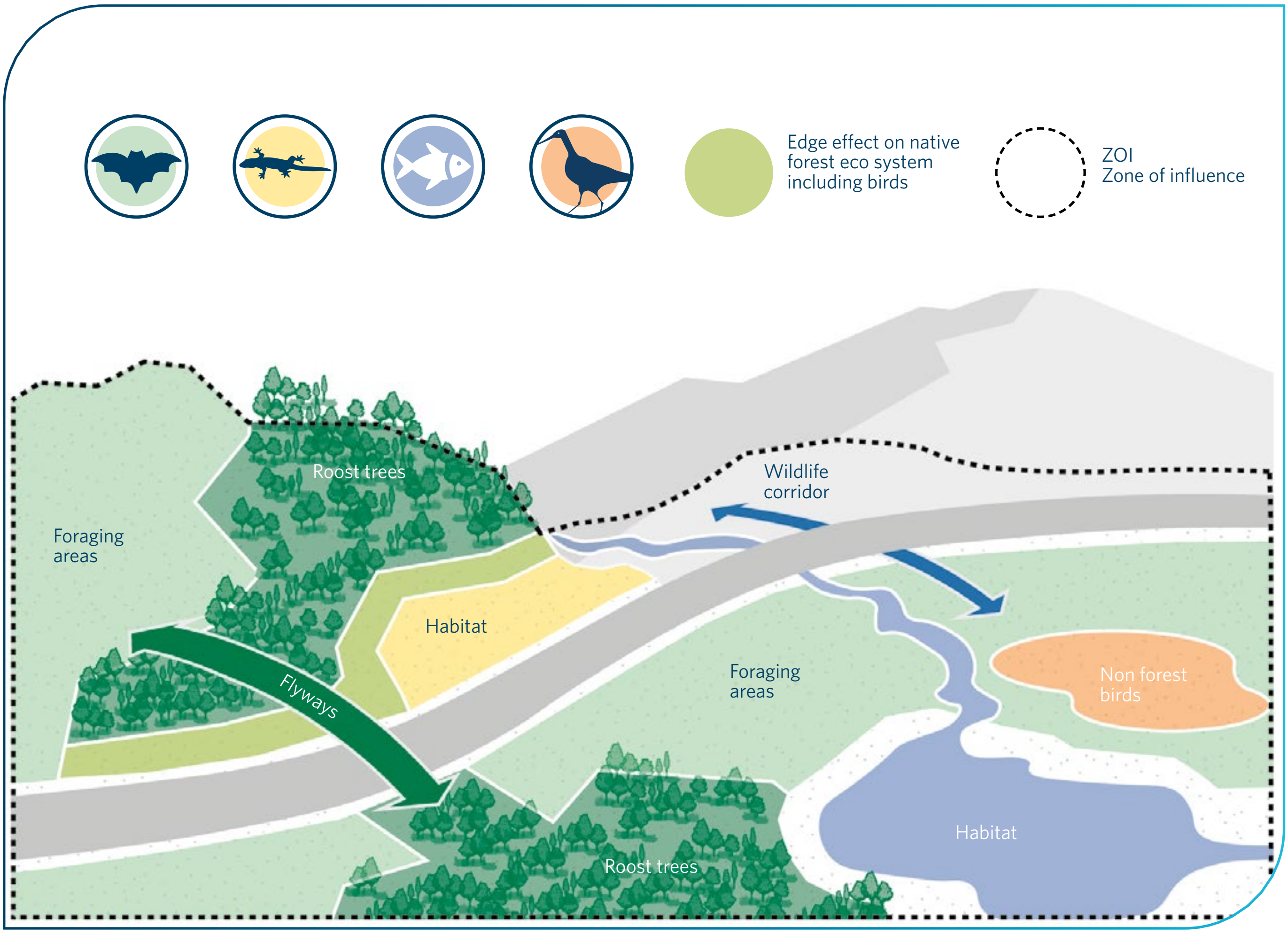

Figure 3. This hypothetical example illustrates how the zone of influence for bats, lizards, birds, fish and forest edge effects is used to establish the EcIA's study area.

2.3 Working with the project team

The ecologist is part of a broader project team and expected to work collaboratively with other specialists (as set out in appendix B). The project manager shall give direction regarding and overlap between ecology and other disciplines, so the specialists involved know who they should connect with to identify interdependencies and co-benefits. The ecologist needs to:

- ensure the project team are clearly aware of the full range of ecological components, including ecosystem services associated with indigenous biodiversity at the site and ecological integrity and connectivity within and beyond the site
- ensure the team understands ecological values, challenges, opportunities and constraints, and that these are reflected in decisions and project programming (see appendix D2).
- make the project team aware of any risk of late discovery of a species that would trigger the need for detailed surveys and cause potential delays
- flag the need for ecology specialists, such as when as assessment of non-vascular plants or invertebrates is needed, or where bats and lizards are present
- clearly explain the reasons behind their assessments and provide information that can be readily interpreted by non-ecologists, so the non-expert can understand the reasons behind the recommendations from both a technical and a statutory point of view
- work closely with other environmental specialists and the design team, adopting an iterative process
- consider all relevant effects topics and opportunities for integrated mitigation
- ensure the design and mitigation intentions are very clearly explained in the EcIA and in subsequent management plans for the teams involved in constructing, operating and maintaining the new asset
- work closely with the consent planner, drafting proposed designation and consent conditions so that recommended ecological effects mitigation, offsetting or compensation is appropriately reflected in RMA conditions as well as working on the Wildlife Act approvals, ensuring RMA conditions and Wildlife Act requirements are not inconsistent.
- throughout the EcIA process, flag opportunities for positive effects from the project and discuss with the project team (see section 3.3).

2.4 Engaging with partners and stakeholders

Effective engagement is an integral part of Waka Kotahi business and EcIA benefits from early consultation. Detailed guidance on engagement is available on the Waka Kotahi Highways Information Portal (HIP).

The scope and timing for discussions with stakeholders/partners should be determined within the project team and be consistent with the project engagement strategy, while enabling the ecologist to gather necessary information as early as possible. Early engagement allows the formation of a more accurate EcIA scope and ability to flag risks and opportunities during optioneering that may strongly influence options assessment. Ecologists need to be open to being informed from partners and stakeholders of their knowledge of the area. Engaging with them early may:

- provide early information of the location of high-value ecological features, better enabling the project to avoid these whilst its flexible enough to alter route selection and/or design
- help identify ecological features that should be included in the EcIA scope and rule out others that are not likely to be present
- provide local context to ecological features present
- have information to add to preliminary findings/assessments that can help frame or support future studies
- reduce risk to the project of missing ecological features and/or issues that would lead to costs at a later stage
- make known any cultural values of ecological features present, for example taonga species
- flag biodiversity outcomes the project could align with, such as local and/or regional values and priorities
- inform the project team of local partnership opportunities/existing projects to interface with for biodiversity gains such as restoration, pest control and monitoring projects.

Preliminary discussions with stakeholders should determine ecological features affected and appropriate assessment methodologies. As early as possible there should be discussions regarding potential strategies to avoid or minimise any adverse effects, potential ways of offsetting for any significant adverse residual effects (after mitigation) and enhancement opportunities.

Local ornithologists had been collecting dotterel breeding information for many years before a project was planned. Their information was used to form a baseline.

2.5 Working with Māori partners

Waka Kotahi upholds and respects the environmental ethic of kaitiakitanga. It is recognised that the environment is a taonga (treasure) that must be managed carefully, and that Māori have a responsibility and obligation to care over their communities and environments.

Te Ara Kotahi – Our Māori Strategy provides direction on how to work with and respond to Māori as the Crown's Treaty partner. A key priority of the strategy is caring for the environment by supporting Māori to exercise their environmental kaitiaki responsibilities.

Māori input should be undertaken early in the EcIA process (table 4). The project ecologist should go through the project manager (or planner) in the first instance. Where appropriate, a Māori consultant may be engaged to assist with this process. For further guidance contact the Waka Kotahi Pou Arahi (Regional Advisor Māori) in the Waka Kotahi Māori Partnerships Team.

The following should be consulted or considered:

- Te Ara Kotahi – Our Māori Strategy
- direct participation from relevant iwi representatives in line with Hononga ki te Iwi: Our Māori Engagement Framework.
- any broader outcomes related to Māori business and tangata whenua, in line with our Broader Outcomes Procurement Strategy, that aligns with the EcIA
- any iwi environmental management plan or other information relevant to the location of the assessment.

At Rangiriri Paa a large wetland was restored, and flax planted for cultivation, helping restore the mana and ora of this waahi tapu/waahi tupuna. Photo: Waka Kotahi

3 Legal, strategic and policy framework

Photo: Matt Turner, Boffa Miskell

There are multiple legislative, strategic and policy directives for Waka Kotahi when addressing biodiversity. The EcIA should consider the significant ecological effects of a project in the light of relevant planning policies and legislation. In addition to statutory requirements there are a suite of organisational environmental objectives and policies that need to be given effect to within the EcIA process and in some cases may be greater than minimum statutory requirements.

3.1 Statutory requirements and national policy

Legislation relating to biodiversity is evolving, with a suite of environmental law reforms in progress as well as the development and revision of various national environmental directives. Current legislation and statutory requirements relevant to different ecological features are provided on the Biodiversity page on our website. For each EcIA the ecologist and consents planner need to check relevant statutory requirements as part of the statutory assessment, including those policies that stipulate which adverse effects are to be avoided.

3.1.1 National strategic and policy direction

Waka Kotahi is to 'exhibit a sense of social and environmental responsibility' (Land Transport Management Act 2003). The Ministry of Transport's Transport Outcomes Framework (TOF) sets a purpose for the New Zealand transport system centred around the wellbeing of people and the liveability of places in response to Treasury's Living Standards Framework. The TOF outlines five outcome areas to contribute to this purpose including environmental sustainability which biodiversity is a component of. Specifically, to improve people's wellbeing and liveability, transport needs to make a positive contribution to environmental sustainability by maintaining or improving biodiversity, water quality and air quality. The Government Policy Statement for Land Transport identifies the strategic priorities to focus investment of the National Land Transport Fund (NLTF) to deliver TOF outcomes.

3.1.2 Statutory assessments

Throughout the EcIA process, the project ecologist should work with the consents planner to ensure that suitable information is provided to support statutory assessments and other legislation relevant to the project such as the Wildlife Act 1953. At the start of the EcIA process the environmental screen will help to inform the consenting strategy (section 4.1). The EcIA should enable the consents planner to assess the biodiversity objectives and policies in the relevant plans and demonstrate how a project will meet these. While the EcIA's study limits are determined by the ZOI (section 2.2) the statutory context should be framed by the consents planner, who identifies:

- the nature of the statutory application or process (for example whether it is an notice of requirement (NOR), district/regional resource consent or Wildlife Act authority (WAA) application)
- as appropriate, details of relevant district/regional plan provisions, and
- whether there is a permitted baseline relevant to the project which is proposed by council to be relied on within the statutory assessment, as per the RMA.

At the direction of the consents planner, the effects assessment can be undertaken both with and without the permitted baseline in place. An effects management package should also be considered with and without the permitted baseline.

3.2 Waka Kotahi policy and strategic direction on biodiversity

Waka Kotahi policy directs the responsible management of the land transport system's interaction with people, places and the environment. For biodiversity, this is communicated through various means as shown in table 2. EcIA is a key tool to enable projects to adhere to Waka Kotahi organisational direction on biodiversity.

Waka Kotahi direction	Description
Environmental and social responsibility policy	The Environmental and social responsibility policy (ESR) helps set out how Waka Kotahi will operate in ways that reflect the statutory operating principles of the Land Transport Management Act of social and environmental responsibility. Waka Kotahi commits to protecting and enhancing the natural environment, including health, integrity and connectivity of biodiversity, inclusive of ecosystems, indigenous species and their habitats.
Toitū te Taiao – Our Sustainability Action Plan	Toitū te Taiao supports Arataki, the Waka Kotahi long-term plan for the land transport system. Toitū te Taiao responds to four big challenges, one of which is to reduce adverse effects of land transport on biodiversity (and water quality). The long-term outcomes (to 2050) include managing the transport network to support and enhance indigenous biodiversity.
State highway environmental plan: improving environmental sustainability and public health in New Zealand	The Environmental plan (2008) sets out the strategic environmental vision for state highways. While it was prepared prior to some key statutory changes; the plan still provides strong direction on biodiversity. Its three objectives for ecological resources are: • Objective E1: Promote biodiversity on the state highway network. • Objective E2: No net loss of native vegetation, wetlands, critical habitat for endangered species. • Objective E3: Limit spread of pest plants.
Z/19 Taumata Taiao – Environmental and Sustainability Standard	The purpose of Taumata Taiao is to give effect to the legal obligations of Waka Kotahi and our Environmental and Social Responsibility Policy by ensuring that environmental matters (including biodiversity) are considered early and consistently throughout the lifecycle of a project. Taumata Taiao explains how and where to implement the Waka Kotahi environmental and sustainability requirements.
Land Transport Benefits Framework	When considering suitable benefits and measures for an investment (section 1.4.1), how the project can support Waka Kotahi biodiversity objectives and national strategic outcomes need to be considered, particularly where there could be co-benefits for biodiversity, climate change and human wellbeing (section 3.3).
Sustainability Rating Scheme Policy	Waka Kotahi requires new projects over $15 million to consider the merits of undertaking an Infrastructure Sustainability Council (ISC) rating and those over $100 million are required to undertake an ISC rating. Infrastructure sustainability rating schemes provide a consistent method of driving, measuring, and recognising sustainability performance and outcomes across a range of sustainability areas (environmental, social, governance, economic). The ISC rating scheme includes credits to drive improved ecological and biodiversity outcomes.

