

**DEPARTMENT OF NATURAL RESOURCES, MINES & ENERGY
INTEGRATED RESOURCE MANAGEMENT OUTPUT**

**HANDBOOK OF
RESOURCE PLANNING GUIDELINES**

CHAPTER C6

ADAPTIVE MANAGEMENT FRAMEWORK

Status: *Authorised for public release*

Keywords: *Adaptive Management Framework; regional planning; science into planning; monitoring; evaluation; State of the Environment reporting*

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Purpose of this Paper

This paper outlines the concept of the Adaptive Management Framework (AMF), which is an iterative, hierarchical organisational process for undertaking natural resource planning activities. It provides a conceptual vehicle for integrating knowledge and science into planning to achieve sustainable outcomes.

The paper has been written for staff of the Department and regional NRM bodies to explain the relationships between science, participatory processes and good planning outcomes.

1. INTRODUCING THE “ADAPTIVE MANAGEMENT FRAMEWORK” (AMF)

1.1 Definition of the Adaptive Management Framework

The purpose of this Guideline is to explain the concept of the ‘Adaptive Management Framework’ (AMF). The framework provides a useful conceptual model around which Departmental staff and regional natural resource management bodies can organise the preparation and implementation of NRM plans; and serves as a checklist for planners and scientists contributing to resource planning processes.

The Adaptive Management Framework is a systematic process for continually improving management policies and practices by learning from the outcomes of operations [definition derived from the British Columbia Forest Service (2000)].

The framework is intended to be flexible and responsive to new knowledge gained by targeting research to management needs; monitoring, evaluation, review and reporting of progress; and by continually improving stakeholder capacity, skills and learning.

It involves synthesising existing knowledge, exploring alternative actions by making predictions about future trends and outcomes, then agreeing on and implementing the preferred strategy. Further research, objectives and actions are then based on improved understanding and outcomes of monitoring and review.

The Adaptive Management Framework is applicable to a wide range of resource planning and management activities. It is a process that can be applied to simple, single-issue tasks for homogenous landscapes, such as a property-scale pest management plan.. Equally, it can be useful for undertaking complex, interdisciplinary exercises, involving multiple stakeholders and tiered spatial consideration, such as a Regional Framework for Growth Management exercise or a Regional Natural Resource Management Plan for the National Action Plan for Salinity and Water Quality (NAPSWQ).

1.2 Benefits of the AMF

The AMF offers advantages to resource managers being an approach that encourages government, landholders and other stakeholders to adapt their planning and management responses flexibly to environmental and institutional pressures and changes.

A key advantage of the cyclical AMF is that it allows for decision-making to proceed even when there are considerable gaps in knowledge and uncertainty, by specifying actions, monitoring and adjustment of visions, targets and associated management practices.

Adaptive management is an appropriate approach to resource management and policy development when the decisions cannot be postponed while further data are collected and the risk of environmental harm using ad hoc, trial-and-error methods is too high. This reflects the use of the ‘precautionary principle’ in resource management decision-making.

The AMF is applicable when dealing with activities across disciplines and activities with tiered spatial scales and timeframes. It can improve the efficiency and effectiveness of numerous parallel planning and management processes by linking individual planning activities so that property-scale and single-issue management contributes to the achievement of catchment and regional goals.

The AMF benefits participating stakeholders by showing how to coordinate shared knowledge, a common community vision, resources and activities undertaken to achieve agreed mutual goals.

1.3 Features of the AMF

The basis of the AMF is the recognition that agreed outcomes arise from an evolving learning-based model in which the acquisition and sharing of knowledge is used to continuously review and evaluate the implemented management actions. Central to the AMF is the initiation of targeted research and experimentation to fill information gaps and to trial management options in order to reduce risk and uncertainty in decision-making.

The Adaptive Management Framework shows following features:

- the focus is on place-based, issue management;
- it is a proactive, preventative approach not a reactive and curative one;
- emphasis is on learning by doing;
- emphasis is on partnership processes, including all stakeholders, on promoting shared responsibility, communication and cooperation rather than on competitive structures;
- institutional arrangements and decision-making processes are negotiated transparently to provide a platform for building mutual trust between stakeholders;
- access to information, knowledge and decision-making tools is maximised to promote collective learning; and
- collaborative processes (including the implementation program), as well as environmental condition, are monitored, evaluated, reported and revised.

