

# **Integrated Monitoring**

## **A Manual for Practitioners**

**Prepared by:**  
Ruth Beanland and Beat Huser

**For:**  
Environment Waikato  
PO Box 4010  
HAMILTON EAST

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# Purpose of the Manual

**To help local government and other resource management agencies co-ordinate monitoring effort.**

This Manual is mainly targeted at resource planners, policy analysts, monitoring staff and resource consent officers involved in identifying information needs and the gathering, analysing and reporting of environmental information. However, the process and tools discussed here may also help community groups, iwi, industry and business to identify their environmental information needs.

This Manual builds on an earlier Monitoring Guide that reviewed the monitoring requirements of local authorities (MfE, 1996) and a more recent publication investigating the state of the environment monitoring activities of selected city and district councils (MfE, 1998a).

The Manual provides guidance and useful tools for undertaking cost-effective monitoring, including the development of indicators, by co-ordinating and integrating monitoring efforts. The process and tools described here can be applied to achieve better integration:

- within an organisation (for example between compliance monitoring of resource consents, state of the environment monitoring and a policy/plan effectiveness monitoring)
- between resource management agencies (for example regional councils and district/city councils).

Developing integrated monitoring strategies and action plans should ideally be an integral part of policy development, that is during the preparation of regional or district plans. Depending on the resource management issues, available resources and the extent of existing partnerships an agency might either focus first on internal co-ordination of monitoring activities or adopt an approach that includes other relevant agencies. The latter is required to reap the full benefits of integrated monitoring, including cost-effectiveness.

The process and tools outlined in this Manual were developed and tested as part of a pilot study undertaken in the Waikato by eight central and local government agencies with support from the Ministry for the Environment's Sustainable Management Fund. The tools described in this Manual are constantly evolving, as similar initiatives are also undertaken in other parts of the country. Therefore, the Manual should not be taken as defining or providing a definitive interpretation of legislative monitoring requirements, but as a guide for local government agencies interested in carrying out improved monitoring practices. Ongoing review and improvement is important – but to get started is even more important!

# How to Find Your Way Around the Document

- Section 1 provides an overview and looks at the pros and cons of monitoring.
- Section 2 provides a step-by-step guide to achieve integrated monitoring. This includes five stages, each with specific tools and supporting material (refer Figure 3).
- Section 3 summarises the lessons learnt, identifying and discussing both the benefits and constraints of integrated monitoring.
- Appendix 5 includes a practical example illustrating the process and applying the tools outlined in Section 2.

Additional examples of case studies, other documents and resource material produced by the Project Team in support of this Manual and referred to in the text have been collated into a Resource Kit. This can be accessed via the Ministry for the Environment's (MfE) website (**Error! Bookmark not defined.**). The inside back cover provides a list of documents and reference material contained in the Resource Kit.

## Abbreviations

ANZECC	Australia New Zealand Environment and Conservation Council
EPIp	Environmental Performance Indicators programme (MfE)
OECD	Organisation for Economic Co-operation and Development
PSR	Pressure-State-Response (framework)
SMF	Sustainable Management Fund
WAP	Waste Analysis Protocol

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## Consultants

Planning & Resource Management Consultant: Ruth Beanland.

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# Key Terms Used

## Monitoring

- means the planned and repeated collection of data
- involves regular analysis of data - to provide information (preferably in the form of an indicator)
- interprets results
- includes regular reporting of findings
- leads to feedback and review.

**Integrated Monitoring** (also referred to as *integrated environmental monitoring*):

- encompasses all the statutory monitoring responsibilities of local government agencies and, where applicable, Central Government
- involves all agencies with a statutory responsibility for the management of an issue, or aspect thereof
- occurs across issues and natural resources (i.e. air, water, land), taking into account biophysical, economic, social and cultural considerations
- includes use of resource consent information.

**State of the Environment Monitoring** involves monitoring of key *indicators* (see below) to determine:

- the environmental 'baseline' – quality and quantity
- sudden changes or gradual trends away from that baseline
- the cause-effect relationship between human activity (pressure), actions (management response) and environmental outcomes (the state)
- the success and effectiveness (performance) of resource management policy.

**Environmental Indicators<sup>1</sup>:**

- are defined as 'an information tool [that will] summarise data on complex environmental issues to show the overall status and trends of those issues' (SBSTTA, 1997).
- For a more detailed definition and description of indicators refer to MfE's Environmental Performance Indicators Programme (**Error! Bookmark not defined.**)

**Environmental Domains** (Landcare Research, 1998):

- are areas of similar environmental characteristics, including biotic assemblages, ecology and physical processes. Environmental domains provide a framework to classify ecosystems.

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<sup>1</sup> Note: indicators need to be supported by additional data and information (the base of the pyramid in Figure 2) and targeted research in order to assist in their interpretation and, if necessary, the planning of the most effective response(s) and action(s).

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# 1 Introduction

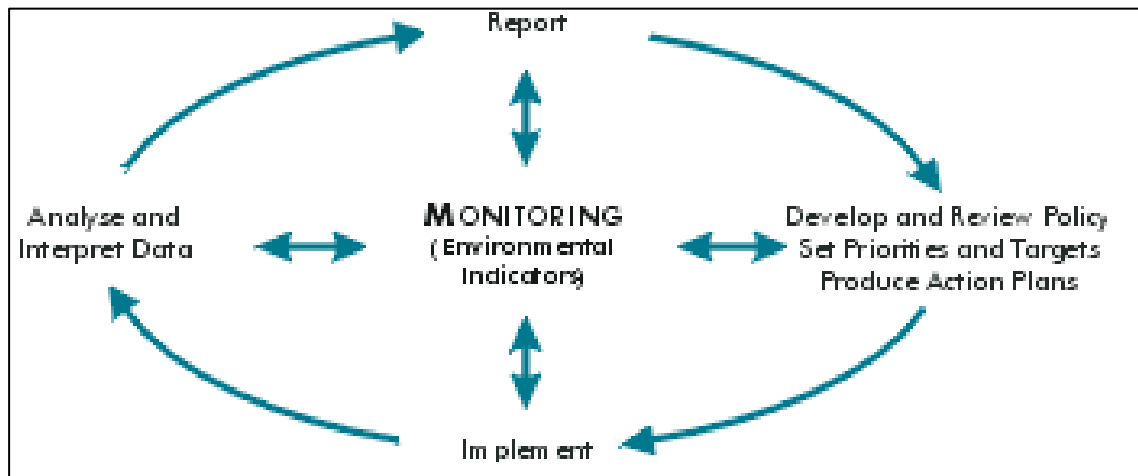
## Why Monitor – the Pros and Cons of Monitoring<sup>2</sup>

From a local government perspective the need to monitor arises from:

- legislative duties (mainly RMA S.35)<sup>3</sup>
- policy and plan requirements
- good resource management and business practice (performance, accountability).