Table 2: Waka Kotahi programmes, standards, guidelines and processes relevant to ecological impact assessment

The Huntly section of the Waikato Expressway runs through a degraded biodiversity area which will benefit from predator control undertaken as part of the project.

3.3 National strategic outcomes and project opportunities

Waka Kotahi projects can potentially offer opportunities or undertake works to support national indigenous biodiversity strategic outcomes and contribute to national targets. Degraded areas and/or depauperate biodiversity areas especially provide opportunities for Waka Kotahi to enhance biodiversity and align with regional and local priorities.

Opportunities may be beyond and separate to statutory effects management. They should not form part of the designation or resource consent conditions, unless specifically directed by Waka Kotahi, as RMA conditions should relate directly to an adverse effect that requires management. However, they may potentially be considered as part of benefits management and/or contribute to sustainability scheme rating certification (table 3). When considering suitable biodiversity benefits and measures, how these and therefore the project can support Waka Kotahi biodiversity objectives and national strategic outcomes need to be considered.

Potential opportunities to support biodiversity	Directives	
Biosecurity: • effective predator control to support community efforts • collaborative partnerships in pest plant and/or animal control programmes (eg KiwiRail, DOC, council, iwi). • pest plant control on land beyond project footprint.	National adaptation plan (NAP) Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy (ANZBS) Predator Free 2050	*NAP NE1 and NE2* *Objective 9 and 11*
Ecological connectivity: • plant appropriate native species to connect two isolated significant natural areas • protection, enhancement and/or creation of ecological corridors • protect and maintain the physical connection/link between ecological domains: terrestrial, freshwater and coastal.	ANZBS Benefits management – potential biodiversity benefit measure. Sustainability rating scheme National Policy Statement for Indignous Blodiversity (NPSIB)	*ANZBS Strategy Outcome 1* *ANZBS Strategy Outcome 2* *Policy 13, 14, 15, 16*
Climate change and biodiversity co-benefits: • avoidance, protection, and enhancement of climate change mitigation assets such as wetlands and indigenous forest (carbon sinks) • secure land for biodiversity and nature-based solutions along transport corridors to create a green/blue network.	NAP ANZBS NPSIB	*NAP NE1 and 2* *Policy 4 and 10*
Improving biodiversity in areas with no/low ecological values: • re-establishing appropriate indigenous vegetation within transport corridor, protecting and maintaining it • creating weed-free areas along the state highway to buffer high-value ecological areas.	ANZBS Benefits management – potential biodiversity benefit measure ISC NPSIB	*ANZBS Strategy Outcome 1* *Policy 8. 10, 14*
Urban ecology: • integrate local ecology into mitigation such as stormwater treatment • provide habitat and ecological connectivity through appropriate landscape design and ongoing maintenance.	ANZBS Benefits management – potential biodiversity benefit measure NPSIB	*ANZBS Strategy Outcome 3* *Policy 14 and 15*

Table 3: Examples of how Waka Kotahi projects could support indigenous biodiversity and strategic outcomes

4 Ecological impact assessment

Photo: Jake Ball, Boffa Miskell

The EcIA comprises several key steps, as illustrated in figure 4 and further described in appendix C. The assessment is to be based on scientific evidence and professional judgement, with its predictions and conclusions supported by clear rationale. The EcIA needs to be commensurate with the scale and significance (to indigenous biodiversity) of the proposal.

When using EIANZ, the considerations detailed in section 1.3, are to be applied. For Waka Kotahi projects EcIA is carried out primarily in a project's development and delivery stage (table 4). Project development is guided by the Waka Kotahi Business Case Approach (BCA). The EcIA process aligns with steps in the BCA and may require three levels of assessment, as described in the following sections:

1. the environmental screen
2. a preliminary technical assessment, and
3. a detailed EcIA.

Te Ahu a Turanga -
Manawatū Tararua Highway
(Photo: Carol Bannock)

Iterations	Step	Description
Information gathered in one project phase used to inform and refine the scope of the next.	**Scope** Scope and study area are defined by ZOI and informed by previous ecological assessments (eg ES, PTA).	Process of determining EcIA extent. It sets out ecological issues to be addressed, methods and resources to be used and establishes spatial and temporal limits for surveys and assessments.
	Describe the existing environment Desktop study Consultation Detailed investigations	'Pre-work condition' ecological data is collected to describe existing environment and give baseline condition information. Site investigations are likely needed for a suitably comprehensive EcIA.
Impact assessment and/or effects management identify need for further investigations.	**Determine value of ecological features identified**	The EcIA must establish the value of all ecological features that could be affected by the project.
	Assess effects on ecological features Understand the project and activities and how they could affect ecological features.	Identify impacts and their effects on ecological features. Assess the significance of any residual effects after mitigation.
Revised impact assessments incorporated into effects management.	**Ecological effect management options** How to manage ecological effects	Follow effects management hierarchy, identifying the different approaches applied to effects on ecological values, seeking first to avoid harm.
Adaptive management of effects based on monitoring and evaluation.	**Monitoring and evaluation**	The EcIA should set out the ecological monitoring required to audit predicted impacts and effects against the actual situation.

Figure 4. Ecological impact assessment process, showing potential iterations (adapted from EIANZ).

Table 4: How EcIA fits within the project Development and Delivery Framework, including the Business Case Approach

Lifecycle stage	Phase		Ecological assessment process	Informing/supporting	Desired outcomes of the EcIA
Development	Programme business case		Environmental screen	• Multi-criteria analysis (MCA) process • Options assessment – longlist	• Early technical input from ecologists to an adequate level into options assessment. • Early awareness of important ecological features. • Climate change considerations (appendix E) • Discussions with Waka Kotahi technical specialists when high-value ecological features have been identified. • Options that impact on high-value ecological features generally and in most cases avoided.
	Single-stage business case	Indicative business case	Environmental screen	• MCA • Options assessment – shortlist	**As above and the following:** • Initial EcIA scope determined in relation to the zone of influence (ZOI) of the options. • Early engagement with Department of Conservation (DOC) for projects that affect conservation estate and/or high-value ecological features. • Early engagement with iwi and early knowledge of taonga species present. • Early engagement with external parties with relevant local ecological knowledge as appropriate.
		Detailed business case	Preliminary technical assessment (PTA)	• Options assessment – preferred option • Consenting strategy	• Ecologists with right level of competency engaged. • EcIA scope added to/refined by ecologist as appropriate. • Ecological baseline information requirements identified and included in site investigations. • Indication of whether a Wildlife Act authority (WAA) is needed. • Site investigations programmed with realistic timeframes (if required). • Species-specific investigations to support as necessary. • Identify any effects on identified taonga species • Likely future monitoring requirements factored in to inform survey methods. • Data collected that can provide ecological baseline of pre-work condition. • Integration with other technical disciplines. • Early indication of effects management options. • Consideration of scope of mitigation needed, should avoidance not be an option.

Lifecycle stage	Phase	Ecological assessment process	Informing/supporting	Desired outcomes of the EcIA
Delivery	Pre-implementation (procurement, consenting)	Detailed EcIA	• Project design • Project consenting • Assessment of effects on the environment (AEE) report • WAA	Adopts findings of PTA plus: • Ecological baseline condition information so effects of the project can be assessed. • Strong working relationship with design team and other specialists. • Robust EcIA to support the preferred option and alternative options assessment. • Consideration of national strategic biodiversity outcomes • Waka Kotahi directives (section 3.2) • Early and clear guidance on the ecological effects management package. • Opportunities (section 3.3)
	Implementation (design and construct)	Ecological monitoring and management plan	• Adaptive management • Meet designation and consent conditions by implementing ecological mitigation and monitoring plans • WAA	• Adhere to effects management hierarchy • Design in mitigation for those ecological features unable to be avoided, eg bridges. • Work with the design team and others and challenge each other for better solutions. • Realistic, effective outcome-focused solutions.
Maintenance and operation	Post-implementation (operation and maintenance)	Monitoring and evaluation	• Feedback on EcIA predictions and mitigation success. • Adaptive management • Meeting designation and consent conditions and other authorisations	• Confidence in any analyses of impacts and effects management success. • Effects management is adaptive through monitoring and evaluation of outcomes to direct next steps. • Feedback mechanism on whether EcIA predictions are correct. • Data, including ongoing costs of mitigation, captured in a way that can be used to inform future projects. • Monitoring requirements flagged in maintenance and operations contracts and environmental management plans (EMP).

Business case pathways

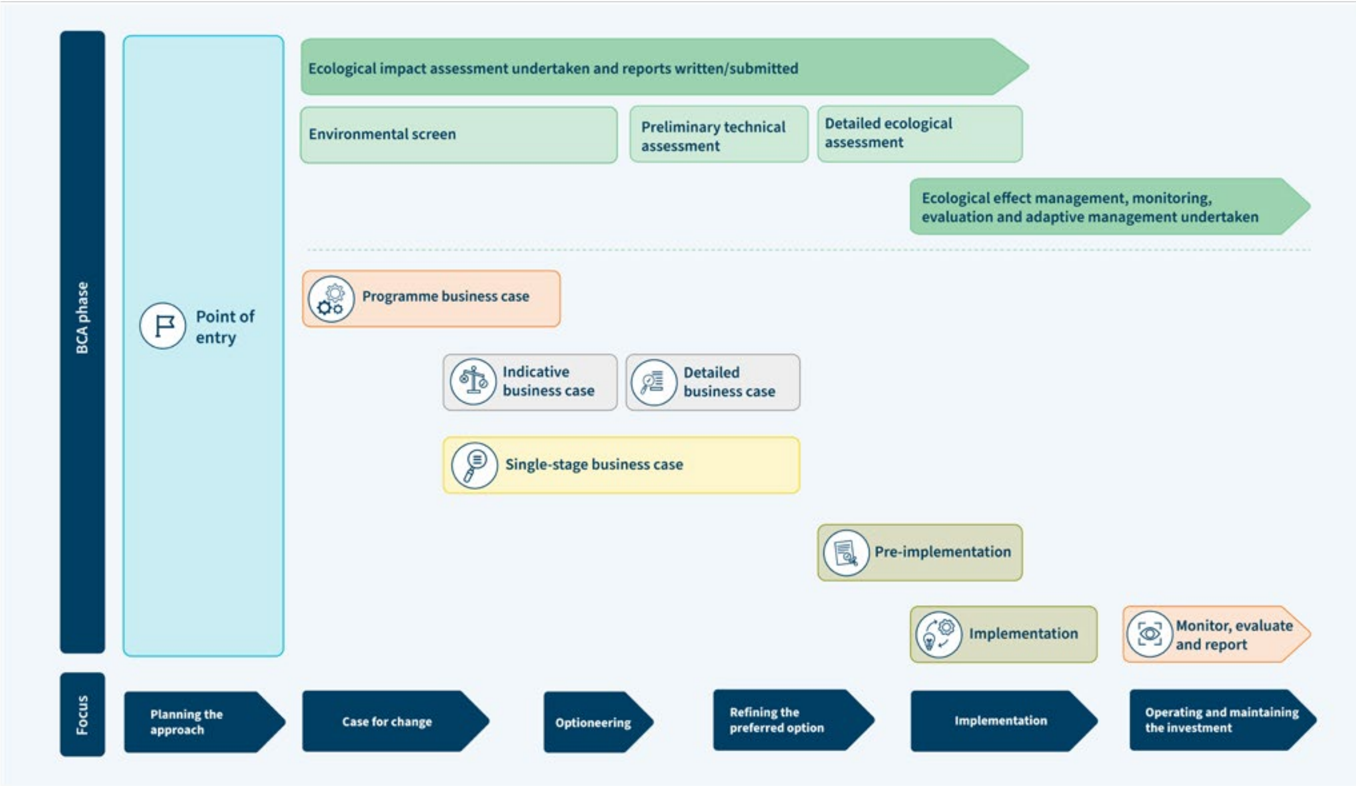

Figure 5. Where different levels of EcIA assessment may occur in the BCA. For less complex projects that are progressing through a single-stage business case the preliminary technical assessment may be all that is necessary.

4.1 Environmental screen

The Waka Kotahi environmental screen (ES) is a deliverable required by Z/19 Taumata Taiao – Environmental and Sustainability Standard, which is a contract requirement for all projects fully funded by the National Land Transport Fund (NLTF) or where Waka Kotahi is the primary entity responsible for the activity (in cases where Crown funding is used).

The ES is a checklist of questions designed to identify early in the BCA whether an option may have environmental opportunities and constraints. It can be used for any project as part of the EcIA to provide a coarse indication of ecological risks and opportunities that informs the scope of the PTA and/or detailed EcIA.

The environmental screen asks questions on whether there is potential impact on fish passage and also asks if there are opportunities to improve it.