2. COMPONENTS OF THE AMF

The Adaptive Management Framework comprises six basic components (Figure 1) which are described in detail below. The components are:

1. Core Component – Process and Facilitation.
2. Information Collation.
3. Systems Analysis and Visioning.
4. Plan Making.
5. Implementation.
6. Monitoring and Reviewing.

Figure 2 gives further details of the steps and the linkages between the components. A range of example tools and processes for each of the steps in the framework is presented in Table 1 with summary examples from the South East Queensland Regional Water Quality Management Strategy and the Fitzroy Basin Regional NRM Plan for the NAPSWQ.

2.1 Core Component

The Core Component of the AMF consists of: institutional arrangements; processes for facilitating decision-making, communication, information exchange, resourcing etc., agreed by the contributing stakeholders; an evolving knowledge system; and community involvement. Stakeholders should seek to establish an agreement for adaptive management principles that are institutionalised within a partnership of community, industry and government representatives.

Accepted institutional arrangements lead to an ongoing process for capacity building and knowledge growth and the building of trust between all stakeholders about the tasks required to develop and implement the plans.

Creation of healthy regional institutional arrangements appropriate to the community of interest requires a willingness to change and is often championed by key individual and organisations.

2.2 Information Collation

The AMF process commences with an information collation step, during which existing interdisciplinary scientific knowledge and stakeholder experiences are collated, integrated and synthesised into useful knowledge in order to understand the environmental, social and economic systems and explore potentially relevant solutions.

This integration of information serves several functions, including: setting a broader context for the problem; identifying knowledge links and gaps; and developing better communication between scientists, managers and other partners. Pooling information so that it is accessible and useful to all partners is a key step towards facilitating communication and building trust and planning skills.

2.3 Systems Analysis and Visioning

Information from scientists and stakeholders may be used to develop conceptual and dynamic systems models of causal influences between ecosystem components and human activities.

Systems analysis focuses on identifying the features of the biophysical, socio-economic and institutional environments at stake and ensuring that stakeholders gain a broad understanding of the catchment systems in order to define their 'vision' and aspirations for the future.

These aspirational statements are expressed as 'environmental values' and should be consistent with the institutional context including current legislation, policies and guidelines, corporate and strategic plans for industry, catchment coordinating bodies and government agencies.

2.4 Plan Making

During the plan-making step, management goals, targets, performance indicators and management actions are developed. The preferred strategy should consistently embed national, State, regional and local values, goals and targets into an accepted document. The plan should also specify defined action plans, including stakeholder roles and responsibilities, priorities, timeframes, milestones, resourcing commitments and reporting requirements.

Once a preferred future scenario has been approved, the possible social, economic and ecological impacts of the preferred strategy's actions are checked. If potential impacts are unacceptable, stakeholders should review the environmental values to ascertain whether they are realistically attainable, given the constraints. If potential impacts are acceptable, then the preferred strategy can be approved and adopted.

A range of impact assessment techniques can be used during this phase of the framework so that data and information are transformed into usable knowledge that leads to strategic direction and potential solutions.

Planning must be based upon best available science. Management actions should include new research to fill the information gaps. This may involve establishing large-scale catchment experiments to obtain necessary information required to meet agreed goals and targets.

2.5 Implementation

Implementation of the approved actions and assignment of responsibility for each follow the plan-making. The implementation step includes: establishing and administering the institutional arrangements for initiating a change in management actions; establishing or reinterpreting relevant codes of practice, guidelines, licences, permits, based on expectations and responsibilities of all stakeholders; and funding, staffing, programming and offering on-ground actions.

It is desirable that the preferred strategy details the roles and responsibilities of all stakeholders to support the management actions. The preferred strategy will describe the allocation of resources, funds, expertise, priorities, timeframes, milestones, performance measures and reporting requirements.

Implementation also includes investing in community participation, education and awareness programs, and providing strategically targeted financial and rewards incentives for engaging in key programs.