Good resource management and business practice implies that local government agencies close the loop between (refer Figure 1):

- policy and plan development and review: setting of environmental priorities and appropriate targets, planning of work programmes and action plans
- implementation: rules and regulations (consents), operational activities (e.g. biosecurity, land transport, waste management, asset management) and environmental education (e.g. Care Groups, Cleaner Production)
- monitoring and reporting.



**Figure 1: Linking Environmental Monitoring and Resource Management**

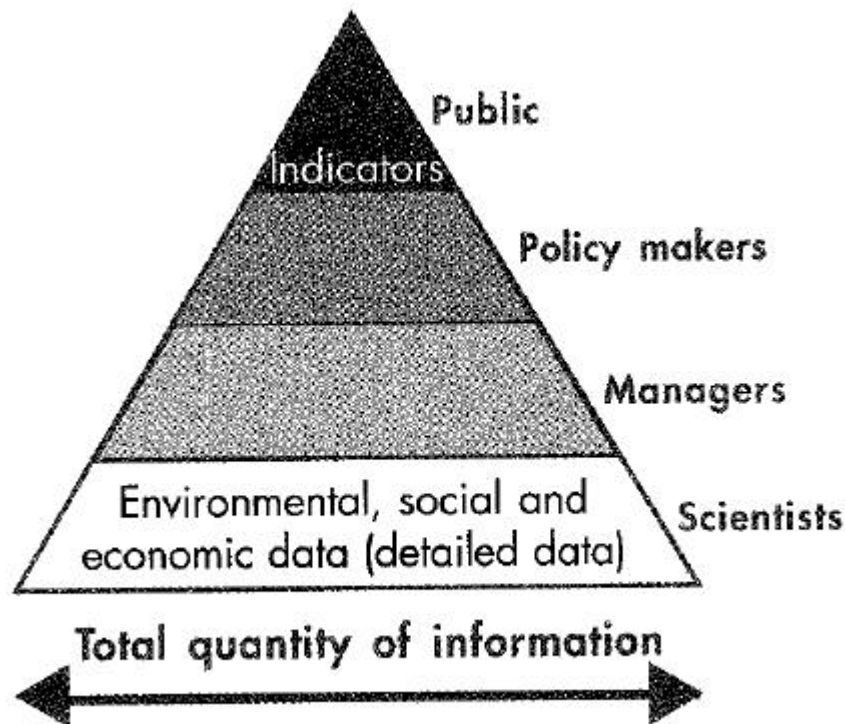
Monitoring can help to increase the extent, quality, timeliness and relevance of the information and knowledge base. This in turn should lead to more informed decision-making, as environmental priorities can then be set which reflect the degree of risk posed by an issue, together with the options and capacity for reducing such risk.

<sup>2</sup> Monitoring is defined as a systematic process that involves the planned and repeated collection of data, its analysis, interpretation and reporting (MfE 1996). Monitoring is primarily designed to assist in planning and decision-making to enable appropriate responses and actions.

<sup>3</sup> MfE (1996) and Environment Waikato (1996) provide an overview of RMA monitoring duties. Other important legislative requirements for monitoring are found in the Local Government Act 1974 and Amendments, Biosecurity Act 1993, Hazardous Substances and New Organisms Act 1996, Building Act 1991 and land transport legislation.

# What to Monitor

Agencies need to focus on identifying their **information needs** (the bottom of the pyramid in Figure 2) along with the selection of **indicators** (the top of the pyramid).



**Figure 2: The Hierarchy of Information Needs**

MfE is currently developing the Environmental Performance Indicators Programme (EPIp). At this stage, local government and other agencies with environmental monitoring responsibilities are not required to adopt and monitor any national indicators developed by MfE. If resource management agencies, either singly or as a multi-agency team, clearly identify their local needs and work to identify areas of commonality and overlap with the efforts of MfE, then the benefits of information sharing should be felt at all levels of Government. Agencies wanting to establish integrated monitoring, either internally or as part of a wider regional group, are therefore advised to liaise with the EPI project team (**Error! Bookmark not defined.**).

## What's the Problem?

There are a number of challenges facing local government agencies establishing environmental monitoring and reporting programmes, including (MfE, 1996; 1998a):

- inadequate financial resources
- complexity, uncertainty and lack of understanding of the environment
- lack of appropriate skills, technical expertise and knowledge
- institutional factors – organisational structure and culture which can make closing the loop between management, planning and monitoring difficult
- some overlap and uncertainty about respective functions and duties
- difficulty in converting general policy goals into measurable outcomes and targets

- focus on processes, outputs and financial accountability rather than environmental outcomes
- ineffective and duplicated monitoring effort
- lack of standardised methodology for determining which parameters and/or indicators should be monitored, how, where and how frequent they should be monitored, and how the results should be analysed, interpreted and reported.

## How Monitoring Can Be Improved

Integration and co-ordination of information and effort within and between organisations is the key to overcoming the problems listed above. The emphasis of this Manual is on **inter-agency** integration, whereby agencies work together to:

- identify information requirements
- review existing monitoring and available data
- identify information gaps
- identify opportunities for collaboration
- develop indicators and new monitoring programmes where necessary.

However, the process outlined in this Manual and the tools provided can also be applied to internal or **intra-agency** integration, for example between consent monitoring, plan effectiveness monitoring and state of the environment monitoring activities of a local government agency. This recognises the need for local government agencies to have their own house in order before the full benefits of inter-agency integration may be realised. Establishing and implementing an integrated monitoring programme for a single district or a whole region requires long term effort and commitment from participating authorities.

# The Benefits of Integrated Monitoring

It is recognised that most local government agencies face budget constraints. For some, economic reality means that complying with legislative monitoring requirements is often a lower priority than, for example, waste management or consent processing. These constraints highlight the need for resource management agencies to work together to avoid duplication, achieve economies of scale and share costs wherever possible. For example, the widespread use of aerial photography by resource management agencies implies that a consortium approach (involving for example, the regional council, district/city councils, power companies and DoC) to funding their acquisition is appropriate.

The benefits of co-ordinated and integrated monitoring can be summarised as:

- effectively meeting Council's monitoring responsibilities, including S.35 (RMA)
- avoiding duplication
- sharing of data, information and knowledge
- better interaction between agencies resulting in improved integrated management
- enhanced availability and accessibility of good quality and policy relevant information
- structured approach to gathering of information and the development of indicators
- linking compliance, state of the environment and policy effectiveness monitoring
- facilitating the shift from policy development to implementation and review
- improved decision-making and policy analysis resulting in better environmental outcomes.