Environmental screen

Purpose	• Identify and assess environmental opportunities and constraints. • Inform the multi-criteria analysis (MCA) and option selection process by providing a high-level assessment of potential environmental effects of different options. • Can be used in EcIA as a preliminary scoping tool including for those projects within the existing transport corridor. • For projects expected to have a low level of ecological effect, the environmental screen (ES) may provide a sufficient EcIA scope if undertaken by a suitably qualified and experienced ecologist (section 2.1). • Provide an early indication of ecological features to avoid where possible and/or where mitigation is required to be designed into infrastructure, eg tunnels, bridges. • Provides a mechanism for identification of opportunities to support national strategic outcomes.
When is it done?	The ES is to be undertaken during the Business Case Approach (BCA) optioneering step. It may be applied earlier during the strategic case to help determine the environmental context and inform the business case.
Who by?	The natural environment section should have input from an ecologist. For some questions there may be an overlap in technical disciplines that require input from the ecologist and other technical experts. The completed ES screen should be provided to the ecology lead undertaking the preliminary and/or detailed EcIA.
What is covered?	The ES has a series of questions about the natural environment, including identification of potential impacts, opportunities to avoid remedy or mitigate effects, along with opportunities for enhancement.
Things to consider	• Naturally occurring native vegetation should be flagged for further investigation, either through a desktop assessment and/or ideally a site visit. • Exotic vegetation may provide important ecological functions (eg habitat for protected species). • The information obtained from the ES should be used to inform the MCA/options assessment process and criteria. It should be communicated by the ecologist for accurate interpretation and application.
Limitations	The ES may miss ecologically important sites that are not well documented, and some important ecological features may not yet be discovered.
Links to information	Environmental screen and information on how to use it Ecological impact assessment guidelines for New Zealand (EIANZ 2018). Useful desktop resources are detailed within the ES template and in EIANZ.

Table 5: Why and how the environmental screen is used in ecological impact assessment

4.2 Preliminary technical assessment

Once there is a preferred option or options a preliminary technical assessment (PTA) is undertaken during either the single-stage or detailed business case phase of business case development. The PTA builds upon the ES and is used for further decision making regarding route choice, design and to indicate whether likely effects on ecological features can be adequately managed.

The ecological complexity of the Mt Messenger project on State Highway 3 in Taranaki meant ecological specialists were engaged early in the project development process during optioneering.

Purpose	• Provide adequate detail regarding ecological risks and benefits to demonstrate the feasibility of the option before moving to implementation. • Provide the basis of the scope for the detailed EcIA (if required) undertaken during implementation. • For less complex projects, the PTA can be used as the standalone ecological assessment to support consenting and Waka Kotahi policy obligations for project delivery.
When is it done?	During either the single-stage business case phase or detailed business case phase (depending on which business case pathway is adopted).
Who by?	The PTA is led by a suitable qualified and experienced ecologist, who shall identify when specialist input is required
What is covered?	The two main components of a PTA are: • an understanding of the proposed project and its associated activities that may create ecological stress or disturbance • information about ecological features that may be affected. The scope and scale of the PTA depends on the complexity of the proposed project and ecological features affected.

Table 6: Why and how a PTA is used in ecological impact assessment

4.2.1 Assessment approach

The PTA should broadly follow the steps illustrated in figure 6. The PTA includes using site investigations to describe the existing environment, adding to and verifying information collected through desktop studies and consultation.

When undertaking a PTA the ecologist should:

- **Work with the project team** to ensure surveys (including presence surveys) are undertaken at the correct time of year and there is sufficient time to implement the appropriate methodology
- **Seek specialist** technical advice if there are high-value ecological features present in the ZOI – specialist ecologists often identify issues early, including specific impacts, key habitats to avoid and mitigation measures most likely to be effective[3]
- **Flag** to the project team as soon as possible if there is not sufficient scientific evidence available on a particular ecological feature/effect and further survey or research may be required
- **Inform the project team** as soon as possible if threatened/at risk species and/or ecosystems could be present and if detailed site investigations are necessary
- **Maintain ongoing communication** with other project specialists (eg stormwater, landscape design, cultural, heritage and geotechnical) for a clear understanding of the project, its activities, and the likely ecological effects
- **Design site investigations** to inform ecological baseline conditions (if it is the standalone ecological assessment of the project) or so they can integrate with future investigations supporting the detailed EcIA.

3 van der Ree, R, S Tonjes and C Weller (2015) 'Ensuring the completed road project is designed, built and operated as intended.' in Handbook of road ecology. R van der Ree, DJ Smith and C Grilo (eds.) Oxford: Wiley- Blackwell.

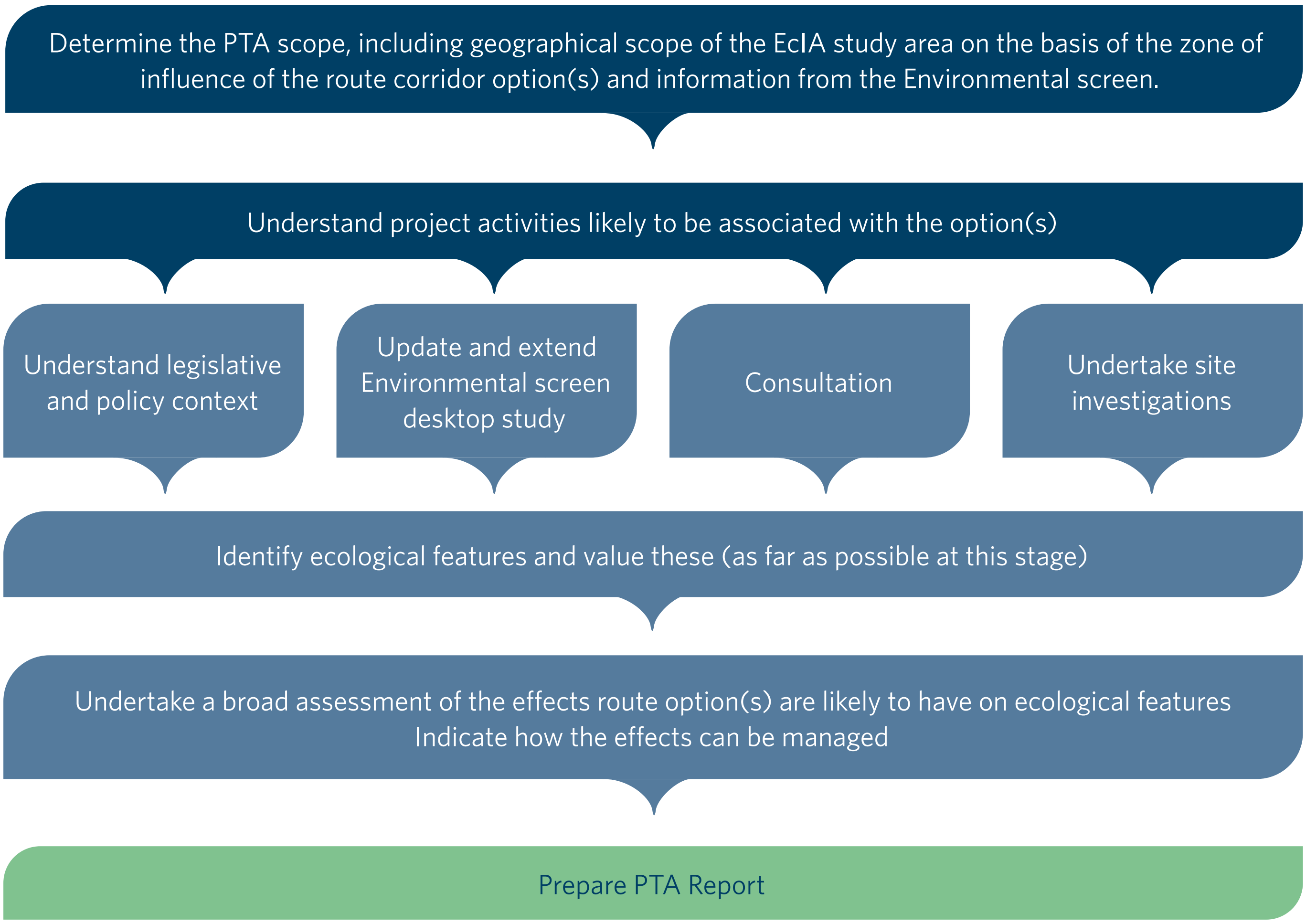

Figure 6. The approach for undertaking a preliminary technical assessment (PTA) of ecology.

4.2.2 Output/reporting

The PTA report should document existing ecological features, the importance of these and potential ecological effects associated with the project. It should state whether the PTA is sufficient to support consenting or if a detailed EcIA is required. If a detailed EcIA is required, the PTA report should provide enough detail to form an accurate scope.

As a minimum the PTA should:

- Determine the presence and importance of ecological features
- Identify the full extent of key ecosystem species and habitats that may be affected
- Identify ecological features that should be avoided if possible and possible measures by which to avoid effects on them
- Identify ecological features that may influence or determine consenting status, for example wetlands
- Identify any knowledge gaps
- Identify information requirements for establishing ecological baseline conditions and assessing changes to these conditions
- Signal further investigations needed and their requirements determine the presence and importance of ecological features
- Support the consenting strategy by making explicit any need for Wildlife Act authorities for ecological surveys and handling of flora and fauna
- Flag opportunities for the project to benefit and/or enhance biodiversity.

Where and how information from the PTA may be used during project stages is detailed in table 7.

Document/process	How the PTA is used
Business case	Content from the PTA is used in the detailed or single-stage business case.
Detailed EcIA scope	The PTA will inform the scope of the detailed EcIA, which will provide the project team with strong direction and understanding of likely ecological features affected, consenting risk and level of detail necessary to support the assessment of effects on the environment (AEE), Waka Kotahi policy obligations and recommended effects management measures. Future ecological work necessary should be apparent through the PTA.
Consenting strategy	The consenting strategy gets updated as the project develops and more detailed information about actual and potential effects on ecological features comes to hand. The PTA sets the level of investigation required to address the AEE requirements for the consenting phase (but also must adhere to Waka Kotahi organisational direction).
PTA used as the detailed ecological impact assessment	Information from the PTA forms the basis of the detailed EcIA. For projects that have little to no ecological value or are relatively simple the PTA may be the stand-alone ecological assessment to support the AEE. This depends on the project's complexity and ecological features affected[4], which also directs the scope and scale of the PTA itself. Should the PTA be sufficient to support a project's AEE (that is, a detailed EcIA is not required), it may be part of the suite of technical reports to support the AEE with its findings fed into the AEE report. This depends on the scope of the notice of requirement (NOR) or resource consents sought.
Design philosophy statement	The PTA can be used to inform the design philosophy statement for the project.

Table 7: How the preliminary technical assessment (PTA) integrates into other project processes

4 For example a project with features of negligible to low ecological value and/or negligible, low or positive magnitude of effect.

Some invertebrates such as peripatus species may be on the NZTCS and/or have local/regional importance and should be included in the EcIA.

4.3 Detailed ecological impact assessment

The detailed EcIA is undertaken once the preferred option has been developed and approved to proceed to implementation. It supports the applications for statutory approvals and enables the project to deliver on Waka Kotahi policy objectives.

The scope of the detailed EcIA will be guided by the ecologist using information from the previous EcIA assessments (ES and PTA). The consenting strategy should identify what types of approvals are needed along with the level of risk. Some aspects (such as mitigation options) will need to be defined in conjunction with the wider project team and alongside stakeholders and partners.

Purpose	• Identify and determine the value of ecological features affected. • Identify and describe all impacts potentially affecting ecological features. • Undertake sufficient assessment to support the development of an assessment of effects on the environment (AEE) required for statutory approvals. • Provide a full assessment of effects and effects management undertaken to meet statutory and Waka Kotahi policy obligations. • Set out the effects management package needed to ensure compliance with environmental legislation and to address any potentially significant ecological effects. • Provide an assessment of the significance of any residual effects and how these should be addressed (eg, biodiversity offset/compensation). • Set out a monitoring strategy including the monitoring of effects management performance. • Flag opportunities to protect and enhance biodiversity.
When is it done?	During the pre-implementation phase, when there is sufficient information available about the project to inform the effects assessment. However, for ecologically complex projects, the ecologist should aim to consider the scope and requirements, (eg. surveys, WAA's), from earlier in the project development process, and discuss these with the project team.
Who by?	The detailed EcIA is to be led by an ecologist who is experienced in undertaking EcIA and who can recognise the need for specialist inputs where appropriate (section 2.1). Should complex ecosystem or species be identified, an expert in that field should be engaged.
What is covered?	The main components of a detailed EcIA are: • describing the existing environment, including identification of ecosystem services associated with the site (geographical scope defined by the ZOI) • assessing the significance and value of ecological features • assessing effects of a project on ecological features • determining how effects will be managed using the effects management hierarchy.