2.6 Monitoring and Reviewing

Monitoring and reviewing is essential for adaptive management and comprises two parts. First, the impacts of the plan are gauged, using the agreed monitoring system, to measure the effects of implementing the plan against the agreed environmental values, management goals and targets. This may involve spatial and temporal evaluation against desired outcome targets for management actions to ensure that the community's expectations for environmental values are being satisfied. The new information continuously updates the shared knowledge base and informed decision-making capacity of the partners.

The results of monitoring feed back into the next iteration of the planning cycle and contribute to an improved understanding of the natural and social systems, revision of environmental values and goals or targets; and a new program of management actions.

In the second part, outcomes from the monitoring are used to assess the effectiveness of the actual planning process and to contribute to the ongoing process of institutional reform and nurturing of healthy regional arrangements that comprise the Core Component of the AMF (see previous s.2.1).

An accurate and transparent reporting system that includes processes for independent review, is a key tool for communicating the results of monitoring and evaluation to all stakeholders in order to improve the informed decision making capacity of the partners.

Ideally, the reporting should include indicators that are consistent with a State of the Environment framework and enable the transfer of information across spatial scales, from property-scale reporting, through to catchment, regional, State-wide and national reporting.

3. SCIENCE AND PLANNING – RESPONSIBILITIES

The Adaptive Management Framework is a conceptual vehicle for improving the cooperative dialogue between science and research practitioners and stakeholders involved in natural resource planning exercises.

3.1 Responsibilities of Planners

Stakeholders undertaking planning should recognise the benefits of using best available science in a planning context but also appreciate that scientific knowledge is always incomplete. Therefore, planning should adopt the ‘precautionary principle’ in decision-making, a principle that aims to prevent environmental harm while imposing a duty of care, or perhaps onus of proof, on those who propose change.

Planners need to advise scientists of the information needed to undertake planning (e.g. resource inventories, maps, resource condition, trend and threats), information gaps and research priorities.

3.2 Responsibilities of Scientists

Scientists need to take a holistic, multi-disciplinary systems view of ecosystems and human social and economic interaction with the environment. Scientists need to communicate to the planners the availability and relevance of existing information directly applicable to a planning exercise.

As a result of dialogue with planners, scientists need to design aspects of their research program to meet the information needs and timelines for the planning activity. The information should meet the quality requirements for the expected purpose regarding scale, resolution, accuracy and certainty. Maintaining a credible peer review process, to check that information is robust and used with objective rigour, ensures quality control of scientific information used in planning.

Scientists need also to ensure that technical information is communicated appropriately to all stakeholders, using methods and media appropriate to the audiences and to the steps of the AMF being undertaken. If necessary, the services of trained and experienced ‘science-brokers’ can be used to facilitate the transfer of information and experience between stakeholders.

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Table 1: Explanation of the Components of the Adaptive Management Framework (including two examples)