## The Integrated Monitoring Project – An Overview

The Project involved six local and two central government agencies: Environment Waikato, Hamilton City Council, Matamata-Piako, Thames-Coromandel, Waikato and Waipa District Councils, Department of Conservation and the Ministry for the Environment. These agencies worked together to develop a process and practical tools to facilitate integration and co-ordination of environmental monitoring for the purpose of:

- meeting their statutory responsibilities
- establishing effective partnerships and strategic alliances
- testing and progressing current national indicator initiatives and associated frameworks for organising and processing information.

The **process and tools** provided within this Manual (see Figure 3) are based around four key principles identified and agreed by the Project partners:

1. **Integration and co-ordination** of information and effort is the key to overcoming problems currently facing local authorities in developing and implementing environmental indicators, monitoring and reporting programmes.
2. An **ecosystem approach** to resource management that takes into account environmental (biophysical), economic, social and cultural considerations provides an excellent conceptual tool for thinking about how to achieve integration. This is because it represents a strategic way of thinking about the whole environment, recognising the importance of natural ecological processes as the basis to human health and our economy (refer Appendix 1).

3. Achieving integration between agencies and statutes, and across issues and natural resources is complex. The following tools are considered useful to help provide structure to the diversity and extent of information:
  - A **Conceptual Environmental Model** of a given issue includes any cause/effect relationships and linkages between issues to assist in identifying information needs.
  - An **Organisational Framework** better organises information, develops and selects indicators and enables structured reporting.
  - A **Spatial Framework** assists with the selection of sites, the identification and monitoring of parameters and indicators, the interpretation of environmental information, the selection of appropriate targets, and the reporting and communication of results.
4. Fully integrated monitoring means linking **environmental and economic** decision-making, and considering **cultural and social** links. This was outside the expertise and skill sets available to the Project Team and will require further effort and research.

The results were tested in three **case studies** through the development of indicators and monitoring plans concentrating on the following priority resource management issues:

- Solid Waste
- Natural Areas
- Rural Development.

Appendix 5 provides a summary of the approach used for the project taking one of the case studies as a practical example (Natural Areas). A Project Summary Report is included in the Resource Kit (*Final Project Report*, refer inside back cover).

A detailed evaluation of the Project was carried out to capture some of the lessons learnt from undertaking the project and to draw some conclusions. The major findings of the project evaluation are summarised in Section 3. The full *Project Evaluation Report* is included in the Resource Kit (refer inside back cover).

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# 3 Integrated Monitoring – A Step-by-Step Guide

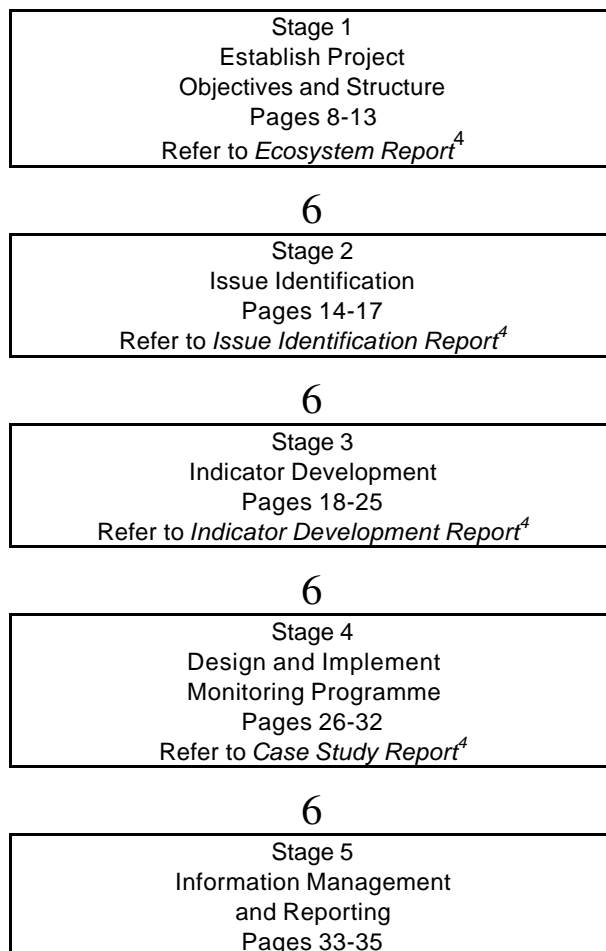
## Overview

**The key is to get started! Review and improvement will occur as progress is made.**

Figure 3 illustrates the five stages of the integrated monitoring process and how to navigate through the rest of this Section.

The process is iterative. Agencies may need to return to previous steps and stages to rework and refine outputs as more information comes to hand, understanding amongst participants increases and the process is applied externally.

Key references included in the Resource Kit (refer inside back cover) are linked with each stage of the process, and provide relevant examples and case studies.



**Figure 3: The Integrated Monitoring Process – An Overview**

## **Stage 1 – Establish Project Objectives and Structure**

### **Introduction**

Integrated monitoring implies staff **within and between agencies** working together to contribute expertise in relation to their specialist field and the agencies' respective resource management functions and duties.

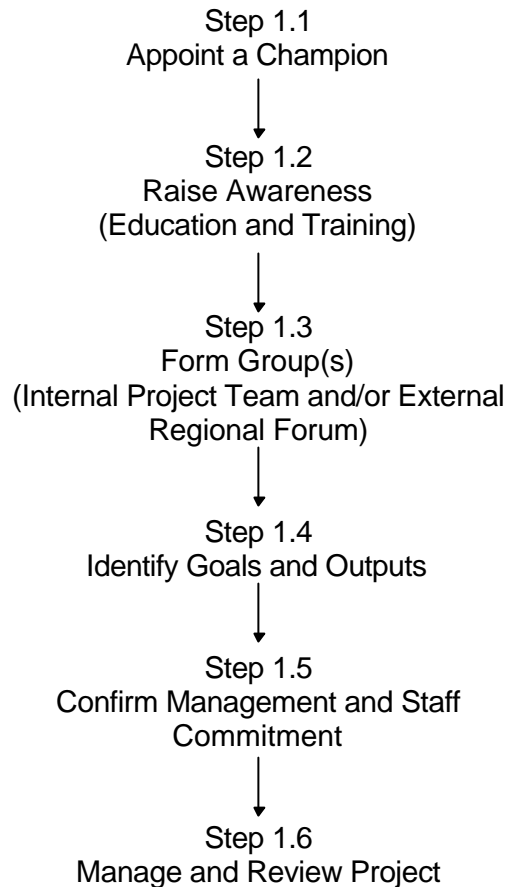
Feedback from the Project Partners stressed that each of the following steps is critical for integrated monitoring to be accepted, developed and implemented.

