

## **GUIDANCE ON ADAPTIVE MANAGEMENT**

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## 1 Introduction

Adaptive management is a systematic process for incrementally improving management practices by learning from the outcomes of past and current practices. If applied rigorously it may be an effective approach to reducing risk where there is uncertainty about management outcomes

Adaptive management has its origins in conservation and natural resource management where it has been applied to the recovery and restoration of poorly known or unpredictable ecosystems and species.

More recently, proponents and regulators have sought to apply the concept of adaptive management to developments such as gas and mining projects. The focus in the context of environmental impact assessment and approvals is on mitigating and managing the harmful impacts of these activities on the natural environment.

While there is much written about the theory of adaptive management, translating it into practice has been challenging, with limited success in application. In particular, there is a tendency to loosely interpret adaptive management as a “trial and error” management process, with inadequate attention or commitment to many of its key elements.

As the effective application of adaptive management in an environmental impact assessment and approval context is yet to be proven, the NT EPA expects that it will be only considered in exceptional cases. Nevertheless, the NT EPA considers there is a limited set of circumstances where adaptive management, if systematically implemented, may be an appropriate approach in the context of management uncertainty.

This document seeks to provide guidance about the circumstances under which the NT EPA may be willing to consider adaptive management in the context of environmental impact assessment and approvals, including:

- the key features of adaptive management
- when adaptive management might be considered by the NT EPA
- how adaptive management might be applied in the environmental impact assessment process, and
- how adaptive management might be applied to environmental approvals.

## 2 Adaptive management in theory

Adaptive management aims to provide a framework for sound management and decision-making in the face of uncertainty. It is a carefully planned and structured, iterative approach that facilitates improved management and decision making over time in response to evolving knowledge and changing circumstances. Fundamentally, it involves implementing evidence-based management actions; monitoring and evaluating the outcomes of these actions; and systematically adapting those actions according to what is learned.

Adaptive management, and when and how it should be applied, is often misunderstood. Effective adaptive management is far more than a process of monitoring activities and changing management direction, or a means of learning that is based on trial and error, or code for “we’ll make it up as we go”. Adaptive management involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, carefully selecting and implementing one or more of these alternatives in a timely way, monitoring to learn about the impacts of management actions, and then using the results to update

knowledge and adjust management actions. Management procedures are changed in steps until monitoring shows that the desired outcome is obtained.

Adaptive management has been recognised as an application of the precautionary principle. The precautionary principle provides for the application of precautionary measures or, where such measures cannot reduce the threat of serious or irreversible environmental harm, other appropriate action including prohibiting the activity from being carried out. While scientific understanding of complex environmental systems is incomplete, uncertainty should not necessarily prevent environmental management activities from occurring. However, to take an adaptive management approach in accord with the precautionary principle, there needs to be a high level of certainty that the environmental objectives can be met, even if there is uncertainty about the most effective management actions to achieve this.

### 2.1 The adaptive management process

The structured decision making and learning process of adaptive management has been described in various ways. The process outlined below has been adapted from Lee (2014). Successful implementation of adaptive management requires careful initial design for each of these steps.

#### Step 1: Define the management problem

Define the problem that needs to be managed. This involves analysing the ecosystem and establishing the baseline conditions and an understanding of how these may be impacted by the development.

#### Step 2: Establish clear management objectives

Set clear, specific and measurable (quantitative) management objectives – the environmental outcomes to be achieved - to guide decision making. Management objectives should be approved by regulators and established through a transparent process in consultation with stakeholders.

Where broad policy goals apply to the management area, they must be translated into site-specific objectives. To be useful for decision making, objectives need to be specific, measurable, achievable, results-oriented and time-fixed ('SMART').

#### Step 3: Identify uncertainties and hypotheses

Identify the uncertainties in the ecosystem that underlie the management problem. Formulate competing hypotheses about these uncertainties and test them.