AMF Steps	Objectives (of the AMF Step)	Outcomes Sought (from the AMF Step)	Example Processes to Undertake (during the AMF Step)	Example Tools & Approaches (to apply during the AMF Step)	Example 1: SEQ Regional Water Quality Management Strategy 2001	Example 2: Fitzroy Basin NRM Plan
<p>Core component</p> <p>Institutional arrangements & partnerships for facilitating agreed processes.</p> <p>(This is a prerequisite for all steps in the AMF.)</p>	<ul style="list-style-type: none"> Recognise & involve all stakeholders & build trust. Agree to the principles of process & timeframes. Establish new paradigm of continuing learning. Institutionalise AMF as a mechanism for knowledge building. 	<ul style="list-style-type: none"> Inclusive, transparent community, industry & government catchment-based partnership is established. Knowledge improvement & capacity building become evolving processes. 	<ul style="list-style-type: none"> Identify stakeholders – roles & responsibilities. Agree on the decision rules. Agree on the timeframes. Define processes for: <ul style="list-style-type: none"> conflict resolution; monitoring; reporting; & communication. 	<ul style="list-style-type: none"> Logical framework to identify & link the goals, projects, tasks & activities. Knowledge System Framework on web. Risk assessment. Community education program. Organisational process. Citizens' jury. 	<ul style="list-style-type: none"> Moreton Bay Waterways & Catchment Partnership (MBWCP). Formal community, government & industry committees. Healthy Water Ways (HWW) communication campaign & website. 	<ul style="list-style-type: none"> NR&M NAP Task Force established to facilitate “healthy regional arrangements”. Regional Coordination Group - Fitzroy Basin Association formalised as NRM regional coordination group.
<p>1. Information collation</p> <p>(AMF process commences)</p>	<ul style="list-style-type: none"> Access & integrate data, info & knowledge from all stakeholders. Establish info systems to support synthesis & evaluation of data, info & knowledge. 	<ul style="list-style-type: none"> Essential environmental, social & economic info is known, credible, objective. All info is fit-for-purpose & accessible. Info is available for systems analysis & for establishing management options. Stakeholders understand environmental impact cause-effect relations. 	<ul style="list-style-type: none"> Prioritise data requirements. Gather data, info & knowledge. Identify info gaps. Establish an info sharing protocol. Manage info quality assurance & metadata. Synthesise spatial, temporal & functional differences across datasets. Integrate quantitative & qualitative data. 	<ul style="list-style-type: none"> Regional Info Systems e.g. HRIC. Interactive web-GIS e.g. Caloundra MapRoom. Metadata & knowledge databases e.g. Coastal Meta & OzEstuaries. Models for visualising spatial, temporal variability. Existing State & national databases e.g. NLWRA. Systems to capture & integrate quantitative & qualitative data. SoE reporting. 	<ul style="list-style-type: none"> Healthy Waterways website. Data management project consolidated data & info on website. 	<ul style="list-style-type: none"> Regional info system proposed to integrate data & info. Resource Info Paper for Central Queensland Strategy for Sustainability (CQSS), by Coastal CRC.
<p>2. Systems analysis & visioning</p>	<ul style="list-style-type: none"> Outline a broad context of aspirations, policies, plans & developments of all 	<ul style="list-style-type: none"> Vision' statement is developed & agreed to by stakeholders. 	<ul style="list-style-type: none"> Group facilitation. 			

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2.1 Context analysis	<ul style="list-style-type: none"> partners. Communicate significant relationships between systems components & establish links between activities requiring coordination. 	<ul style="list-style-type: none"> Issues are understood by stakeholders within political & institutional contexts. 	<ul style="list-style-type: none"> Identify how partners make decisions, interact & communicate. Identify interactions, timeframes for decisions & communications. 	<ul style="list-style-type: none"> Stakeholder analysis. Institutional analyses (roles, regulation & policies etc.). Corporate, strategic & business plans. Communication strategies. 	<ul style="list-style-type: none"> Formal partnership of MBWCP. 	<ul style="list-style-type: none"> FBA to establish appropriate linkages between community, industry & government. Vision & stakeholder aspirations & priorities established in FBA's CQSS.
2.2 System understanding	<ul style="list-style-type: none"> Understand broad-scale ecosystems functioning within which they operate. Establish social, environmental & economic aspirations ('environmental values'). 	<ul style="list-style-type: none"> Stakeholders understand environmental, social, economic interactions & the potential impacts of management options. Stakeholders express community's future aspirations. Understanding is informed by science. 	<ul style="list-style-type: none"> Model the relationships between biophysical, economic & social drivers. Synthesise information to model ecological processes (e.g. causal understanding, resilience & stability etc.). 	<ul style="list-style-type: none"> Ecosystem process models (causal & predictive). E.g. Murray Darling Basin SR Audit. QUEST. INFLUENCE (CSIRO). Multi-criteria analysis. 	<ul style="list-style-type: none"> Graphical models of river, estuary & Bay, components processes & pressures. 	<ul style="list-style-type: none"> CQSS - data & info on resource condition, trend & threats compiled & synthesised.
2.3 Identify environmental assets & establish environmental values (with stakeholders).	<ul style="list-style-type: none"> Agree to environmental values & community desires for identified natural resources. 	<ul style="list-style-type: none"> Stakeholders understand & agree on the social & economic & ecological assets & their values. 	<ul style="list-style-type: none"> Disseminate info on ecosystem health. Identify uses & values of natural resources. Identify areas of conservation significance. Establish social, economic, aspirational values. 	<ul style="list-style-type: none"> Legislative drivers. Local govt plans. State of the Environment Report. RFGMs. State/Regional Coastal Management Plans. Other regional plans. 	<ul style="list-style-type: none"> HWV vision & environmental values clearly defined. 	<ul style="list-style-type: none"> Targets set at catchment & regional scales.
3. Plan making						<ul style="list-style-type: none"> Consultative workshops.
3.1 Establish goals (with stakeholders)	<ul style="list-style-type: none"> Agree on the detailed management goals to meet the community 	<ul style="list-style-type: none"> Specific goals for protection of social, economic & 	<ul style="list-style-type: none"> Set detailed social, economic & environmental 	<ul style="list-style-type: none"> Legislative drivers. Environmental Protection Policy 	<ul style="list-style-type: none"> Pressures defined (point sources, urban & rural runoff). 	<ul style="list-style-type: none"> Pressures defined qualitatively in CQSS. Simplified catchment,