### **Purpose**

To establish and manage a monitoring project aimed at achieving integrated monitoring and reporting, both within and between agencies, with clear objectives and explicit team structure and relationships.

<sup>4</sup> Document is included in Resource Kit (refer inside back cover).

## Method



## Notes for Implementation

Project planning and design is critical to the long term success of any monitoring project, particularly in terms of securing political support, staff commitment and adequate resources (through the Strategic and Annual Planning process). Often, insufficient time is spent on the planning and design of monitoring programmes.

Education and up-skilling is a crucial part of securing organisational commitment and enabling progress to be made.

### Step 1.1 Appoint a Champion

- Appoint a person to be responsible for driving the Project.
- Undertake informal networking within the agency.
- Development of options:
  - single agency approach (*'within'* integration)
  - multi-agency approach (*'between'* integration).
- If multi-agency approach: Undertake informal networking between potential agencies and work towards securing commitment from participating agencies.

### Step 1.2 Raise Awareness (Education and Training)

- Run workshops aimed at making council, management and staff aware of their responsibilities, and of the benefits of monitoring and the options for internal and external integration of effort. Staff and Councillors need to be made aware of how the information derived from integrated and targeted monitoring programmes can be used to improve resource management decision-making, and hence environmental outcomes.

- Ensure that key staff involved in monitoring projects have access to information to bring them up to speed with the latest developments in environmental monitoring (indicators, methodology, standards, legislation, existing monitoring). It will also be necessary to ensure they know how to access relevant information and contacts (refer reference section and Resource Kit, inside back cover).

### Step 1.3 Form Group (Internal Project Team and/or External Regional Monitoring Forum)

- Formalise membership of team(s). Figure 4 illustrates the likely structure and relationships of the internal project team and the external *Regional Monitoring Forum*, made up of representatives from a number of different agencies.
- Identify and agree on the roles and responsibilities of team members, agencies and representatives.
- Agree on process.
- Agree on administration of the Project.
- Develop *Memorandum of Understanding* to formalise structure, relationships, goals and responsibilities of the Regional Monitoring Forum.

#### Membership – Internal Project Team

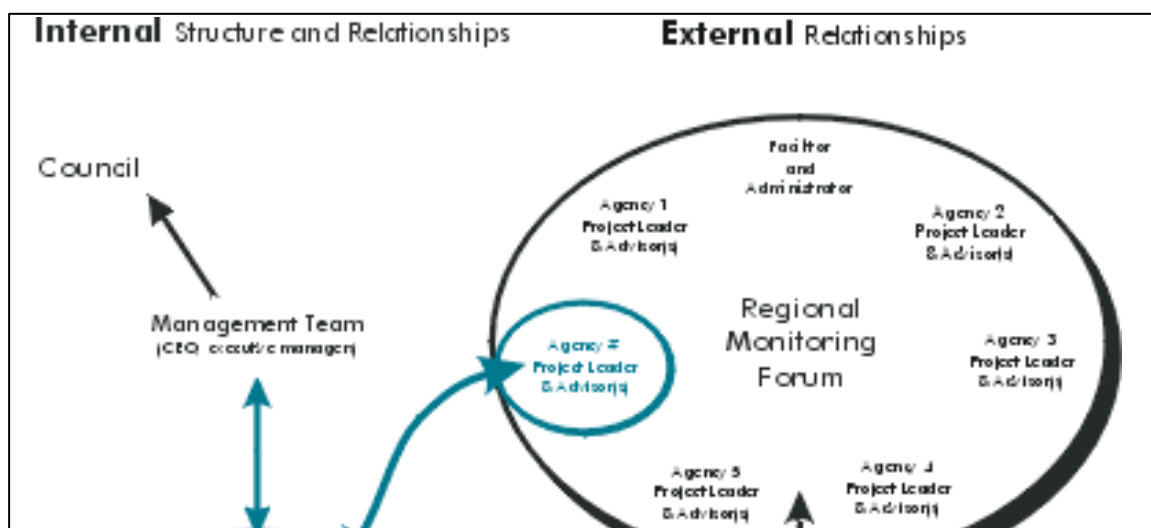
For internal project teams, a *Project Leader and Adviser* needs to be appointed. The rest of the team requires a mix of technical and policy skills, including policy analysts, information management staff, water quality scientists, waste management engineers and resource consent officers. Their involvement will depend on the issues under consideration and the relative priority of the issues selected.

The *management team* provides the vital link with politicians and provides a mechanism for information flows between staff, management and Council. This will help to keep the Project focused, practical and realistic, increasing the priority of monitoring as an important part of the resource management process and therefore its chance of long term success.

#### Membership – External Regional Monitoring Forum

For external integration a regional monitoring forum made up of representatives from a number of agencies with monitoring responsibilities is required. A *Facilitator and Administrator* needs to be appointed, either from agency representatives on the forum or independently contracted.

Representation from iwi, Central Government agencies, including MfE, research institutions, interest groups, industry and business sectors and community groups may also be appropriate and required during the process. The exact nature of the relationships and the involvement of these representatives with both internal and multi-agency project teams will be site-specific, that is, they will depend on the issues and the agencies involved.



## Figure 4: Integrated Monitoring – Internal and External Relationships

### Step 1.4 Identify Goals and Outputs

- Develop and agree on what the monitoring project is trying to achieve. For example:
  - Is it for a single district or is it regional?
  - Is it purely SoE monitoring or is it also for the purpose of reviewing/developing the Regional Policy Statement, Regional/District Plan (*Policy/Plan Effectiveness Report*)?
  - Is it intended to prepare a joint regional SoE or Policy/Plan Effectiveness Report, or a number of single agency SoE and Plan Effectiveness reports?
  - Will it deal with priority issues only, common issues, or all issues covered within a Policy Statement or Plan?
  - Is it intended to develop indicators and monitoring programmes for the long term and ongoing gathering and provision of information, or simply as a benchmark to report on what is there now?
  - Will it achieve information sharing only, or integration in the broader sense of co-ordination of effort?
- Identify and agree on appropriate Project outputs and a timeline. These will need to be reviewed.

