

**Title: An adaptive management protocol: planning evaluation for collaborative water management**

**Abstract**

*Water Quality Improvement Plans are being developed in the Great Barrier Reef (GBR) catchments to manage the pressures of agricultural impacts on water quality that threaten the GBR lagoon and its ecosystems.*

*Linking land management practices to responses in the resilience of Reef ecosystems is engaging leading scientists and driving the development of sophisticated modeling and assessment tools. Managing the uncertainty inherent in both setting meaningful targets, and negotiating the delivery of collaborative actions to achieve those targets, is a risk for investors, program managers and key stakeholders.*

*Adaptive management has long been promoted as the panacea to managing uncertainty, yet the track record of delivering explicit, active adaptive management is poor. This paper reports the results of a project that explored the application of adaptive management to the management of Reef water quality.*

*The project developed a protocol for adaptive management strategies in GBR Water Quality Improvement Plans. An expert panel was engaged to develop a conceptual framework that was tested against a draft Water Quality Improvement Plan for the Tully catchment. This raised critical boundary issues between catchment-scale and GBR-scale planning systems. The implications of the interdependence of these planning tools are discussed and how an adaptive approach can provide a negotiation focus for collaborative activities and a mechanism for effectively linking the two scales.*

*The protocol was developed from the Tully case study, and tested with regional planning managers, scientific experts and investors. The purpose of the protocol is to provide assurance to both stakeholders and investors that a structured and iterative approach to evaluation and learning will manage significant uncertainties within a complex and collaborative management system.*

*The approach described is to develop and document the plan logic, key uncertainties and associated learning objectives, performance measures and trajectories, feedback loops and responses to scenarios anticipated. The protocol makes uncertainty explicit and negotiates performance measures and evaluation strategies with multiple stakeholders. Anticipating the corrections that may need to be made, and the triggers that would cause them, provides confidence for investors that plans will effectively manage both the uncertainty in the underpinning science and the uncertainty of negotiated delivery of collaborative actions.*

*This approach has potential for wider application in natural resource management planning and evaluation, and indeed in the delivery of complex, collaborative projects in other fields. The approach offers a simple and intuitive strategy for embedding collaborative evaluation strategies at the start of plan implementation*

## **The project**

This paper reports on the outcomes of a project funded by the Department of Water, Heritage and Arts (DEWHA) as part of the Coastal Catchment Initiative, to support development of Great Barrier Reef Water Quality Improvement Plans. The contract was hosted by Terrain NRM, with contributions by Eberhard Consulting, CSIRO and members of the RWQP Scientific Advisory Panel.

## **Context**

The health of the Great Barrier Reef (GBR) lagoon and its ecosystems is affected by the quality of the water from adjacent catchments. The Australian and Queensland Governments have developed the Reef Water Quality Protection Plan (Reef Plan) to protect the Reef from the impacts of catchment water quality, specifically sediments, nutrients and pesticides. Reef Plan relies on a range of partners to assist in its delivery, and specific tasks are allocated to non-government partners including regional natural resource management (NRM) bodies, agricultural industry peak bodies, research institutions and local government. Regional NRM bodies are responsible for developing and implementing regional NRM plans that engage the regional community in delivering actions to achieve water quality and other NRM outcomes. This involves a particular role in facilitating the long term integration of effort across a wide range of institutional partners towards the achievement of natural resource management targets. The Reef Water Quality Partnership (RWQP) has been established to facilitate improved collaboration between regional NRM bodies and governments in setting water quality targets, monitoring and reporting outcomes.

The development of Water Quality Improvement Plans (WQIPs) in high priority catchments is an action within Reef Plan that has been supported by the Coastal Catchments Initiative administered by the Department of Environment, Water, Heritage and the Arts. In GBR catchments WQIPs are being delivered by regional NRM bodies and local governments (regional NRM bodies will incorporate WQIPs into their regional NRM planning and delivery processes). These plans are developed to capture current knowledge, establish environmental values and develop water quality targets, identify management strategies to achieve water quality improvement targets, and develop implementation, monitoring / modelling and adaptive management strategies.