AMF Steps	Objectives (of the AMF Step)	Outcomes Sought (from the AMF Step)	Example Processes to Undertake (during the AMF Step)	Example Tools & Approaches (to apply during the AMF Step)	Example 1: SEQ Regional Water Quality Management Strategy 2001	Example 2: Fitzroy Basin NRM Plan
	desires & environmental values.	ecological values are set.	management goals (spatial & temporal). • Set specific goals for protection of ecosystems components (e.g. riparian veg.).	(Water) 97. • ANZECC Water Quality Guidelines. • Regional Growth Management Frameworks.		receiving water & economic models developed to assess priorities and impacts.
3.2 Establish objectives / targets (with stakeholders)	• Set objectives that will ensure environmental values are protected.	• Quantitative and qualitative objectives/targets for ecosystem health. (e.g. water quality, biodiversity etc.) are set.	• Establish appropriate indicators related to the environmental management goals. • Using appropriate guidelines, set objectives to protect values.	• http://www.napswq.gov.au/ • http://www.nrm.qld.gov.au/salinity/national_action_plan.html • Multi-objective Decision Support Systems (DSS)	• Models used to assess priorities for & impacts of alternative management strategies.	• Objectives are closely related to aspirational targets for NAPSWQ.
3.3 Making sense to achieve goals	• Transform data and info into useable knowledge (i.e. set strategic directions and compare potential management solutions).	• Resource condition targets are set. • Management targets are set. • Feasible solutions are developed, evaluated and compared.	• Identify issues and opportunities. • Predictive impacts scenarios. • Decision analysis: multi-objective evaluation. • Review options - simple to complex. • Risk analysis. • Conflict resolution.	• Spatial & temporal simulation models. • GIS visualisation. • Catchment scenario planning & testing. • Ecological footprint analyses at different scales. • Social & economic impact assessment. • Non-market & market valuation.		
4. Implementation	• Translate planning into on-ground action.	• Actions are undertaken according to funds, resources, priorities & responsibilities.	• Timeframes. • Milestones. • Expectations. • Responsibilities. • Resources. • Assign expertise. • Budgets. • Priorities.	• Institutional change. • Collaboration (synergy). • Integrated Programs. • Formalise commitment. • Stakeholder capacity, empowerment.	• Water quality management strategy developed in Stage 2. • Implementation Groups responsible for implementing management actions.	• Integrated NRM plan being developed under NAPSWQ for accreditation. • Regional Vegetation Management Plan. • Fitzroy River Water Resources Plan. • Will lead to priority

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5. Monitoring, evaluation, review & reporting.	<ul style="list-style-type: none"> Obtain info that can serve both as a basis for iterative, adaptive management & to enhance the ongoing knowledge base. 	<ul style="list-style-type: none"> Transparent reporting of activities & outcomes. Improved understanding of: <ul style="list-style-type: none"> changes (+ or -) to enviro health; unanticipated changes; implementation successes; & failures. New research & improved management processes are recommended. 	<ul style="list-style-type: none"> Monitoring protocols. Independent auditing of processes. Coordinated State of the Environment reporting. 	<ul style="list-style-type: none"> Site/field monitoring techniques. Ecosystem Health Assessment. Audit of management actions & arrangements. Audit of stakeholder expectations. State of Environment Reporting. 	<ul style="list-style-type: none"> Ecological Health Monitoring Program of estuary & Bay extended to all rivers & estuaries. Annual report card based on waterway monitoring results. Review of management actions. 	<p>management actions being funded.</p> <ul style="list-style-type: none"> Monitoring & review to be components of NRM plan.