#### Example 1 – Tasks for a Regional Monitoring Forum

The following short term outputs might be expected from a regional monitoring forum:

- A Memorandum of Understanding (membership, objectives/goals, budget and resources, operational protocols and procedures).
- A monitoring newsletter.
- A website (for dissemination and sharing of information).
- An inventory of current monitoring activities across the region (and maintaining an up-to-date list).
- Specific project results (mix of short term outputs and longer term tasks).

### Step 1.5 Confirm Management and Staff Commitment

- Establish Project sponsorship. In many cases a shift in resources, from policy and planning to monitoring, may be required. This is timely, as many local government agencies are shifting resources from policy development to implementation and review. This also implies the need for support from management and Council if the Project is to gain and continue to receive sufficient resources to function. It is therefore suggested that a management team, made up of key executive staff (i.e.

those with overall responsibility for resource management and finances) be established to oversee and sponsor the project.

- Provide for budgetary and staff allocation by incorporating the Project into annual and strategic planning processes.

### **Step 1.6      Manage and Review Project**

- Undertake regular reviews and adapt the structure and relationships of agency and regional monitoring teams to ensure appropriate goals and outputs are met.

## Example 2 – A Strategic Focus for Intra-Agency Integration

Environment Waikato produced a strategy for the integrated gathering and provision of the environmental information Council needs to undertake its functions. This *Environmental Information Strategy* is an example of an internal process. The Strategy links information to policy development, implementation and review to ensure that Council's efforts are targeted to address the key environmental issues (Environment Waikato, 1996).

Key tasks to implement the strategy are incorporated into Council's Strategic and Annual Plan process and include:

- establish an inventory of currently available data/information (metadata directory), see also Example 15
- develop an integrated, organisation-wide *Information Gathering Plan* (refer Example 13)
- identify environmental indicators and produce regular State of the Environment reports
- assess the relative environmental risks of issues and set priorities for action.

Taranaki Regional Council (TRC 1995a,b; 1997) has also adopted a strategic approach with the development of a *Regional Monitoring Strategy* and monitoring procedures for undertaking its responsibilities under Section 35 of the RMA. Key tasks have included:

- identification of the purpose and principles of monitoring activities
- the development and adoption of a state of the environment monitoring and information gathering programme
- the development of procedures to provide for implementation of monitoring activities through the Annual Plan process and to formalise links with appropriate Council management systems.

Other regional councils have also reviewed existing monitoring activities and developed organisational monitoring strategies (e.g. Manawatu-Wanganui, Hawke's Bay, Northland, Auckland).

The challenge now is to develop these strategies further to provide for *inter-agency* integration as well as *policy* and *plan review and development*, and better integration of *resource consent monitoring*. This process is necessarily iterative.

# Stage 2 – Issue Identification

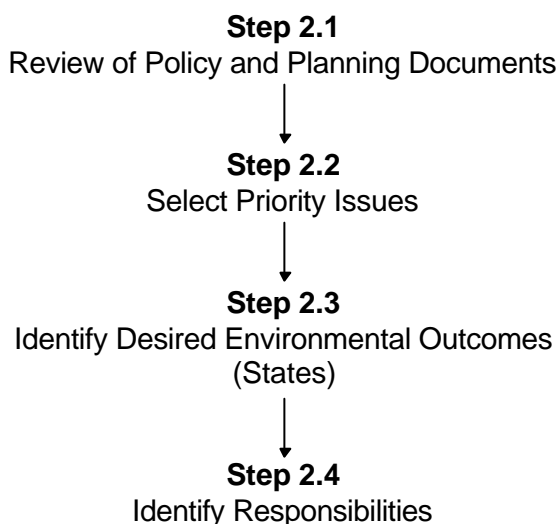
## Introduction

Stage 2 is about identifying priority issues which then determine core information needs and subsequent indicators. Most agencies have completed the first round of issue identification as part of developing policy and plans under the Resource Management Act 1991. However, it is neither possible nor necessary to monitor everything. It is therefore suggested that these issues are prioritised.

## Purpose

To identify and select priority issues for indicator and monitoring programme development.

## Method



## Notes for Implementation

Stage 2 applies equally to internal and external implementation. It is likely to be iterative and involve several meetings or workshops to refine the selection of priority issues, further define desired environmental outcomes and clarify responsibilities.

### Step 2.1 Review of Policy and Planning Documents

- Identify significant resource management issues from proposed and operational national, regional, local and iwi policy and planning documents.
- Identify issues that are common to more than one agency.

### Example 3 – Identification of Resource Management Issues

The policies and plans reviewed in the Environment Waikato SMF Project included:

Level	Organisation	Resource Management Policies and Plans
National	Ministry for the Environment	Environment 2010 Strategy
Regional	Environment Waikato	Regional Policy Statement for Waikato Region (RPS) Proposed Regional Coastal Plan for the Waikato Region (RCP) Waikato Regional Plan (Outline) (WRP) Environment Waikato Strategic Plan Regional Pest Management Strategy Regional Transport Strategy for Waikato Region (Draft) (RLTS)
	Department of Conservation	Waikato Conservation Management Strategy (Volume I: Visions, Principles and Strategic Objectives)
Local	Hamilton City Council	City of Hamilton Transitional District Plan City of Hamilton Strategic Plan
	Matamata-Piako District Council	Matamata-Piako Proposed District Plan
	Thames-Coromandel DC	Thames-Coromandel Proposed District Plan
	Waikato District Council	Waikato District Proposed District Plan
	Waipa District Council	Waipa District Proposed District Plan

### Step 2.2 Select Priority Issues

- Develop and agree on criteria to be used to select priority issues. Suggested criteria include<sup>5</sup>:
  - the environmental risk the issue currently poses
  - the potential to reduce or manage the environmental risk
  - the need for co-ordination and integrated resource management between the tiers of government or agencies (for external projects).
- Agencies may wish to start with issues that are simple or of high priority, so that monitoring programmes can be built up over time.

<sup>5</sup> As an additional criterion for the SMF Project the issue had to be of local, regional and national significance as well as relevant to other regions and districts in New Zealand.

#### **Example 4 – Prioritisation of Issues**

For the SMF Project, 238 resource management issues were identified for the five partners. Of these, 46 issues were identified as being common to more than one plan. Three issues were selected for indicator and monitoring programme development: Waste Generation and Disposal; Rural Area Development; Protection of Indigenous Flora and Fauna (referred to as 'Natural Areas'). Refer *Issue Identification Report* (see inside back cover).