Predictive models can be used to characterise system behaviours and responses to management actions. Models can vary in complexity and type, from simple conceptual diagrams to complex mathematical models. Model predictions can be used initially to identify and refine management actions. Over time, models can be systematically tested against monitored data, building confidence in the model and reducing uncertainty.

#### Step 4: Establish performance indicators or triggers

Establish quantitative performance indicators that can be used to assess progress towards objectives can be assessed, and identify when performance deviates from the objectives, triggering a change in management actions.

It is critical that meaningful and measurable indicators of ecosystem response to management actions are selected. The performance indicators selected will inform monitoring requirements.

Triggers for management decisions should ideally include intermediate triggers for further investigation and triggers for management intervention. Triggers for intervention should be sufficiently below absolute impact limits to ensure action can be taken before the impacts exceed acceptable limits, recognising the potential lag times between performance monitoring, management actions and ecosystem response.

### **Step 5: Identify, select and implement management actions**

Identify a broad set of possible management actions based on the range of hypotheses considered. The alternative actions should be evaluated against the management objectives and modelled outcomes to clearly identify the best-supported management actions to be taken in the first iteration of the process.

Actions must be under management control and a range of options should be designed that will promote learning and reduce uncertainty. Actions should reflect the current state of knowledge and best available technology and management techniques.

There should be a set of alternative (contingent) management actions that can be implemented if monitoring of trigger levels indicates that the management objectives are not being achieved. Alternative management actions and the circumstances in which they will be implemented should be clear, explicit and documented. These responses should be capable of being legally enforced under a regulatory instrument.

The implementation of selected management actions should be reported to regulators and the public.

### **Step 6: Monitor ecosystem response**

Implement a monitoring program that is informative about progress in relation to the performance indicators and triggers. Monitoring has four key purposes:

- to evaluate progress towards achieving management objectives
- to identify when a trigger level for action has been reached
- to increase understanding of ecosystem function and status, in order to better identify appropriate adaptive management actions
- to improve models and understanding of ecosystem dynamics through the comparison of predictions against monitoring data

The monitoring program must be designed around the identified performance indicators or triggers, and demonstrate sufficient power to detect change at a sensitivity appropriate to the trigger values.

Monitoring results should be made publicly available to ensure transparency.

### **Step 7: Evaluate effectiveness**

Systematically evaluate the impact of management actions and the achievement of management objectives. Monitoring data should be compared against the performance indicators or triggers, and outcomes predicted by modelling, to evaluate progress towards objectives and improve understanding of the ecosystem and effectiveness of management actions.

Evaluations should be periodically reviewed by independent experts and reported to the regulator and the public to ensure transparency and accountability.

### **Step 8: Adjust management actions**

Adjust management actions in response to what has been learned. Where management actions are not having the desired outcome, they should be altered or replaced.

The system for evaluating and adjusting management actions needs to be clearly defined. The system must define when changes must be made to management actions through trigger thresholds, the corresponding management actions if those triggers are exceeded, and who is responsible for decision making (including any requirement for stakeholder consultation).

### Step 9: Iteration

Repeat the above elements are repeated in an iterative cycle. As the cycle continues, management evolves in response to improved understanding, as well as any observed changes in the ecosystem.

## 3 Adaptive management in environmental assessment and approvals

### 3.1 When the NT EPA will consider adaptive management

The NT EPA is responsible for conducting environmental impact assessment of development proposals under the *Environmental Assessment Act*. The outcome of the NT EPA's assessment is an assessment report that is provided to the NT Minister for the Environment and the minister responsible for authorising a proposal (the responsible Minister). The NT EPA's assessment report provides recommendations for consideration by the responsible Minister in deciding whether to approve a proposal and conditions to impose on any approval.

The NT EPA is also responsible for granting environmental approvals for certain activities under the *Waste Management and Pollution Control Act*.