Figure 1: Adaptive Management Framework - Core Processes

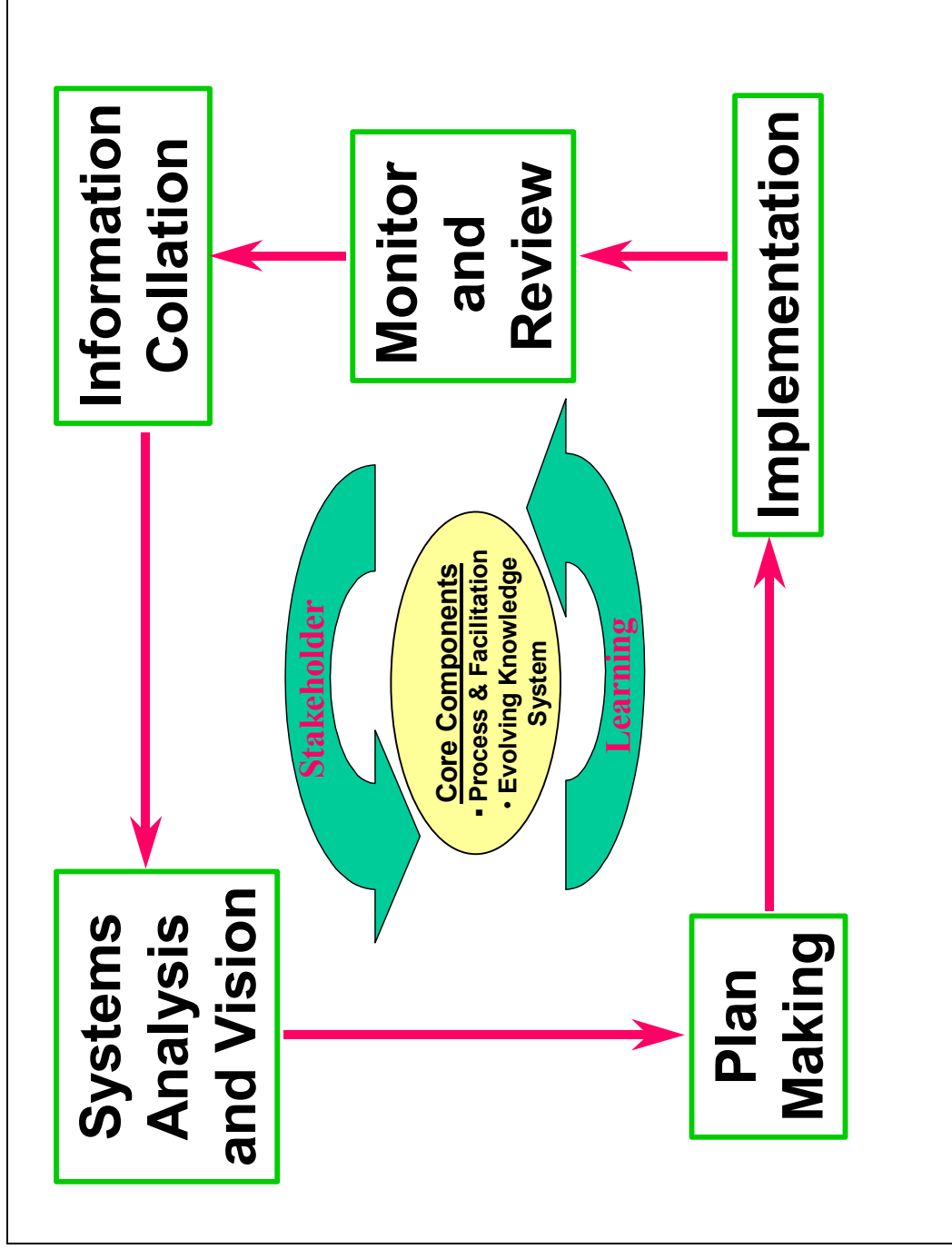