These issues provide three different aspects of integrating environmental monitoring data into the resource management process:

- Waste – this case study used results from a national survey to measure the total quantity of solid waste disposed to landfills. This included information collected by contractors for the purpose of performance measurement. The study clearly demonstrated the need for standardised methodology and procedures (Waste Analysis Protocol developed by MfE) for the effective aggregation of site/district information for regional and national reporting.
- Natural Areas – one Project Partner (Thames-Coromandel DC) developed rules in its District Plan for 'Bush Covenant Lots'. The case study provided useful tools for effective monitoring and feedback for implementing policy and associated rules.
- Rural development – this case study used a combination of land classification data (Land Use Capability) and information from resource consent databases to get an understanding of the level of pressure, that is the scale and type of rural development.

### **Step 2.3 Identify Desired Environmental Outcomes (States)**

- Develop a summary statement of the desired environmental outcome from the range of goals, objectives, desired states, and anticipated environmental results specified in relevant policy and planning documents. In the first instance, the desired environmental outcomes are likely to be general rather than specific.
- Over time, monitoring data can be used to develop more precise, quantifiable policy targets, for example, the reduction of solid waste from volume 'x' to volume 'y'. In many cases, this will require further research and analysis of results to determine acceptable, desirable or unacceptable levels.
- Consider monitoring requirements in relation to quantifiable targets during policy development. This will significantly enhance the relevance and workability of policies, facilitating their subsequent effective implementation. An appropriate spatial framework has the potential to assist this process considerably.

### **Example 5 – Identifying Desired Environmental Outcomes**

The various environmental results for waste specified within the policy and planning documents reviewed by the SMF Project were summarised to reflect two common desired environmental outcomes:

- Reduction in the volume of solid waste (m<sup>3</sup>) disposed of per annum
- Increase in the reuse, recycling and recovery of waste materials.

Ideally, these desired outcomes should be formulated as quantifiable and hence measurable targets, for example:

- reduce the annual volume of solid waste disposed by 30%, by 2003
- increase the proportion of paper recycled (or organic material composted) to 50%, by 2002.

In another example that emphasises the importance of setting clear policy objectives and targets, the Proposed Regional Soil Plan for Taranaki (TRC 1999a) sets out eight environmental results in relation to two issues:

- accelerated erosion (soil loss) as a result of inappropriate land management practices
- degradation of soil health as a result of inappropriate land use practices.

The environmental results have been specifically developed to be 'SMART' – simple, measurable, achievable, relevant and timely, within the 10-year anticipated life of the Plan (TRC 1999b). For example, Environmental Result 1 is:

*“An increase from 74% to 79% in the area of privately-owned land in the hill country that is sustainably managed (used within the LUC classification).”*

Consideration is currently being given to the methodologies and costs associated with monitoring these environmental results and subsequently the effectiveness of the Plan. The detailed programmes and procedures for monitoring will be included in the Council's State of the Environment Monitoring Programme.

### **Step 2.4 Identify Responsibilities**

- Agencies will need to identify and clarify responsibilities for monitoring those issues where overlapping or unclear legislative mandates exist. While possible changes to the RMA may lead to more clarity, an analysis of case law to determine precedents may still be required.
- Step 2.4 may apply for both intra- and inter-agency integration. The existence of a regional monitoring forum ought to make Step 2.4 easier to complete.
- Monitoring responsibilities are reflected in the Monitoring Plan, which identifies who monitors what (refer Stage 4).

# Stage 3 – Indicator Development

## Introduction

Stage 3 provides for the identification of information needs for prioritised issues and their associated desired environmental outcomes (states), the review of existing data and information, and then for the development of indicators which are capable of meeting these needs. This stage also provides for a rapid evaluation of potential indicators to rule out any considered to be unsuitable prior to Stage 4.

The main point to emphasise about Stage 3 is the importance of *clearly identifying information needs* rather than just developing indicators. This will help in priority setting and resource allocation. An *internal review of existing monitoring programmes, data and information* will help to make the most use of historical monitoring activities and highlight the gaps between information required and what is already available/accessible.

Two tools have been included to assist with the development of indicators:

- a *Conceptual Environmental Model* (Example 7)
- the *PSR Template*<sup>6</sup> (Example 8).

Both tools are based on a modified PSR Framework (Appendix 2) and provide a test against which information requirements can be identified and indicators developed. This should help to ensure that indicators are developed and monitored which give us information on the complete picture, that is including economic, social and cultural aspects (where relevant) in addition to the biophysical environmental information. Indicators that link biophysical, social, economic and cultural information are also referred to as *sustainability indicators*.

## Purpose

To identify information needs and develop indicators for selected issues.

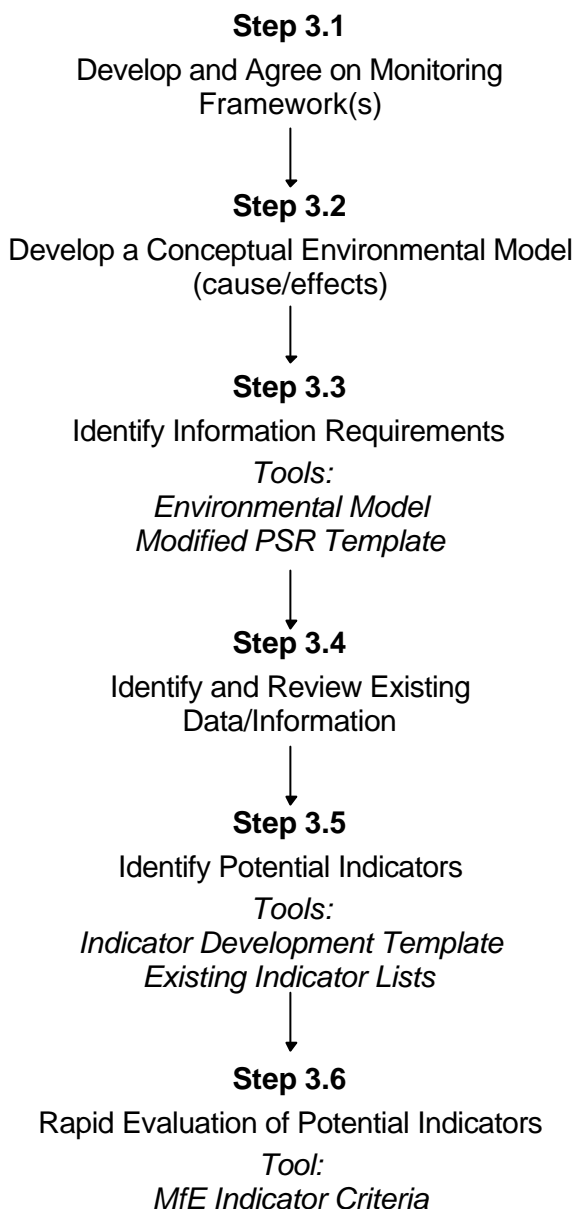
### Step 3.1 Develop and Agree on Monitoring Framework(s)

- Select an organisational and spatial framework to assist with identifying information requirements and developing indicators (refer *Ecosystem Report*, inside back cover).
- The following *universal themes* were matters which the Project Partners felt must be included in the consideration of any resource management issue to ensure integration:
  - indigenous biodiversity
  - economic
  - social
  - cultural aspects.