Table 8: Purpose and use of detailed ecological impact assessments

4.3.1 What the assessment involves

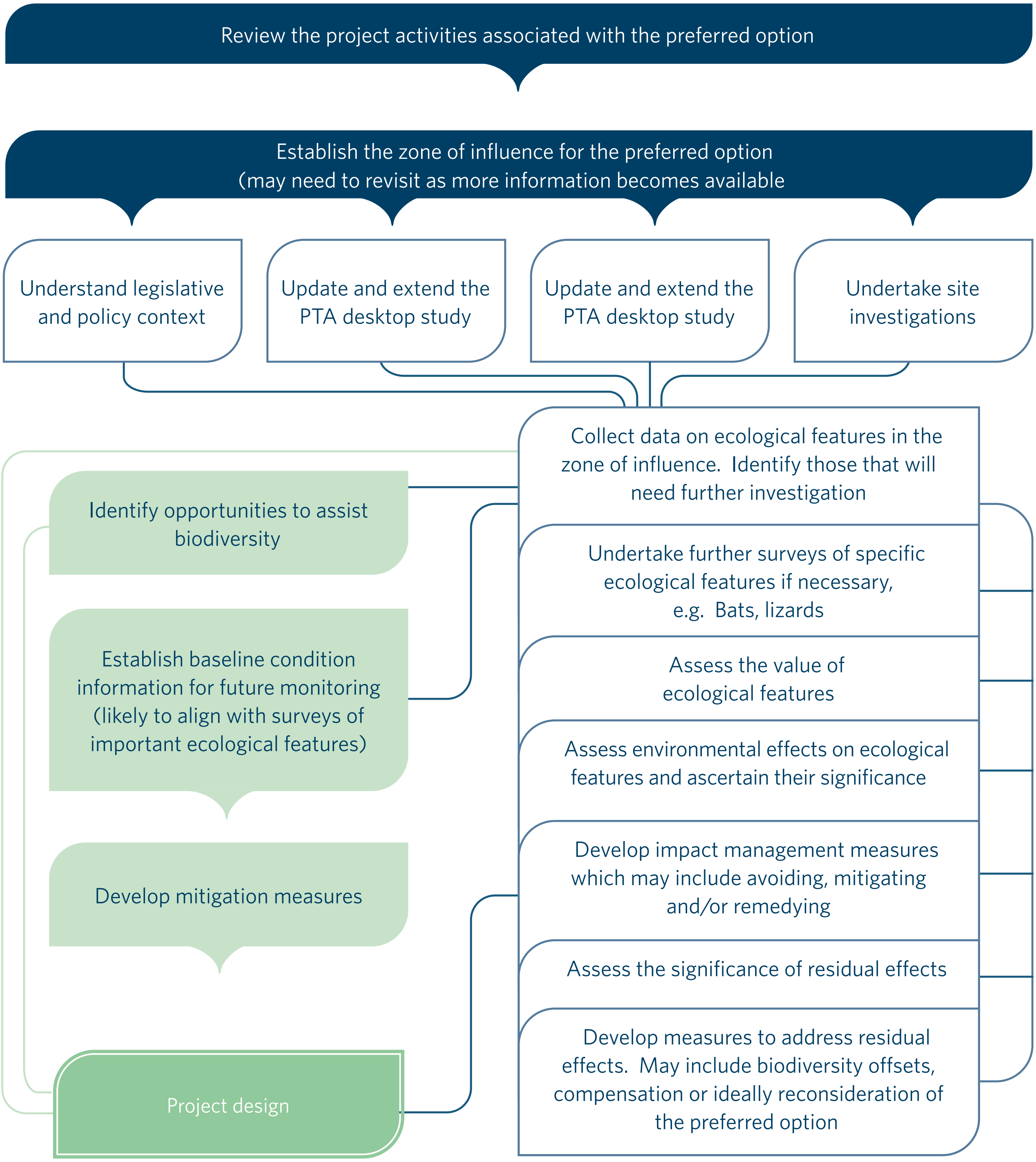

Figure 7. Process for a detailed EcIA

When using the EIANZ matrices for Waka Kotahi EcIAs, ecologists need to keep in mind the following considerations[5]:

- The matrix framework does not replace the need for rational interpretation of ecological data based on a sound understanding of environmental principles.
- EIANZ matrices or guidelines do not replace the statutory assessments required under the RMA and/or regional/district plans.
- The ecologist needs to distinguish between evidence-based and value-based judgements and provide their expert assessment and justification separate from the matrix. When using value ranking or numerical scores, there needs to be a clear definition of the criteria and thresholds that underpin them.
- It is important that ecologists assess the project at several spatial and temporal scales as appropriate to the project's context (section 2.2).
- Criteria to describe value needs to consider ecological context and scale.
- Criteria to describe magnitude of effect may be modified according to the nature of the project and ecological context.
- Existing guidance for specific ecological features may be used to help inform the criteria for magnitude.
- Statutory requirements may influence the value of and/or impact on an ecological feature, ultimately changing the magnitude of effect. The ecologist needs to document both assessment findings and explain how and why the magnitude has been altered.
- The matrices' assessment results should not be 'lumped' or averaged. The value and level of effect of each distinct ecosystem and focus species needs to be afforded separate consideration at the appropriate scale with appropriate context
- Matrices need to be supported by a written explanation of the predictions and conclusions of the assessment. They should always be accompanied by discussion and interpretation of the information, summarised to enable decision makers to understand the evidence base. As above, it is important to show the technical assessment and if/how this has changed when applying statutory requirements.

5 Effects management design considerations, with examples of successes and challenges (adapted from CIEEM[6] 2016 & Treweek[7] 1999)

6 CIEEM (2016) '*Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition*'. Chartered Institute of Ecology and Environmental Management, WInchester.

7 Treweek. J (1999) '*Ecological Impact Assessment*,' Blackwell, Oxford.

4.3.2 Output/reporting

The detailed EcIA report should clearly set out all the ecological information necessary for robust decisions to be made (eg route choice, infrastructure design). It supports statutory assessments and helps inform development of proposed designation and consent conditions.

EcIAs and any subsequent management plans need to be future-proofed and written in a way that makes sense to planners and project managers involved in project development and consenting.

The EcIA report should include Wildlife Act 1953 compliance requirements and should identify where and when WAAs are required. It also must address Waka Kotahi policy obligations (section 3.2).

The structure of the EcIA report must clearly articulate what the effects are for a particular ecological feature for the project and how effects should be managed. For projects seeking multiple consents across a large site, it is recommended that rather than dividing the EcIA report consent by consent that a table or similar is included that lists the consents being requested and cross references these to the relevant report sections. This will produce a technical assessment report that provides clear interpretation of the effects the project will have on specific ecological features and how these are being addressed by the project whilst enabling information to be easily extracted by the consents planner to support the statutory assessments.

The EcIA shapes the appropriate effects management package, including the need for biodiversity offsetting or compensation, monitoring requirements and contingency plans where residual adverse effects remain (that is, after avoid, minimise, remedy).

Waka Kotahi requires a full assessment and mitigation of effects in the EcIA report, regardless of whether a permitted baseline is utilised (refer to section 2.2). If requested by the consents planner, a permitted baseline can be considered in the detailed EcIA report. However, this assessment shall be undertaken in addition to the ecological baseline. The decision shall be left with the consents planner as to what is presented within the statutory assessment.

A detailed EcIA shall also::

- describe the justification for ecological value and magnitude of effect (based on criteria within EIANZ) for each effect within the detailed EcIA.
- where there is uncertainty, clearly state the limitations and/or uncertainty around any predictions regarding the effect or scale of effect
- show the level of effect without mitigation and then the effects assessment with proposed management in place – that is, both pre- and post-management, and describe residual effects (after mitigation) and how these will be managed through offset/compensation
- Flag positive effects from the project, for example a degraded habitat may provide opportunities for maintaining and improving biodiversity in the local area.

5 Effects management

Te Ara o Te Ata -
Mt Messenger Bypass
Photo: Waka Kotahi.

Waka Kotahi projects must adhere to the 'effects management hierarchy' (figure 8). The hierarchy is the set of steps (approaches) applied sequentially that seeks to avoid, minimise and remedy the impacts of development on biodiversity. Only after these mitigation steps have been applied and an adverse effect remains (residual effect) should biodiversity offsetting or compensation be considered. This aligns with current practice as set out in the NPSIB and National Policy Statement for Freshwater (NPSFM). The EcIA needs to consider national statutory direction relevant to effects management such as direction to avoid (or avoid significant effects) on certain features. For a table of legislation, statutory requirements and policy direction see the Biodiversity web page.

Effects management generally consists of several different actions presented together as an effects management package. Adverse effects should always be avoided completely where possible. However, partial avoidance actions can also be proposed (along with minimise and remedy actions). When developing the effects management package questions presented in table 10 should be asked to help inform and test the design. When different effects management approaches may be applied on a project site is illustrated in figure 9. Effects management is most effective when initiated early on in a project's inception, however it is not solely a project design consideration undertaken during project development. Effects management implementation needs to be monitored during both construction and maintenance phases to ensure its correctly undertaken and the ecologist needs to be involved. Other considerations when developing the effects management package are provided in table 9.

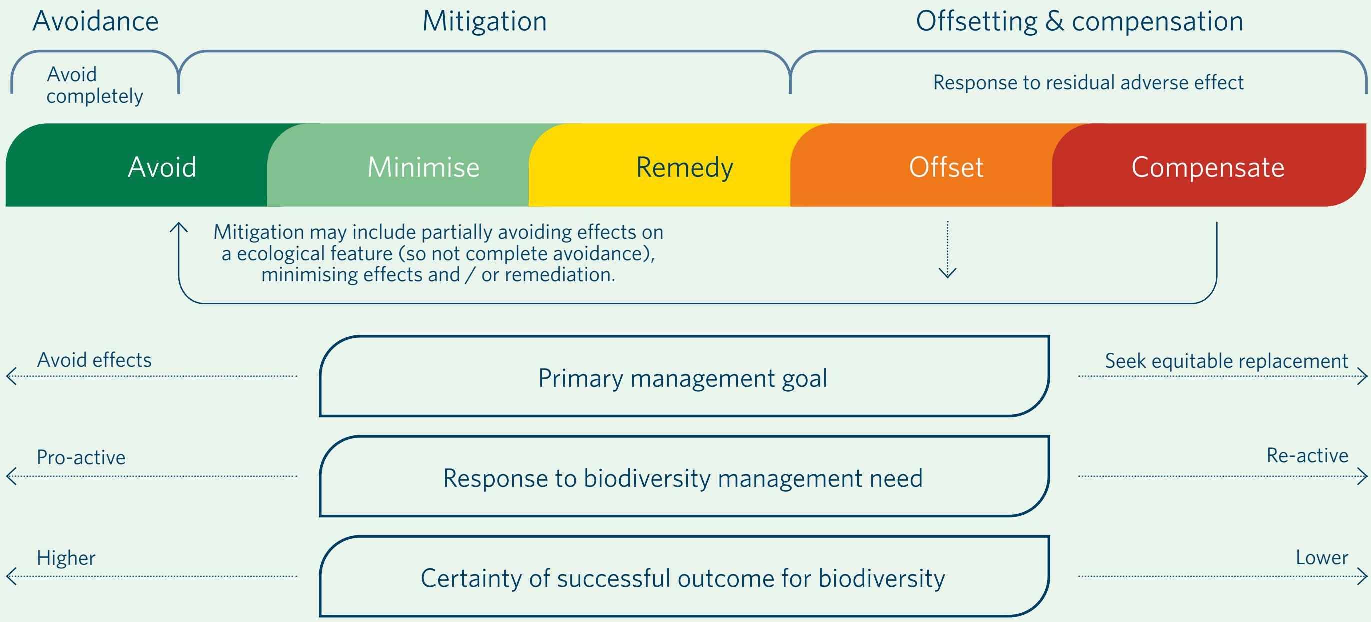

Figure 8. The effects management hierarchy, from most favoured approach to least, adapted from Maseyk et al (2018)[8]. Avoid may avoid an ecological feature completely, resulting in no further effects management needed and 'avoid' can also be part of effects mitigation as illustrated in figure 9.

8 Maseyk, F, et al (2018) *Biodiversity offsetting under the Resource Management Act.* Wellington: Local Government NZ

Element	Considerations
Options assessment	• At the options assessment stage there is more flexibility in modifying the route alignment to avoid and/or minimise ecological effects. • Early ecological input into options assessments is a valuable and risk-averse approach to road planning and design. • Many effects can be avoided or reduced by considering alternatives during optioneering. • Options that impact on high-value ecological features should be avoided where practicable. • Effects management can be a considerable cost to the project. Large-scale or expensive effects management measures need to be identified during optioneering so costs and benefits of each option can be properly evaluated. • Consider climate change adaption and mitigation with route selection (Appendix E)
Addressing effects	• The EcIA and other reports (eg Assessment of effects on the environment) need to be clear about which effects management approaches are being employed to address a particular ecological effect (eg minimised and remedied). • The EcIA must be transparent on how ecological effects are being addressed and the reasoning behind the approach, including changes made as the project develops (eg design changes).
Opportunities	• Seek opportunities that align with national, regional and/or local priorities, ensuring the effects management hierarchy is applied. • Seek opportunities for an integrated effects management package across specialist ecological topics and different disciplines. • Consider potential climate change adaptation and mitigation opportunities (Appendix E)
Effects management intent is clear	• Effects management options with specified design intentions and success criteria need to be developed alongside likely options for adaptive management. • Clear objectives for effects management interventions, and measurable outcomes, need to be agreed on. • The ecologist is to work closely with the project team to ensure the scope and intent of any effects management is clear and well communicated. • The design and mitigation intentions are to be clearly explained in the EcIA and subsequent management plans for those involved in constructing, operating and maintaining the asset.
Management and maintenance	• There needs to be understanding around the requirements of any long-term management, identifying maintenance needed and enabling the project team to discuss early how this will be achieved (including funding) for greater chance of biodiversity outcome success. • Effects management interventions should be mapped and identified on the Waka Kotahi asset management database to enable appropriate management. • Consider how other maintenance actions may impact the mitigation (eg, mowing, herbicide application, water-table treatments).
Monitoring and evaluation	• In cases where effects management strategies are unproven, or linked to resource consent requirements, the efficacy of installed mitigation measures should be tested. • Pre-construction monitoring at control and mitigation sites may be needed, supported with ongoing monitoring so design components are retained through the life of the intervention. • The intent of effects management needs to be clearly captured in any ecological monitoring and/or management plans. • How monitoring results will be used and how adaptive management will be applied to improve mitigation success during the project lifecycle (including maintenance and operation) needs to be clear.