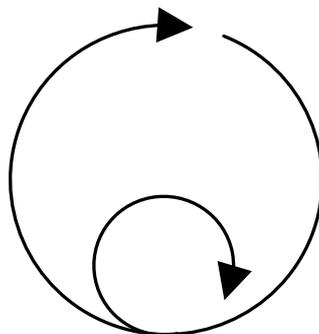
An adaptive management strategy thus forms an integral part of a WQIP. Adaptive management is a systematic process to improve management effectiveness by adopting an explicit approach to learning and review. In the context of a WQIP, reasonable assurance statements assess the uncertainty associated with the knowledge base for developing targets, and the capacity to deliver actions to achieve targets. An adaptive management strategy articulates how these uncertainties will be managed; when the assessment of WQIP uncertainty is high, there is likely to be a need for greater flexibility and regional experimentation in approaches adopted to achieve targets.

The project report provides a conceptual framework for adaptive management in the GBR, a protocol for catchment-scale adaptive management strategies, and discusses the implications of embedding an adaptive approach at the catchment and GBR scales. This paper and presentation focus on a brief outline of the conceptual framework and the protocol, as a tool to frame and support effective evaluation at the regional scales. The authors consider that this has potential application to other broad-scale, collaborative plans for environmental or other complex fields e.g. social services.

## **Conceptual framework**

An adaptive management approach incorporates clear feedback loops in which progress towards the management objective is monitored, and actions are adjusted in response to measures of progress and new technical or policy input. Using feedback to review and

improve management is the foundation of adaptive management. It is useful to conceptually separate the review of plan implementation from the review of the plan itself by describing two cycles in adaptive management: an inner cycle, in which targets are fixed, performance monitored and actions chosen, and an outer cycle (over a longer time scale) in which the overall strategy (i.e. the WQIP), including objectives and targets, monitoring and performance measures, available actions and decision rules, is reviewed and revised. This approach forms the basis of the discussion in this report. In the GBR this 'double-loop' model (Figure 1) can be applied to both the catchment-scale WQIPs and the whole-of-GBR scale Reef Plan. The interaction between these two scales is an important element linking catchment-based activities to broader ecosystem outcomes.



**Figure 1. Double loop model of adaptive management**

### **The Protocol**

The purpose of this protocol is to guide the development of a catchment-level adaptive management strategy to support the implementation and improvement of water quality improvement plans in the Great Barrier Reef. We believe that the protocol can be adopted and adapted to other applications where there are a complex web of institutional dependencies in managing complex environmental or social systems at the broad scale.

In developing the protocol the following principles were recognised:

1. That adaptive management strategies offer a range of benefits to different players, including structured and iterative learning, as well as accountability and audit mechanisms.
2. The interdependence between catchment level and GBR-level adaptive management in objectives, actions, monitoring and evaluation.
3. Adaptive management strategies need to reflect the different stages of the planning cycle, and different contexts (physical, social, cultural and economic).

The following checklist summarises the essential elements of the adaptive management protocol developed.

1. A ***conceptual model*** or program logic that identifies how the WQIP plans to address priority water quality issues. The conceptual model should:
  - identify key process steps and cause-effect relationships from actions to outcomes;
  - initial steps should show the (major) actions taken by the regional body and partners in delivering the WQIP;
  - intermediate steps should reflect the management objectives (management action targets) for the WQIP;
  - final steps should reflect the expected outcomes (resource condition targets);
  - the conceptual model should summarise the major thrust of the WQIP (not the detail);
  - the conceptual model should be agreed by the major stakeholders.

2. **Learning objectives** that address key uncertainties within the conceptual model. Learning objectives should:
  - describe responses to major uncertainties;
  - will often question cause-effect relationships e.g. how an action achieves practice change, or how practice delivers an intermediate resource condition outcome;
  - articulate management questions i.e. answering the question would have a clear link to a management response;
  - identify objectives for investigation, assessment or research.
  