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<sup>6</sup> Similar templates are also used by MfE for the development of national environmental performance indicators (EPI Programme). Copies of both the PSR Template used in the SMF Project and those used by MfE's EPIp are available as part of the Resource Kit (refer inside back cover).

## Method



The issue-based PSR framework adopted by the SMF Project Team was turned into a template (refer Step 3.3). This was then used to assist indicator development. The universal themes served as *prompts* to ensure that all aspects of an issue were addressed when identifying information requirements and developing indicators.

Prior to adopting an organisational framework such as the PSR model, agencies should ensure that all participants:

- understand the concepts, definitions, applications and limitations
- agree on any definitions and understand the terms and how they will apply
- understand what a parameter and indicator is, and why it is either a pressure, state or response
- understand that the indicators need to be considered in combination as a set, rather than as individual indicators, or as direct causal links.

### **Example 6 – Selecting Suitable Framework(s) to Organise Information**

The SMF Project carried out a review of organisational and spatial frameworks (refer *Ecosystem Report*, Resource Kit, inside back cover), which focused primarily on:

- the *PSR model* for identifying information requirements and indicators
- *Environmental Domains* to provide a methodology and a model for the spatial depiction of areas of similar environmental characteristics.

The Project partners modified an issue-based PSR framework to incorporate the universal themes of indigenous biodiversity, economic, social and cultural. This modified PSR framework was used to develop templates for identifying information requirements and developing indicators<sup>7</sup>.

Trial Environmental Domains have been developed for New Zealand (1:500,000), the Waikato Region (1:50,000) and part of Hamilton City (1:10,000). The domains are able to predict spatial and temporal patterns of biodiversity. This understanding can then be used to identify the characteristic biota of each environmental domain (i.e. the candidate species from which to choose indicators) and to prioritise areas for restoration.

The Natural Areas Case Study used the concepts of environmental domains to:

- assess significance, representativeness and habitat fragmentation/isolation in vegetation classification and surveys
- assess areas or ecosystems most vulnerable to pest infestations
- select representative lakes for undertaking extensive monitoring for a management strategy of the Waipa peat lakes (optimum extrapolation of findings)
- identify relevant factors for the calculation of a mean condition score for a '*Rapid Assessment Tool for Natural Areas*', developed by Dr Theo Stephens (Department of Conservation), refer *Case Study Report*.

The Project was unable to trial the domains for other issues. However, MfE is currently undertaking an information gathering exercise to identify environmental classification systems which have the potential to provide an appropriate spatial framework for monitoring and reporting on land, freshwater and terrestrial biodiversity issues.

The next phase of work is likely to provide for the assessment and trialling of the classification systems for selected indicators, together with analysis of potential resource management applications (contact Kirsty Johnston, MfE).

### **Step 3.2 Develop a Conceptual Environmental Model (Cause/Effects)**

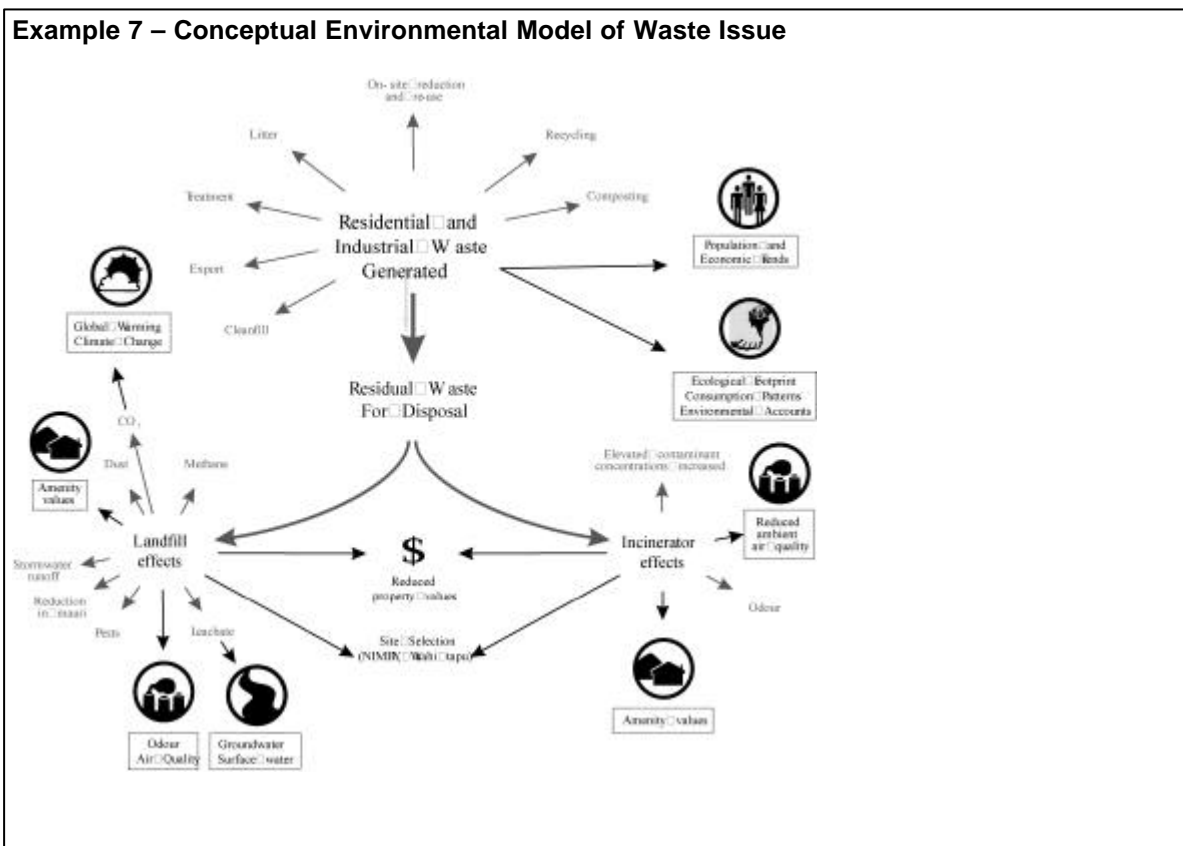
Develop a model that considers the important components of the issue, illustrating cause-effect relationships, as well as taking account of the universal themes and the linkages between issues.