Table 9: Considerations when developing the effects management package

Factor	Description	Example	Image
Technical feasibility	What is the technical feasibility of the proposed mitigation? Are there examples of past projects which support the mitigation approach being proposed?	Mitigation design needs to consider technical feasibility such as the creation of a new wetland and ensuring the correct hydrological conditions can be created and retained to meet the desired ecological outcomes, or the replacement of a specific vegetation ecosystem after soil profiles have been altered during the construction phase.	
Quantity	The overall quantity of the proposed mitigation needs to be considered. Is what is being proposed large enough to be viable?	An area was set aside to take salvaged grass skinks. The most conservative estimate of number of skinks present was used. The actual number salvaged was much higher so the area originally set aside was not large enough. New sites needed to be found well into project implementation.	
Quality	Does the overall quality of the proposed mitigation compare favourably with features lost or damaged?	A wetland was constructed to support a healthy, viable population of mudfish to replace habitat that was being lost as part of a project. Care was taken to provide the correct environmental conditions to create a wetland that has the quality necessary to fulfil this function.	

Table 10: Effects management design considerations, with examples of successes and challenges (adapted from CIEEM 2016[9] & Treweek 1999[10])

9 CIEEM (2016) '*Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition*'. Chartered Institute of Ecology and Environmental Management, WInchester.

10 Treweek. J (1999) '*Ecological Impact Assessment*,' Blackwell, Oxford.

Factor	Description	Example	Image
Commitment	Is there a realistic understanding of the resources and effort required to achieve the predicted outcomes?	A project impacting native forest had strict vegetation clearance protocols due to high values present including kiwi. The availability of experienced ecologists and other resources such as kiwi dogs was limited. This meant progress was slower than predicted at much greater cost.	
Timescale	What is the timescale for predicted benefits? How long until the effect management intervention starts producing desired outcomes?	Trees are often planted to provide roosts for bats; however, the predicted benefits will take around 15 years. This covers the long term, but short- and medium-term roost provision still needs to be provided, eg artificial roost boxes.	
Long-term management	Is there provision for long-term management? How much follow-up management will be required to ensure the effectiveness of management proposed? Is the ownership and ability of Waka Kotahi sufficient to ensure effects management is provided in the long term?	Shell banks enhanced to create safe breeding sites for northern New Zealand dotterel need long-term maintenance to ensure that breeding dotterel have open views from their nesting sites.	

5.1 Mitigation

Mitigation includes measures used to avoid, minimise or remedy adverse effects of a project's activities. Mitigation is applied at the point of impact to reduce the duration, intensity and/or extent of the impacts that cannot be completely avoided. Expectations and recommendations for mitigation (avoid, minimise and remedy) on Waka Kotahi projects are set out in table 11. Examples of different mitigation approaches are provided in table 12 and specific detail on how to avoid, minimise and remedy is in the following sections.

Element	Considerations
Point of impact	• The 'point of impact' should be clearly defined for each activity, based on the context of the ecological value affected and so provide context for proposed mitigation. • Point of impact could include a geographic location or relate to ecological values that are affected by an activity and includes direct and indirect impacts.
Mitigation design	• Mitigation design must consider what is realistically achievable and the likelihood of success based on good practice guidance and evidence. • Mitigation options must be feasible (eg constructed with resources available) and able to be specified in contract documentation. • Key components must be retained through project value engineering, which is a process that seeks to provide the necessary functions of the project at the lower cost. • An integrated approach in mitigation design is encouraged. Talk with other specialists such as stormwater and structural engineers, and landscape specialists (appendix B). • Refer to relevant Waka Kotahi guidance on our Biodiversity web page on appropriate mitigation for specific ecological features or effects, eg bats, fish and fish passage, New Zealand dotterels, edge effects. • The mitigation design should be revisited throughout the project's development with different specialists and the design team to identify any emerging constraints and opportunities and embed desired outcomes. • The ecologist needs to be involved in each of the project's design and construction stages, working as closely as possible with the project team. This is to ensure effects management concepts and designs are interpreted correctly and effective mitigation measures are incorporated into project design. • Any changes to how effects are managed as the project progresses needs to be documented. Distinction should be made between project design changes that seek to avoid or reduce effects, and those that are additional mitigation measures.

Photo: Robyn Simcock

Element	Considerations
Mitigation outcomes	• Mitigation should achieve long-term results. Their duration should match the duration of the effect. • Mitigation measures should have a defined criteria/threshold for success, which allows success or failure to be measured by monitoring.
EcIA report	• The EcIA must clearly articulate the ecological context and linkage between affected values, nature of the impacts, what effects are being addressed by mitigation, and how they intend to do so. • It needs to be clear what is being avoided, minimised and/or remedied. See table 12 for examples. • When describing the mitigation measures in the EcIA, specify the quantity and location of these actions, timing, techniques, resources and intended ecological outcomes.

Table 11: Expectations and recommendations for different elements of mitigation design and application

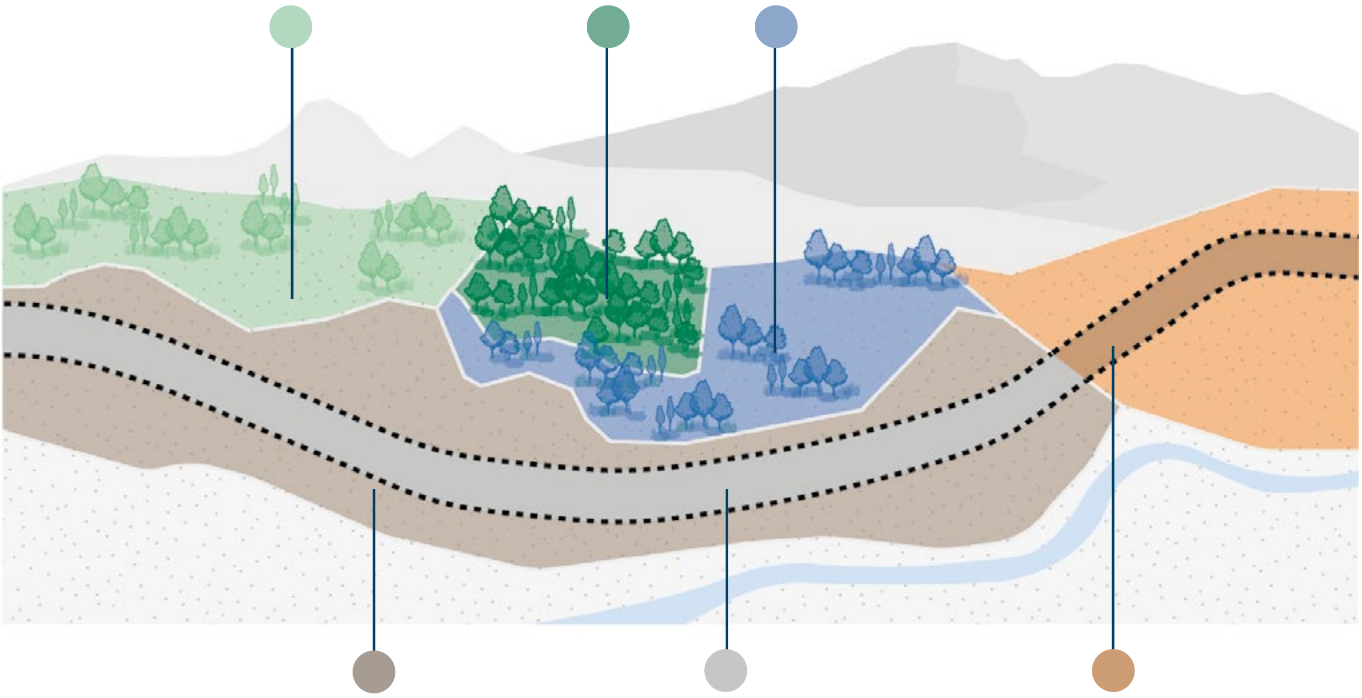

Figure 9. A hypothetical example of how different effects management approaches are applied on a project.

5.1.1 Avoid

A project's best option for successfully managing effects on ecological features is to avoid them. 'Avoid' has the least impact on ecology and holds the greatest certainty of success for a project. It may be possible to completely avoid an ecological feature (including indirect effects) so no effects management is necessary, or partial avoidance actions may be a form of mitigation. Avoidance of ecological features may be through (in order of preference): corridor selection, alignment selection, project design and/or construction methodology (for example the timing of an activity).

Avoiding adverse effects is best achieved through considering potential impacts of a project from the earliest stages of project development. It is critical EcIA informs options/alternatives assessment during optioneering. Effects management considerations relating to options assessment are presented in table 9.
The project ecologist needs to:

- work closely with the project team in early project development to identify ecological values that should be avoided and help inform decisions that may achieve this
- be clear when there is statutory direction to avoid certain ecological (or avoid significant effects) on certain ecological features
- ensure that where multi-criteria analysis (MCA) is undertaken, such statutory direction to avoid certain features is maintained through the process, and that the process and criteria (for example weighting against other values) is appropriate.

5.1.2 Minimise

To minimise an effect is to reduce it to the smallest amount reasonably practicable. Some forms of effects management are highly effective at reducing the disturbed footprint of Waka Kotahi projects. These range from tunnels and bridges to retaining walls and tree-cabling to retain undisturbed habitat, reduce clearance widths, and reduce damage to key ecological structures (such as floodplains).

Examples of methods employed to minimise effects are provided in table 12 and a comprehensive study on edge effects and how to minimise them are available on the Biodiversity page on our website.

Value	Project stage	Impact	Effect	Mitigation measure	Mitigation approach
Bat	Construction	Vegetation removal	Direct mortality	Tree felling protocol	Minimise
Bat	Construction	Vegetation removal	Loss of roosts	Potential bat roost trees are retained	Avoid
Bat	Construction	Vegetation removal	Loss of roosts	Artificial roosts installed	Remedy
Bat	Construction	Vegetation removal	Flyway disruption/ loss in connectivity	Retention of trees within flyway (eg median)	Minimise
Bat	Operation	Artificial light at night (ALAN) from road lighting	Disturbance	Wildlife sensitive lighting design	Minimise

Table 12: Examples of the different mitigation approaches in EcIA applied to bats

5.1.3 Remedy

Remediation, also referred to as rehabilitation and restoration, involves measures to improve ecological features that, as a consequence of a project's activities, will be degraded or removed. Such measures are typically needed towards the end of the construction (implementation) phase. The following measures apply to Waka Kotahi projects:

- Remediation should be designed to deliver benefits for biodiversity and support regional and/or national biodiversity objectives where possible, for example inclusion of appropriate rare or threatened species of plant in the rehabilitation planting scheme.
- Remediation activities should be implemented as early as possible – as soon as it is practicable to do so if there is no risk to the work being negatively affected through potential project changes. This allows a greater period for remediation works to establish before the road becomes operational.
- If the project involves retaining habitat or habitat features, and/or salvage and re-use of materials from the project footprint, this needs to be included in relevant sub-contractors' contracts (such as vegetation, earthworks).
- The remediation areas need to be able to be monitored during construction, and when the road is operational. This means ensuring safe access, which may need to be specifically designed into the project (see below).
- If the remediation involves regeneration, it should align with Waka Kotahi expectations around highway landscaping.[11] Waka Kotahi is developing further guidance in vegetation establishment and the ecologist is to check our Biodiversity web page for any new resources.

11 NZ Transport Agency (2014) NZTA Landscape guidelines. (final draft). Accessed July 2019. https://www.nzta.govt.nz/resources/nzta-landscape-guidelines/

Long-term ecological outcomes

Long-term ecological outcomes need to be considered when developing effects management. Sometimes having a smaller works footprint can result in poorer biodiversity outcomes because of challenges to retain those values. Access to maintain ecological values situated within or alongside the transport corridor may be limited and/or dangerous and costly, and this needs to be considered.

For example, consider:

- including safe pull-off areas for a maintenance vehicle to allow for ongoing maintenance of the ecological mitigation site to achieve ongoing positive biodiversity outcomes
- slope design that encourages native vegetation, increases resilience and enables pest control (compared to very steep slopes).