3. **Performance trajectories** that describe progress towards management objectives (targets) over time. Trajectories should:
  - articulate expectations of performance against targets over time;
  - be based on the best available science and expert judgment and may be highly uncertain (particularly at the resource condition end of the model);
  - inform key milestones or trigger points for review and response
  
4. **Feedback loops** that describe how performance measures and learning objectives will be monitored, assessed and communicated. The feedback loops should:
  - articulate the roles and responsibilities for data collection and assessment;
  - describe the communication products or process, and timing for these;
  - be agreed by key stakeholders, including those undertaking the assessment, and those whose actions will be assessed (directly and indirectly).
  
5. **Scenarios and responses** that describe alternative actions based on anticipated feedback scenarios. Scenarios and responses should:
  - describe responses i.e. 'What if... and then?' Discuss with key stakeholders and document.

## **Application**

**Table 1 (overleaf) demonstrates how the protocol could be applied, using nitrates in the Tully WQIP as an example.**

Table 1. An adaptive approach to managing nitrate in the Tully

	management actions	management action targets	resource condition targets	aspirational targets
Management objectives (hierarchy of targets)				
learning objectives (to address critical uncertainties and improve performance)	<ul style="list-style-type: none"> <li>Effectiveness of incentives and other management actions in achieving targets</li> <li>Effectiveness of partnerships in delivering actions to support BMP adoption</li> </ul>	<ul style="list-style-type: none"> <li>Data on current management practices</li> <li>Evidence of the effectiveness of 6 Easy Steps (and other priority BMPs) in reducing nitrate export at the plot scale</li> </ul>	<ul style="list-style-type: none"> <li>Ability to model catchment processes (e.g. benefits of improved practices, impacts of cane drains) to evaluate progress and review priorities</li> <li>Understanding floodplain processes during overbank floods</li> </ul>	<ul style="list-style-type: none"> <li>Evidence base for marine guidelines</li> <li>Ability to model plumes (relationship of river exports to marine water quality)</li> <li>Ability to quantify ecosystem health targets in response to water quality benefits</li> </ul>
performance trajectories				highly uncertain
measuring progress	<ul style="list-style-type: none"> <li>Terrain NRM compile and report actions delivered &amp; outputs achieved annually</li> <li>Terrain NRM to establish an annual process to gather feedback on performance partnership arrangements e.g. workshop, focus groups</li> </ul>	<ul style="list-style-type: none"> <li>Industry partners to survey and report adoption rates of key practices (biennial)</li> <li>Industry partners periodic survey of drivers of change and review support for incentives program (biennial)</li> </ul>	<ul style="list-style-type: none"> <li>DPI&amp;F to investigate and report water quality benefits of key practices through plot- and paddock-scale trial and investigation (3 year)</li> <li>NRW monitoring subcatchment and catchment nitrate loads, reported annually</li> <li>NRW and CSIRO to develop catchment modelling capacities and report updated modelling results (3-5 years)</li> </ul>	<p>e.g. awareness, education, extension, incentives</p> <p>not addressed at the WQIP scale (support incentives to address these critical uncertainties)</p>
possible scenarios & responses	<ul style="list-style-type: none"> <li>Insufficient funding to support full program (adjust performance trajectories)</li> </ul>	<ul style="list-style-type: none"> <li>Expected adoption rates are not being realised (adjust program delivery methods)</li> </ul>	<ul style="list-style-type: none"> <li>Investigative research determines that water quality benefits of key practices are overstated (adjust program to better performing practices)</li> </ul>	

## **Implications**

The adaptive mgt protocol is another variation on log frames. The key features that differentiate this from other log frames used are

1. Learning objectives that articulate research and knowledge needs to address uncertainty in cause-effect relationships
2. Performance trajectories that document expected outcomes over time, and make lags explicit
3. Scenarios and responses that are developed at the outset and make expectations and consequences explicit

This approach is likely to prove useful with broad-scale plans for complex systems (such as water quality, NRM, social services) when there is a complex web of partnerships involved. Much of the protocol is about making knowledge and assumptions explicit, and agreeing roles and responses in a proactive way (active, collaborative, adaptive management).

The project and the report further considered technical implications for how this might be applied for both the Tully catchment (the case study) and Reef Plan itself.