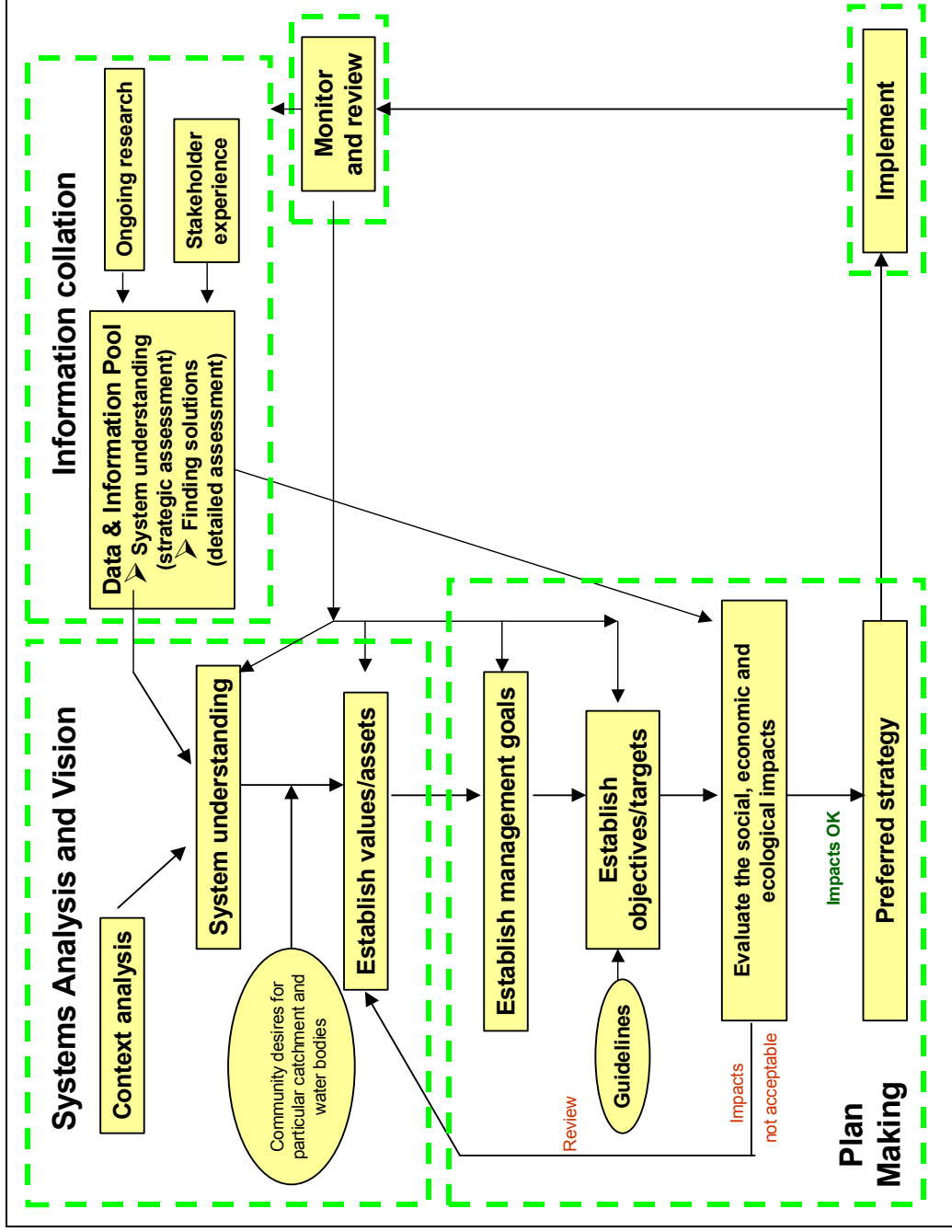


Figure 2: Adaptive Management Framework – Detailed Processes



End of Guideline C6