For positive and lasting biodiversity outcomes it may be better in some instances for project design to enable establishment of ecological interventions or assets that have greater certainty of success (both initial and ongoing), which may mean the affected area is greater than what it could be. The ecologist needs to clearly explain the rationale behind any recommendations, providing costs and benefits to biodiversity should the footprint not be minimised to achieve better long-term biodiversity outcomes.

Planting native rock daisy as part of the Kaikoura recovery response. Photo: Waka Kotahi

5.2 Biodiversity offsetting and compensation

Biodiversity offsets and compensation are only considered and implemented after reasonable steps have been taken to avoid, minimise and remedy adverse effects on biodiversity.

- A biodiversity offset is a *measurable* conservation outcome resulting from actions designed to compensate for residual adverse biodiversity effects arising from activities after appropriate effects management measures have been sequentially applied. The goal is to achieve no net loss of indigenous biodiversity values and, ideally, a net gain.
- Biodiversity compensation is designed to compensate for any more than minor residual adverse effects after all appropriate avoidance, minimisation, remediation and biodiversity offset measures have been sequentially applied. It is not required to demonstrate a no net loss or net gain outcome.

Work is being undertaken to improve the implementation of biodiversity offsetting and compensation in New Zealand, led by local and central government, including DOC and the Ministry for the Environment (MfE). There is also legislative reform and policy being developed relevant to offsetting and compensation. Waka Kotahi supports and encourages the use of the guidance documents Biodiversity offsetting under the Resource Management Act'[12] (2018) and Guidance on good practice biodiversity offsetting in New Zealand[13] (2014).

Biodiversity offsetting and compensation are the least preferable steps in the effects management hierarchy and carry the highest risks of failure. As such, it is incumbent on all Waka Kotahi projects to follow a rigorous approach to their application, clearly demonstrating how all relevant principles will be met (for example Business and Biodiversity Offsets Programme (BBOP) principles, offset principles in RMA plans).

When biodiversity offsetting is part of the effects management package, the project should predict and plan for any potential changes in the project footprint and/or impact that requires offsetting and accommodate this so as to manage the risk of needing additional offset later in project development and/or project delivery. The project needs to show clearly how principles of offsetting have been met in relevant plans.

It may be possible to offset in advance through landscape planting and design areas as long as principles of biodiversity offsetting are in place and are possible to implement, namely that the offset is additional to what is required and that what is offered is like for like (see section 5.3).

12 Maseyk, F, et al (2018) *Biodiversity offsetting under the Resource Management Act.* Wellington: Local Government NZ

13 NZ Government (2014) Guidance on good practice biodiversity offsetting in New Zealand. Wellington: NZ Government. Additional resources can be found at https://www.doc.govt.nz/about-us/our-policies-and-plans/guidance-on-biodiversity-offsetting/

5.3 Ecological effects management and landscape design

Often ecological planting and landscape treatments interface, sharing co-benefits but also sometimes requiring different approaches to achieve desired outcomes. How an area is treated before, during and after construction has direct effects on the ecological features present and the success of ecological effects management. When undertaking vegetation establishment as part of the ecological effects management package, consider the following:

- Work together with the landscape architect on ecological objectives and project outcomes that interface/overlap with each other.
- The project's environmental, landscape and urban design framework should clearly describe ecology and landscape outcomes that interact. This is to achieve a consolidated mitigation package that complements both ecology and landscape. An example of this is where landscape planting can be used to provide lizard habitat replacement.
- Work with the landscape architect to identify areas where the approach to landscape and ecology may differ and those areas where they can complement each other (for example, a landscape planting area may benefit biodiversity if rock habitat is provided or dead trees are left in place to be utilised by species).
- Recognise early in the project any opportunities to reuse material from the clearance of indigenous vegetation for ecological mitigation and remediation work, and implement these, when possible, (such as. tree ferns, oioi, stumps and branches).
- In some circumstances where a project affects naturally occurring indigenous vegetation the landscape treatments may need to deviate from the standard Waka Kotahi landscape specifications.
- Any deviations from the specifications need to be discussed with and agreed by the Waka Kotahi landscape and urban design lead early in project implementation and captured in the landscape and urban design framework (or equivalent).
- Ecological mitigation planting, which includes site preparation, requires technical input, including sign-off from the ecologist. It generally also requires sign-off by landscape experts. This crossover can be easily managed where ecology provides technical support to the project landscape lead.
- Some aspects of ecological planting can only be signed off by ecologists, including closure criteria that include condition of planted or transplanted individuals as well as seedling regeneration.
- It may be possible to offset in advance through landscape planting and design areas as long as principles of biodiversity offsetting are in place and are possible to implement, namely that the offset is additional to what is required and that what is offered is like for like.
- The ecologist and landscape architect need to work together to ascertain what is achievable. For example, can the ecosystem, habitat or ecological feature impacted truly be replaced like for like, and what is the timeframe for this to occur (table 10).

6 Monitoring and evaluation

Photo: AECOM

The ecologist needs to plan future ecological monitoring programmes. Future monitoring programmes will enable Waka Kotahi to understand whether EcIA predictions are correct, and how effective effects management has been. When developing monitoring programmes, the ecologist should consider the following:

- Monitoring methods should follow nationally accepted standard techniques.
- The objectives of the monitoring must be clear. What are the questions the monitoring wishes to answer?
- For monitoring data to be used to evaluate the success or failure of effects management there must be clear indicators or criteria set against a suitable baseline, in an appropriate timeframe, such as short or long term.
- Monitoring data can be used to evaluate the effectiveness of the project and to allow evidence-based adjustments through adaptive management to improve performance.
- Some species are difficult to monitor directly for success. In some cases, other monitoring proxies could be considered, such as pest species numbers or increased habitat area.
- What appropriate timing, frequency, duration and frequency of reporting and evaluation is for this project.
- Monitoring may be used to determine whether the mitigation measures have been implemented as required by the conditions of statutory approvals, the success/effectiveness of the measure, and early warning of failure.
- How a project impacts upon some ecological features may not be apparent for a long period of time. This needs to be taken into consideration so monitoring is designed to adequately address questions posed.
- A biostatistician can advise the project team what effort is needed to address the objectives of the monitoring programme. The specialist can answer questions on how much monitoring effort is required to be reasonably sure that a real effect or difference can be detected over and above normal 'background' variability in the measure of interest.
- There may be natural or other human-induced impacts affecting an ecological feature that is not due to project activities. A control site be incorporated into the monitoring design where possible. Before-after-control-impact (BACI) design provides the most robust results when undertaking monitoring that aims to answer specific questions.[9]
- Adequate description and justification for the proposed monitoring design should be provided to Waka Kotahi.
- Agree on a robust feedback mechanism to ensure that where monitoring objectives have not been met, provision is made for remedial measures and these are implemented.

14 Roedenbeck, IA, et al (2007) 'The Rauishholzhausen agenda for road ecology'. *Ecology and Society* 12, no.1.

7 Glossary and definitions

Photo: Carol Bannock

The table below sets out the technical abbreviations.

Abbreviation/ acronym	Term
AEE	Assessment of effects on the environment
BCA	Business Case Approach
CEnvP	Certified environmental practitioner
CIEEM	Chartered Institute of Ecology and Environmental Management
DOC	Department of Conservation
EcIA	Ecological impact assessment
EIANZ	Environmental Institute of Australia and New Zealand
EMP	Environmental management plan
GIS	Geographic information system
LTMA	Land Transport Management Act 2003
MCA	Multi-criteria analysis
MfE	Ministry for the Environment
NOR	Notice of requirement
NPSFM	National Policy Statement for Freshwater Management 2014
NPSIB	National Policy Statement for Indigenous Biodiversity
NZCPS	New Zealand Coastal Policy Statement 2010
NZTCS	New Zealand Threat Classification System
RMA	Resource Management Act 1991
RPS	Regional policy statement
SNA	Significant natural area
SQEP	Suitably qualified and experienced person
TAR	Threatened/at risk species as per the NZTCS
WAA	Wildlife Act authority
ZOI	Zone of influence

The table below sets out the defined terms

Ecological baseline	Information that describes the existing environment in the absence of the proposed project, which is used to inform the assessment of impact.
Biodiversity	The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity).
Cumulative effect	Cumulative effects are described as the accumulation of impacts over time and space resulting from the combination of effects from one activity/development or the combination of effects from a number of activities.
Designated site	Any site that has formally been recognised as having ecological value, eg national park, significant ecological area.
Detailed EcIA	Detailed ecological impact assessment.
Design framework	Cultural and environmental design frameworks, and urban and landscape design frameworks are prepared as the concept design for Waka Kotahi's large and or complex projects. These require input from a multi-disciplinary team of specialists including ecologists
Ecological feature	Specific aspects that are described and evaluated in an EcIA, including habitats, species, ecosystems.
Effect	The outcome to an ecological feature from the impact. For example, the impact from construction is the removal of a row of trees. The effect on native bats is that connection between roost sites and a foraging area is severed and the effect for arboreal lizard is loss of habitat.
ES	The Waka Kotahi environmental screen required under *Z/19 Taumata Taiao – Environmental and Sustainability Standard.*
Existing environment	Environment as it exists at the time of RMA application including permitted activities and any approved but likely to be implemented consents. Used in planning and only relevant at the time of consent/notice of requirement.
Impact	Project actions that result in changes to an ecological feature, eg removal of a row of trees.
Fish passage	The movement of fish between the sea and any river, including upstream or downstream in that river.
Magnitude	Magnitude is a measure of the scale of the impact and the degree of change that it will cause.
Minimise	Reduce to the smallest amount reasonably practicable.
Mitigation	Measures undertaken at the point of impact to reduce the duration, intensity and/or extent of the impacts that cannot be completely avoided. Mitigate includes measures that avoid some effects, minimise and remedy effects.

Nature-based solutions	Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human wellbeing and biodiversity benefits (IUCN).
Permitted baseline	The permitted baseline is the existing environment plus any non-fanciful activities permitted by rules in a plan. It is at a decision maker's discretion as to whether they wish to consider the permitted baseline when considering effects/ notifications. For more information see the Quality Planning website.
Point of impact	The point of impact could include a geographic location or relate to ecological values that are affected by an activity (such as animals) and includes direct and indirect impacts. A single project may include multiple activities and points of impact based on the ecological values affected.
Positive effect	A change that improves the quality of the environment.
PTA	Preliminary ecological impact assessment.
Project team	The Waka Kotahi project manager, consultant project manager, consent planners and project ecologist involved with project development and implementation.
Rehabilitation	Aims to restore basic ecological functions and/or ecosystem services, for example restoration along sides of stream to carry out riparian function, vegetation buffer to protect interior of adjoining valuable forest.
Remedy	Rehabilitate, restore or reinstate to rectify adverse effects that have occurred.
Remediation	Aims to improve the condition of an ecosystem, especially in reference to the reversal or stopping of damage to the environment. It includes actions to promote regeneration.
Restoration	To restore an area to the original ecosystem that occurred before impacts.
Scoping	The process of determining the broad type and nature of biodiversity and ecological features, and potential impacts of a project.
Zone of influence	The areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities.

Appendices

Photo: Carol Bannock

Appendix A: Ecological impact assessment and maintenance and operations

- An EcIA is generally not required for maintenance and operation activities on the network because environmental risk is managed through the contract's environmental management plan (EMP) unless there is a consent application or condition.
- Waka Kotahi EMP requirements include the identification of sensitive sites (receivers) on the relevant network, located, both on and/or affected by their activities.
- Sensitive sites should be mapped for practical use by staff and referred to in the EMP. They include but are not limited to watercourses, wetlands, significant natural areas, conservation land and other areas identified as having biodiversity value such as habitats for threatened, at-risk or regionally important species.
- The EMP also requires an environmental risk register. This is used with the sensitive site location information to understand potential impact on sites during work programme planning and provide detail to staff undertaking the work to manage the risk without the need for an EcIA.
- Environmental site risk assessment and management is undertaken at the beginning of each job. Prior knowledge of ecological values/ sensitive sites supports appropriate risk management.
- Should there be an incident or near-incident involving an ecological value, this needs to be reported to understand how best to manage risk in the future.
- There may be specific standard operating procedures to be adhered to whilst working in some areas (for example near a watercourse) and/or undertaking some activities (such as trimming vegetation in a significant natural area (SNA)) that does not require an EcIA.
- Some sites within and/or affected by the transport corridor may have a site-specific plan to ensure impacts on high ecological values are minimised (for example Waipoua Forest Management Plan).
- An EcIA may be required for programmed improvements of the current network and/or improvement projects within the existing transport corridor or transport designation to support a consent application or if species protected under the Wildlife Act may be affected as assessment of impacts will be necessary.
- Ecological values within a transport designation may still have value under various policy and legislation or because they have been identified by DOC, council or are taonga.
- There may also be statutory/regulatory requirements that need to be informed by an EcIA (section 3.1). While under the RMA some activities within the transport designation that could impact upon ecological values may be permitted, other policy and legislation such as the Wildlife Act may have requirements that need to be informed by elements of an ecological impact assessment.

- The environmental screen should be used in the first instance to ascertain the level of detail needed for the situation, and if further assessment is needed the initial scope (section 4.1).
- Should an EcIA need to be undertaken, maintenance staff should be engaged with as part of the initial assessment as they are likely to have valuable knowledge.
- An EcIA may be required for non-programmed works such as emergency works. Where possible the contract is encouraged to be proactive, identifying 'weak spots' of their network and transposing with known sensitive sites and understanding what should be done if circumstances allow it (safety is not compromised etc). Should an event occur, being armed with this knowledge will enable impacts to be better managed. An emergency works procedure is an EMP requirement.