Adaptive management will only be considered by the NT EPA in environmental assessment and approvals when the following conditions exist:

- There is a high level of certainty that the environmental objectives are able to be met, but there is uncertainty as to the most effective management actions to achieve these objectives.
- There is an opportunity to apply new and emerging knowledge, technology and management techniques.
- Development proponents are able to apply an iterative decision making process whereby the adaptation of management actions is possible, and have the organisational stability to implement adaptive management over the required timeframe.
- Clear and measurable (quantitative) management objectives with scientific rigour can be identified, and agreed by regulators and stakeholders through a transparent process that ensures accountability.
- The value of information for decision-making is high – the impact of management actions is uncertain and the reduction of that uncertainty, through acquiring information, will accelerate progress in meeting management objectives over time.
- Uncertainty can be expressed as a set of testable models. Adaptive management uses structured decision analysis to inform and analyse the problem. This requires the prediction of effects of management actions, with predictions informed by models.
- A monitoring system, with appropriate power, can be established to clearly determine progress toward objectives, and if performance indicators or trigger values are reached.

- There is an commitment by the proponent to the implementation of adaptive management, with a supporting governance structure and clear systems and responsibilities for management actions and decisions
- There is a strong regulatory regime that is capable of enforcement.

It follows that adaptive management will not be considered by the NT EPA when one or more of the following limitations exist:

- Uncertainty is too great to enable a robust adaptive management framework to be established. For example, where there is significant uncertainty that the environmental outcomes can be met. This level of uncertainty may have broader implications for the acceptability of a proposal.
- There is insufficient baseline data about environmental conditions
- Suitable environmental outcomes cannot be defined (for example, there are irresolvable conflicts among stakeholders in defining explicit and measurable management objectives)
- Monitoring cannot provide useful information for decision making (for example, there is no firm commitment to ongoing monitoring, or inability to design an effective monitoring program to test hypotheses)
- Risks associated with learning-based decision making are too high and a more prescriptive approach is required
- The proposed action is determined to be unacceptable and refusal is recommended (for example, when the worst case scenario resulting from a management action is unacceptable to stakeholders, or the opportunity to improve over time is at the expense of unacceptable shorter-term environmental impacts)

### 3.2 Planning adaptive management through environmental impact assessment

Environmental impact assessment (EIA) is a predictive tool for identifying and characterising environmental impacts and risks associated with development proposals, and the planning phase of adaptive management is best progressed during the EIA process. Thorough EIA provides a framework to describe ecosystem baselines, identify uncertainties and make informed decisions on planning and management. EIA can also assist in providing the transparency required in the adaptive management process

Where a proponent proposes to use adaptive management to deal with uncertainty in the environmental management of a proposal, the NT EPA expects that steps 1 – 5 outlined in Section 2.1 above will have been significantly progressed. Key components should be set out in a draft adaptive management plan provided in EIA documentation.

The adaptive management plan must provide the NT EPA with sufficient confidence that it will avoid unacceptable environmental outcomes in the short term, while enabling learning and the application of learning to improved environmental management in the longer term. The minimum requirements of an adaptive management plan include:

- specific, measurable management objectives relevant to all significant environmental risks and potential impacts;
- quantitative performance indicators to assess progress toward objectives;
- pre-determined triggers for management investigation and intervention if performance deviates from objectives, as determined through monitoring;
- pre-determined, realistic and achievable contingency interventions in response to triggers being met;

- clearly defined management measures/actions that are capable of being implemented in a timely way to meet performance indicators and environmental objectives
- detailed monitoring programs that are sufficiently powerful to determine whether management measures are effective, and to inform decisions about adjustments to management actions or need for alternatives;
- a continual feedback system to ensure appropriate actions are initiated when triggered and environmental objectives are being met;
- iterative development of new management actions as required based on knowledge gained from experience at the site and elsewhere across industry.

Performance indicators, triggers and actions in an adaptive management plan should all aim to ensure that the specified objectives are met. All key elements of an adaptive management plan need to be auditable. The process for developing an adaptive management plan must be inclusive and transparent to all stakeholders. To ensure transparency the adaptive management plan must be available to the public and progress in its implementation, including monitoring results, must be reported to stakeholders and the public.