Appendix B: Technical disciplines

The ecologist is part of a broader project team, interfacing with different technical disciplines such as those presented in the table below. Examples of challenges and opportunities associated with different disciplines are provided.

Technical discipline	Potential challenges – examples	Potential opportunities – examples
Archaeology and built heritage	• Habitats for native fauna damaging heritage structures, eg barns, monuments. • New planting compromising archaeological features or built heritage (eg roots, irrigation). • Landscaping for ecological benefits diminishing historic setting or views.	• Reinstate historic landscape elements, eg wetlands to tell the story of a place. • Reinstate authentic historic plantings where well documented. • Integrate historic and natural heritage through storytelling and interpretation.
Climate change	• Designs to lower emissions impact upon biodiversity, eg removing habitat or creating barriers. • Removal of forest during construction and conversion of land trigger Emissions Trading Scheme (ETS) financial liabilities. • Infrastructure stops ecosystems from being able to adapt to climate change, eg hard coastal structures which can also cause adverse effects on the broader area.	• Protect existing carbon sinks and enhance these as part of applying nature-based solutions to the transport network. • Design infrastructure to allow species and ecosystems to adapt to climate change (manages risk of 'squeeze'). • Ecological planting of ETS compliant 'forest species' may simultaneously achieve compliance with ETS forestry obligations and broader statutes, reducing the financial liability triggered by qualifying deforestation.
Human health/ wellbeing	• Route selection to reduce effects on human health (eg air pollution, noise) impacts on natural areas. • Human health mitigation options may have negative impacts, eg birds striking transparent noise walls, alteration of physical conditions.	• Noise walls designed to incorporate native plant species may assist ecology, eg habitat, connectivity, use of uncommon native species. • Planting to reduce dust particles. • Greenspaces supported and improve driver experience and human wellbeing.

Technical discipline	Potential challenges – examples	Potential opportunities – examples
Mātauranga Māori	• Balancing ecological restoration with archaeological values. • The significance of cultural and ecological impacts may not align for a particular option.	• Recognition of tangata whenua values in ecological mitigation. • Restore the mauri of habitats using mana whenua principles. • Incorporation of iwi values associated with wetlands.
Safety and design	• Even minor improvements to the transport corridor may involve removal of naturally occurring native vegetation and ecosystems. • Straighter alignments (often influenced by design speed) have less ability to avoid ecological features.	• Bridge design and construction methods can significantly reduce impacts on existing vegetation and maintain ecological connectivity. • Use of naturally occurring vegetation can encourage lower speeds, allowing such vegetation to remain present.
Social	• Human values may not be aligned with ecological values, eg a boardwalk further away from the road and more into the marine area may negatively affect birds that feed in the intertidal area. • Public access and safety.	• Human and ecological features shared space. • Acknowledgement and appreciation of the natural environment resulting in restoration of degraded areas for biodiversity outcomes. • Education and community engagement in the natural environment.
Stormwater	• Highway drainage requirements and maintenance requirements may impact biodiversity. • Design may not support ecological values of local region/area.	• Stormwater features developed to provide value to indigenous biodiversity. • Use of native species appropriate to the area in treatment devices. • Design provides good ecological connectivity.
Urban design and landscape	• Challenging conditions in the road corridor for plant establishment. • Safe access for maintenance. • Contractual and consenting sign-off triggers (eg canopy closure). • Maintenance requirements.	• Ecological connectivity. • Provide habitat for native fauna. • Introducing native biodiversity in plantings. • Integration of landscape associated with ecological structures (eg fish passage).

Appendix C: Considerations for specific ecological impact assessment components

The relevance of specific EcIA components to the environmental screen, preliminary technical assessment and detailed EcIA are indicated in the table below. The following text provides more detail on these components. The ecologist should be familiar with these considerations early in the project, however, the level of effort can be adjusted depending on the business case stage and/or complexity of project.

EcIA component	Environmental screen	Preliminary technical assessment	Detailed EcIA
Scoping	Yes	Yes. ES helps inform scope	Yes. Scoping is usually iterative with previous assessments informing the next
Desktop studies	Yes. Key method for assessment at this stage	Yes	Potentially. Further information may come from consultation that had not been done in early stages
Site investigations/ surveys	Possibly – there may be site walk over surveys but mostly will be reliant in desktop information	Site walk over. Possibly more detailed investigations should there be a reasonable chance of vegetation, ecosystem or species and/or their habitat with moderate or greater value	Yes
Detailed site investigations	Unlikely but potentially for high-risk projects	Possibly – for high-risk projects	Yes, but not always for low-risk projects
Valuing ecological features	Yes – limited to ecological features gained in desktop	Yes – desktop	Yes – detailed
Assessing ecological effects	Yes – high level	Yes – high-moderate level	Yes – detailed
Effects management	Yes. Greater opportunity to flag high biodiversity values to avoid	Yes. Greater opportunity to flag high biodiversity values to avoid	Yes – detailed

C1 Scoping

Scoping is the process that sets out the extent of the EcIA, ensuring it includes details of the scale and significance of the effects the project may have on ecological features. It determines the ecological issues to be addressed, the methods and resources to be used, and establishes the study area and timeframes for surveys and assessments.

- Scoping is part of an iterative process, with information gathered in one project phase used to inform the requirements for assessment of the next.
- Scoping should begin as early as possible to ensure there is sufficient time to adequately inform the EcIA process. The ecologist needs to use their knowledge and experience to judge the resources required to complete an adequate and effective EcIA.
- For Waka Kotahi projects, the ES is used early in project development to provide a coarse indication of ecological risks and opportunities (section 4.1). This informs the scope of any PTA required, and the PTA provides the scope for the detailed EcIA.
- Ecological information may be available from the benefits selection process that could help inform the EcIA scope (section 1.4.1). The ecologist needs to confirm with the Waka Kotahi project manager whether biodiversity measures have been selected for the project for benefits management and if they have been, be provided with relevant information.
- Early engagement with partners and stakeholders can assist with the scoping process (2.4).
- Knowledge gaps needing to be addressed and fieldwork requirements (including methods, timescales and seasonal considerations) should be scoped as early as possible to factor in potential programme constraints (D3).
- The ecologist (often in consultation with the consents planner) should address any national and regional biodiversity guidance or policy documents where relevant (for example National priorities for protection of indigenous biodiversity on private land).

C2 Desktop studies

The initial step to describe the existing/baseline environment is undertaking a desktop investigation. Refer to EIANZ (2018) for a list of resources/databases.

- Material reviewed as part of the desktop study should include literature and data on the area potentially affected and ecological features present or likely to be present. This should be documented and included as a reference list within the detailed EcIA.
- The ecologist should think spatially from the outset, collecting or developing suitable maps of the receiving areas, including habitat distributions.

- Local knowledge of species and ecosystems that may be present can be gained from talking with iwi, DOC, local authorities, and other potential sources of information such as museum curators. See section 2.4 regarding engaging with partners and stakeholders.
- For online improvement projects information can be gleaned from talking to the maintenance teams, which is useful when species can be living in non-traditional areas (for example dotterels).
- The ecologist should discuss with the consents planner any national and regional biodiversity guidance or policy documents if relevant, such as national priorities for protection of indigenous biodiversity on private land.

C3 Site investigations/surveys

- Initial site investigations are usually walkover surveys, which are most useful for characterising ecological features in general and identifying whether more detailed survey effort is required.
- Initial investigations should be designed to support future survey and monitoring efforts, for example data may inform the following: presence (or likely absence) of an ecological feature, effect of the project on an ecological feature, and/or success of effects management package.
- Spatial and temporal limits of surveys need to be established. This will help provide an ecological baseline for accurate prediction of the effects of the project, feed into effects management, and present a clear rationale for the work involved.
- The ecologist should note any challenges and constraints to designing the survey, for example 'No suitable control site', and document as far as possible how these challenges have been addressed.
- A biostatistician may be useful to advise on the sampling effort needed to address the objectives of the survey programme and address challenge around species-level analysis, which can be difficult.
- The ecologist is to inform the project team as early as possible when:
  - a particular species requires repeat surveys at different times of the year to understand seasonal changes/how they are using the landscape, such as coastal waders
  - more than one year of data is needed to gain a higher degree of confidence in the accuracy of the baseline or to understand the seasonal/inter-annual variability in the data.
- Site visits should be timed for the best chance of detecting species present. Influencing factors can include the season, time of day, moon phase, tide, precipitation, and temperature (appendix E).

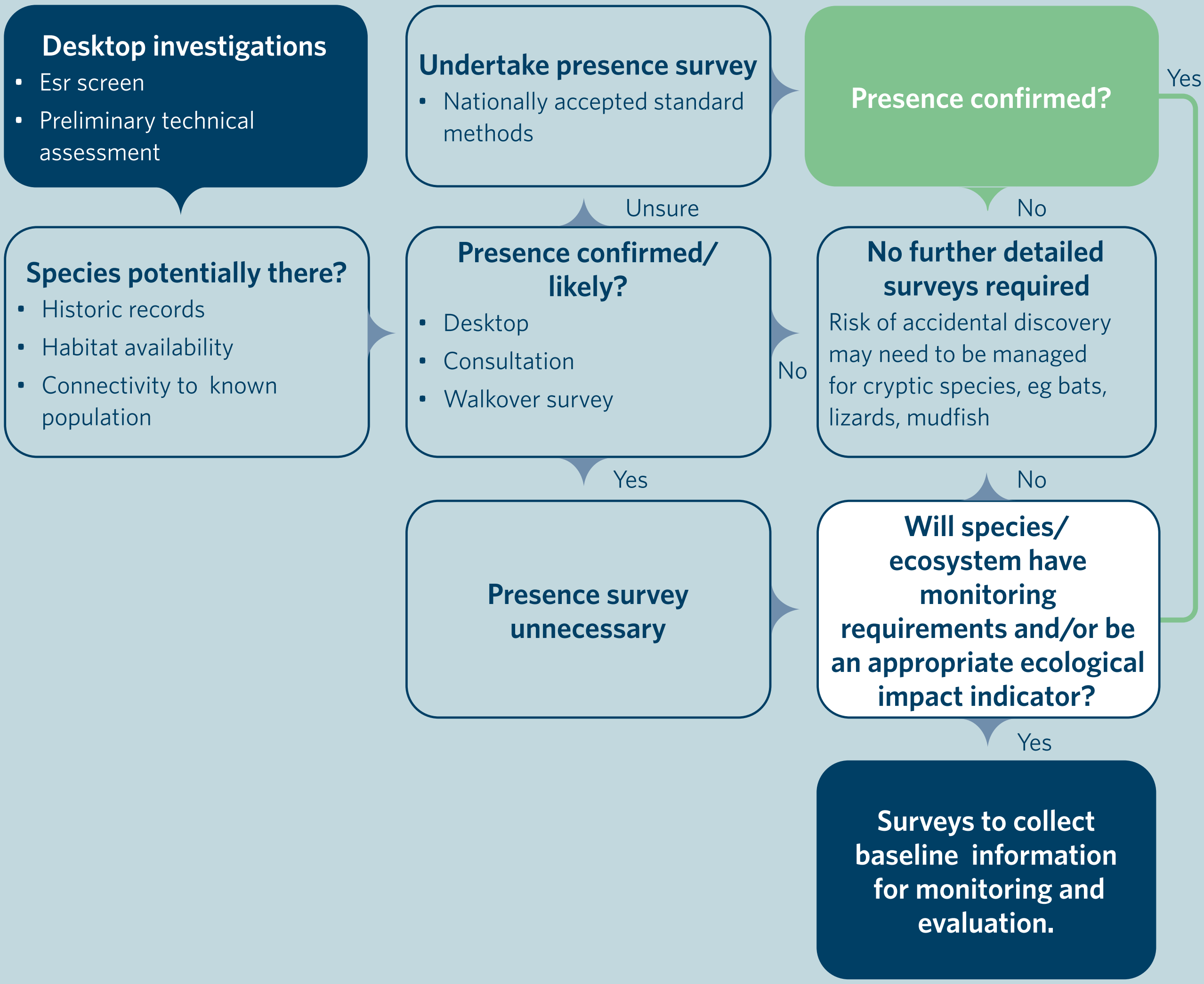

Figure 10. Determining the need for species-specific surveys

- Site investigations need to consider programme planning factors such as:
  - intended timing for project implementation
  - property access requirements
  - likelihood of project location, option and/or designs changing
  - availability of resources
  - scale and budget of project
  - potential delays to be factored in, for example postpone due to weather.
- Where it is likely that offset/compensation is required, then surveys to identify and value potential receiving sites should be included the scope of site investigations. In addition, further assistance from the project team may be required in regard to offset planning logistics, such as private landowner negotiations.
- The scope of surveys should incorporate appropriate survey methods to support different types and timing of statutory applications (resource consent (regional plan matters) and/or NOR (district plan matters), including WAA applications) while at the same time providing enough information to guide design decisions and future consenting 'red flags'.