In some circumstances where adaptive management has not been proposed by a proponent within the draft environmental impact statement (EIS) but is considered to be an appropriate approach for managing uncertainty, the NT EPA may recommend the proponent use the supplement to the EIS to develop and present an adaptive management plan. The NT EPA may also make recommendations about how stakeholders should be engaged in developing and implementing the adaptive management plan. In such cases the NT EPA will need to be confident that a proponent has the capacity to put in place the necessary governance and management systems required to support an adaptive management approach. The NT EPA may also require that the adaptive management plan is endorsed by the NT EPA prior to approvals or commencement of the activity.

### 3.3 Implementing adaptive management through environmental approvals

Adaptive management must be incorporated into conditions of an approval under authorising legislation to make it enforceable. This must be done in a way that establishes clear legal guidance on what is required in implementing adaptive management. A condition simply stating an adaptive management plan must be implemented is not sufficient.

To achieve the necessary clarity and enforceability, it is the NT EPA's expectation that conditions of an approval would:

- establish the clear, specific and measurable management objectives to be achieved, and the performance indicators required to determine their achievement;
- establish legally binding obligations to adapt when monitoring data shows change is necessary, including
  - detailing the triggers for change in management actions, ensuring that these triggers are set appropriately to protect significant environmental values;
  - establishing what actions are required if triggers are exceeded, including decisions to discontinue an activity;



- determining who makes the decision to change management actions (including discontinuing an activity where required), and the evidence on which such decisions must be made;
- establish a process with the regulator for reviewing and adjusting triggers
- establish transparent monitoring, reporting and review requirements;
- establish processes to ensure transparency and stakeholder engagement in design and implementation.

An approval may require independent auditing of adaptive management commitments on a periodic basis.

Where necessary, the NT EPA will make recommendations to the approving authority in its assessment report on the appropriate conditioning of adaptive management in an approval for a project.

### 3.4 Stakeholder engagement

The uncertainties associated with managing ecological systems make decision making challenging and potentially subject to conflict among stakeholders. This conflict can undermine confidence in decision making relating to activities that potentially impact the environment.

The structured decision making process of adaptive management used to identify and evaluate environmental objectives and options should engage stakeholders, experts and regulatory decision makers in a transparent manner.

Stakeholders should be engaged early and throughout the adaptive management process. Stakeholders should be engaged in assessing the management problem and reaching agreement on its scope; determining management objectives; and identifying and assessing potential management actions. Stakeholders should agree to the process for adjusting management actions over time based on learning. All phases should be open and transparent to stakeholders, and there must be commitment by the proponent to remain engaged with stakeholders over time once the project is in operation.

## 4 References

Lee, J. (2014) Theory to practice: Adaptive management of the groundwater impacts of Australian mining projects. *Environmental Planning and Law Journal* 31: 251.

Preston, B.J. (2017). *The Judicial Development of the Precautionary Principle*. Presentation to the Queensland Government Environmental Management of Firefighting Foam Policy Implementation Seminar. Retrieved from <http://www.lec.justice.nsw.gov.au/Documents/Speeches%20and%20Papers/PrestonCJ/Justice%20Brian%20J%20Preston%20SC%20Keynote%20Address%20-%20Precautionary%20Principle%20%20delivered%2021.02.17.pdf>

Williams, B. (2011). Adaptive Management of Natural Resources: Framework and Issues. *Journal of Environmental Management* 92: 1346.

Williams B.K., Szaro R.C. and Shapiro C.D (2009). *Adaptive Management: The U.S. Department of Interior Technical Guide*. Adaptive Management Working Group, U.S. Department of the Interior, Washington DC.

## 5 Further information

Further information and guidance on environmental impact assessment in the Northern Territory is available on the NT EPA website at: <https://ntepa.nt.gov.au/environmental-assessments>.

Comments on this guidance are welcomed and should be directed to the NT EPA:

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