Further investigations, which might take the form of a 'ground-truthing' exercise, may be necessary to check the data and baseline are still accurate. This can happen in the event that there is a lengthy delay (years) between when ecological investigations are carried out and when the project actually commences.

C4 Valuing ecological features

While EIANZ provides a set of criteria to determine the value of ecological features, the ecologist needs to also assess them against criteria from the relevant regional or district plan. The ecologist needs to be transparent with their assessment of value and use of criteria. Should the value rating be different between the EIANZ guidance and statutory direction, the highest value rating is to be used in the EcIA to direct effects management. This will provide more certainty that appropriate/sufficient effects management will be implemented and greater change it will result in no net loss and ideally net gain.

Ecological value of an area

The ecological value of an area is determined by the value of species, communities and habitats found there and the area's contribution to the maintenance of indigenous biodiversity. In New Zealand an accepted approach to valuing ecological features is allocating a rating to indicate ecological value: negligible, low, moderate, high and very high.

The professional judgement of the ecologist is to be used when applying EIANZ criteria and assigning the final overall ecological value. Justification of how ecological value is assigned is to be included in the reporting.

- Ecological value can be assessed at a range of scales, such as local, regional and, national. For example, a particular ecosystem may be locally common but is poorly represented nationally (or vice versa). The ecologist needs to justify why they chose the scale they did and what would happen had a different spatial scale been selected.
- The EcIA should reflect the underlying importance of local (ecological district) settings, while taking into account some or all of the national priorities and tools such as Land Environments of New Zealand, Manaaki Whenua Landcare Research's Naturally Uncommon Ecosystems factsheets and the New Zealand Threat Classification System (NZTCS).
- To assist in determining value to terrestrial sites consider using DOC Guidelines for assessing significant ecological values.
- Degraded naturally occurring indigenous vegetation/ecosystems can have high value, particularly if they are representative of original vegetation/ecosystem types. Natural areas in degraded ecological districts (less than 20% indigenous cover remaining) may be the best/only examples of their type left nationally or regionally in an ecological district.
- Should highly mobile indigenous fauna be present, identify how they could use the site.
- Value of habitat dominated by introduced species, including weeds, cannot be discounted. In more modified landscapes, they may provide habitat for threatened/at risk (TAR) species.

Ecological value of species

Where species are being considered in isolation, an accepted method for assessing and assigning ecological value is by considering their threat classification. The NZTCS is a key tool for identifying threatened species and using this to assign a rating to indicate ecological value. Regional and district lists may also be applicable. In addition, a species may have value in the ecological role it plays or in its intrinsic value. While EIANZ provides guidance on assigning value depending on threat status, this is not rigid and EcIA requires the ecologist to apply their experience and knowledge of the specific circumstances before assigning value to a species. The following considerations are to be applied when assessing and assigning species value:

- Contextual information about distribution and abundance of a species population is fundamental in determining value in the EcIA when using the NZTCS. For example, a species that is common locally may be declining nationally or mainland populations may be rare while large numbers are present on offshore islands.
- A species' value from a local, regional and national context should be established.
- Understanding the reason for a species' threat status (that is, the qualifiers) under the NZTCS is important in assessing its value in the local context. For example, shore skink *(Oligosoma smithi)* is not threatened nationally due to stable populations on offshore islands. However, on the mainland this species is declining.[15] Therefore, if shore skinks were present on a mainland project site their value rating would generally be high.
- Consultation with local experts, records from museums and herbariums, and relevant regional and district plans may assist in providing local context.
- DOC and some regional councils are starting to develop lists of regionally threatened species and some regional and district plans already refer to these in the ecological significance criteria.
- Species recovery plans, and other species management documents such as iwi plans for taonga or management documents under the Conservation Act 1987 can inform the assessment of ecological value.
- The NZTCS lists get updated periodically and the status for some species may change.
- Species value is assessed as a separate feature to the habitat it utilises, which could make up several habitat units.
- Species (both exotic and native) may be important for non-ecological reasons and should be considered in the relevant assessment rather than in the EcIA, for example gamebirds and recreational/social assessments.
- Aquatic species are not valued separately (as per NZTCS); they are included in the overall value assessment of the aquatic feature, for example a stream.

15 Hitchmough, R, et al (2016) Conservation status of New Zealand reptiles, 2015. Department of Conservation New Zealand Threat Classification Series 17.

C5: Assessing ecological effects

Assessing effects on ecological features occurs through various phases of a Waka Kotahi project. The coarser level of assessment from the initial phase is built upon and refined in the next phase. When using EIANZ to determine the level of effect, considerations in section 1.3 are to be applied.

Effects must be assessed in the context of the predicted ecological baseline conditions within the ZOI throughout the lifetime of the project.

Further considerations include:

- The ecologist should be aware of Road edge-effects on ecosystems research.
- The timeframe of expected ecological effects may overlap and happen at different rates after construction begins.
- Ecologists should assess the project effects at several spatial and temporal scales and then identify which ones they prefer and why. This ensures transparency for decision makers who can then clearly see what the consequences of the ecologist's spatial/temporal decisions are.
- Liaise with other technical disciplines to fully understand what the biophysical changes are and how they could affect ecological features, for example changes in hydrology or lighting change.
- Effects must be assessed and presented separately for the construction and operation/maintenance phases of a project.
- There is often a time lag between when the construction occurs and when its full ecological effects are detectable. This needs to be considered in survey and monitoring programmes.
- Consider the effects of road development and climatic change. Some ecological communities, for example, will not be able to shift or adapt due to barriers caused by roads (for example marsh communities).
- There may be cumulative effects. Cumulative effects can be different in nature, larger in magnitude, greater in significance, longer lasting and/or greater in extent than any individual effect.
- Should potential cumulative effects of a project be considered significant the ecologist should flag this to the consents planner. An example of this might be the cumulative effects of habitat removal by several projects within a local area that adds up to a larger effect than the individual project effects.

Appendix D: Site investigations

D1 Site investigation types

(Adapted from Smith, D, et al (2017) *Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature.* NZ Transport Agency research report 623.)

Stage	Site investigation1	Purpose	Typical project phase
Development	Walkover survey	Ground-truth aerial photograph analysis. Check desktop investigation findings. Identify features not already picked up through the desktop investigation and/or flag those ecological features that may be present but not yet confirmed.	Programme, indicative or initial stages of single-stage business case
	Presence survey	Determine the likelihood of an ecological feature being present (or likely absent). Add to knowledge of species' distribution/habitat preferences Avoid high-value significant ecological features such as habitat, foraging grounds and roosting/nest sites.	Single-stage business case
	Baseline survey	Establish ecological baseline conditions. Describe important ecological features and their distribution. Identify key resources for a specific species. Gather information to undertake a preliminary EcIA. Minimise or avoid impacts on ecologically significant features.	Single-stage business case

Stage	Site investigation1	Purpose	Typical project phase
Delivery	Destructive survey	A destructive survey, which entails removing the habitat of the species in question and thoroughly searching it for individuals, may be appropriate when the habitat needs to be removed to enable the project to go ahead and: • there is a risk that a species/ species group may be present despite not being found through site investigations, or • the most practical way to salvage individuals is through removing their habitat. All wildlife permits must be in order before proceeding.	Implementation
	Detailed survey	Collect/update baseline survey information if required. Collect 'before' works data to compare with 'after' construction to allow assessment of impacts and/or mitigation. Identify and evaluate ecological resources and features likely to be affected by project. Predict and characterise impacts of the project. Recommend the location and outline design of mitigation measures.	Pre-implementation Project design, consenting and assessment of effects
	Monitoring (before/during construction)	Collect pre-construction baseline data, (using baseline survey data when available and applicable). Undertake monitoring during construction to measure effects. Determine effectiveness of construction mitigation. Assess compliance with consent conditions.	Implementation / Construction
Maintenance and operation	Monitoring (post-construction)	Implement post-construction monitoring to measure effects of project. Assess compliance with consent conditions. Determine effectiveness of operational mitigation. Check how results compare with what was predicted in the EcIA. Apply feedback to inform adaptive management and provide lessons learned to other projects.	Operation and maintenance

D2 Key considerations when survey and programme planning

Consideration	Explanation	Example
Access	Permission to access property should be arranged well before the survey season begins. Waka Kotahi has a specific access procedure. Seek advice from the property/planning team. If access cannot be obtained seek alternative ways to assess.	For the Mill Road project, alternative sites on public land were used for to undertake bat monitoring when ecologists were unable to access certain properties.
Baseline data requirements	To account for natural populations fluctuations and environmental variables baseline data may need to be collected for more than one year and well in advance of construction work commencing.	Northern Busway required five years of pre-construction dotterel breeding data to monitor effects.
Ecological studies and research	Ecological studies may need to be started well in advance of works to support the AEE.	Different translocation sites were trialled for a threatened plant species to better understand its requirements.
Expertise and equipment	The availability of experts at key times (eg seasonal surveys) can be an issue. Equipment may need to be ordered well ahead of when it is needed.	Ecologists with skills and experience with bat surveys and handling were in short supply when several Waka Kotahi projects needing bat surveys during the same season.
Fish spawning and mitigation periods	Fish species have specific times of the year when they should be surveyed, depending on their spawning and/or migration period. This also influences when disturbances in watercourses and/or their banks should be avoided.	
Lead-in time for ecological surveys	Fish species have specific times of the year when they should be surveyed, depending on their spawning and/or migration period. This also influences when disturbances in watercourses and/or their banks should be avoided.	Standard methods for the use of artificial cover objects require them to be set out for a specified period before being used in surveys.
Mitigation	Invest in arrangements for mitigation as soon as possible. Considerable forward planning may be necessary to put effective measures in place.	Bat boxes/landscape planting need to be in place for several years before working as mitigation for the loss of bat roosts.

Consideration	Explanation	Example
Monitoring	To understand what effort is needed for a monitoring programme to successfully answer the questions posed, it is recommended the project team develop the monitoring design in consultation with a biostatistician.	Sometimes monitoring data is not sufficient and/or appropriate to address the monitoring questions.
Moon phases	The moon phase may affect detectability of certain species (eg the full moon may deter or attract species).	The emergence of bats from their roosts may be affected by the moon.
Nesting/bird breeding season	Nests and eggs of most species of New Zealand's indigenous birds are protected. Works should avoid nesting periods or have a contingency in place to manage risk of birds nesting in areas programmed for works during the bird breeding season.	Northern New Zealand dotterel.
Season	Some flora and fauna are best detected and/or salvaged at a certain time of the year. Standardised monitoring may require undertaking surveys at specific times of the year.	Reptile, frog and bittern surveys.
Tide times	To detect some species tide times may need to be considered, eg species may be present at high tide only.	Coastal wading birds.
Weather	Ecological surveys may depend on certain weather conditions (eg temperature, no rain). Programming needs to allow for potential weather delays.	Bat and lizard surveys need to be undertaken during specific weather conditions.
Wildlife Act authorities (WAA)	The time to gather information to support and prepare WAA to the satisfaction of DOC, including interactions between DOC and the project team, needs to be factored in.	Progress this early to avoid inconsistent consent conditions and programme delays.

Appendix E: Climate change and project development and delivery

Most impacts of climate change on biodiversity are expected to be indirect, manifested through other drivers of biodiversity decline including habitat fragmentation, land use changes, pest species, resource use and pollution. Land transport is directly and/or indirectly linked to each of these key drivers. Climate change will strongly influence future species and ecosystem distribution whose ability to adapt to climate change could be hampered by physical barriers such as roads.

We recommend that climate change should be incorporated into EcIA, including identification of potential climate change adaptation and mitigation opportunities.

Project stage	Climate change and biodiversity considerations
Options assessment	• Transport infrastructure placement and design (including multimodal) is future proofed to enable ecosystems, habitats and species to adapt to a changing climate (eg shift distribution). • Avoid important biodiversity areas including, but not limited to, protected areas, endangered ecosystems, and carbon sequestering ecosystems.
Infrastructure design	• Protect the fragile physical connection between coastal and land environments. • Design selection should achieve climate change mitigation (reducing emissions) as well as safe and efficient vehicle operation, with least harm to existing natural climate change mitigation and biodiversity. For example, by considering tunnel or bridge options that avoid native forest and wetlands, as alternatives to cut and fill. • Investigate how nature-based solutions with biodiversity benefits can be weaved into landscape/urban design and retrofitting.
Effects management and enhancement opportunities	• Avoid harming important natural carbon sinks such as wetlands and old indigenous forest and, where possible, protect and enhance these. • Seek nature-based solutions that have co-benefits in climate change and biodiversity • Secure land for biodiversity and nature-based solutions along transport corridors to create a green/blue network that has co-benefits of supporting human wellbeing, mitigating and adapting to climate change and supporting/being consistent with the national adaptation plan (NAP), the emissions reduction plan (ERP) and the Aotearoa New Zealand Biodiversity Strategy.
Maintenance and operation	• Identify existing natural carbon sinks on Waka Kotahi land, including the existing transport network that may provide biodiversity co-benefits. • Assess opportunities and consider these as part of risk assessment when programming works in or near these areas, including improvement projects. • New assets (eg electric vehicles charge stations) are placed so as to not impact important biodiversity features and functions.

If you have further queries, call our contact centre on 0800 699 000 or write to us:

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This publication is also available on Waka Kotahi NZ Transport Agency's website at **www.nzta.govt.nz**