This step is important as it facilitates an ecosystem approach to identifying information requirements and the development of indicators by helping to ensure all aspects of an issue are considered. The model can identify linkages and overlaps between issues and hence common information requirements. In this regard, indicators developed for a particular issue may well provide relevant information for another issue. For example, leachate from the disposal of waste may have effects on both surface and ground water quality. Integration between these issues therefore needs to be taken into account throughout the rest of the indicator development process.

<sup>7</sup> Similar templates are also used by MfE for the development of national environmental performance indicators (EPI Programme). Copies of both the PSR Template used in the SMF Project and those used by MfE's EPIp are available as part of the Resource Kit (refer inside back cover).

To develop a conceptual model, teams should simply brainstorm to identify the activities and their subsequent environmental effects stemming from a particular issue. Cause-effect relationships can then be drawn and the linkages between issues identified. The universal themes can be used as prompts in the development of the model.

An example is provided below:



### Step 3.3 Identify Information Requirements

- Identify information requirements for each of the issues, based on the PSR Template and the environmental model.
- Identify the linkages between issues (refer Step 3.2 above) and identify those information requirements which apply to more than one issue.

### Step 3.4 Identify and Review Existing Data and Information

- Identify and document relevant historic and current monitoring programmes, data and information. This review can form the first step in the development of a hard copy or electronic *Metadata Directory* of information gathering activities (refer Examples 2 and 15).
- Identify information gaps by comparing existing data and information with the information requirements identified in Step 3.3. This analysis will help with completion of the *Monitoring Plan* (Step 4.1).

### Example 8 – PSR Template to Identify Information Needs for the Issue ‘Waste Generation and Disposal’

**Note:** The information requirements identified below are examples considered by the Project partners to be important to the ‘waste generation and disposal issue’<sup>8</sup>. The examples included here are not intended to be comprehensive.

<sup>8</sup> Information requirements that have links with other issues are highlighted in **italics**.

**PSR Template** → **To identify information needs**

**Desired Environmental Outcome**

- Reduction in the volume of solid waste (m<sup>3</sup>) disposed of per annum
- Increase in the reuse, recycling and recovery of waste materials

**THEMES**  
**General Information**

**INFORMATION REQUIREMENTS**

**Pressure**

Quantity of solid waste generated.

Composition of waste disposed at landfill.

**State**

*Effect of disposal and composting facilities on groundwater and surface water, air quality and amenity values.*

*Effects of landfills on significant natural area or significant habitat.*

**Response**

Quantity of waste recycled.

Quantity of green waste composted.  
Types of facilities and associated environmental and operating standards.

Clean up and/or closure in areas considered necessary.

Mechanisms to restrict any new landfills in areas likely to threaten indigenous biodiversity.

**Indigenous Biodiversity**

<b>Economic</b>	Quantity of waste generated from residential and business sources as a proportion of regional GDP.		Disposal and recycling costs.
<b>Cultural</b>		<i>Effects of landfills on cultural values, waahi tapu or other culturally significant sites.</i>	
<b>Social</b>	Access to recycling facilities.	<i>Odour and amenity values.</i>	Participation in waste recycling schemes.  Number of businesses with current waste minimisation initiatives.

### Step 3.5 Identify Potential Indicators

- Gather and analyse existing indicator lists available from agencies within New Zealand and internationally. Refer to *Indicator Development Report* (see inside back cover), which includes the relevant indicator sets from MfE's EPIp, OECD and ANZECC. The MfE website (**Error! Bookmark not defined.**) contains additional information including a list of the current indicators developed as part of the EPIp. The EPI list should be consulted prior to embarking on indicator development.
- Taking the information requirements identified on the PSR Template (Step 3.3 above), use the *Indicator Development Template* to identify a set of the most suitable pressure, state and response indicators for the issue, based on:
  - the information requirements identified in Step 3.3
  - a review of parameters and indicators historically and currently used along with data and information currently held
  - existing indicator lists, where applicable.

#### Note:

The *Project Case Study Report* (available as part of the Resource Kit, refer inside back cover) includes the indicators developed during the Project relating to the three Case Study Issues:

- Waste Generation and Disposal.
- Rural Area Development.
- Protection of Indigenous Flora and Fauna (referred to as Natural Areas).

### Step 3.6 Rapid Evaluation of Potential Indicators

- Undertake a *rapid evaluation* of potential indicators using the MfE criteria (refer Appendix 3). This can be done by individual team members and/or as a team. It simply involves thinking and brainstorming to assess whether the indicators are likely to be:
  - policy relevant
  - analytically valid
  - cost effective
  - simple and easily understood.

#### Note:

A more robust evaluation will take place later in Stage 4 (Step 4.2) following the development of a monitoring plan.

**Example 9 – Indicator Development Template listing potential indicators for the issue ‘Waste Generation and Disposal’**

**Note:**

Some of the potential indicators developed by the Project Partners are included below<sup>9</sup>. Note that some of the information requirements (refer Example 8) are met by indicators that fall into a different column. This refers to the situation where a state information requirement may sometimes be met by a pressure or a response indicator.

**Indicator Development Template** —————> **To identify potential indicators**

- Desired Environmental Outcome**
- Reduction in the volume of solid waste (m<sup>3</sup>) disposed of per annum
  - Increase in the reuse, recycling and recovery of waste materials

THEMES	POTENTIAL INDICATORS		
	Pressure	State	Response
<b>General Indicators</b>	Total quantity of waste generated from residential sources.	<i>Compliance of disposal and composting facilities with consent</i>	Quantity of waste recycled from municipal facilities and all off-site sources.
	Total quantity of waste generated from business sources.	<i>conditions relating to contamination of the environment.</i>	
	Total quantity of waste disposed at landfill and incinerated from residential and business sources.		Quantity of green waste composted.
	Composition of waste disposed at landfill (using 8 WAP categories – paper, glass, plastic, metal, organic, C&D, potentially hazardous and other) from residential and business sources.		
<b>Indigenous Biodiversity</b>	Distance of landfill from significant natural area or significant habitat.		

<sup>9</sup> Indicators that link with other issues are in **italics**.

<b>Economic</b>	Quantity of waste generated kg per unit of regional GDP per annum from residential and business sources.	<i>Cost of disposal of waste to landfill per tonne per annum.</i>	Dollars spent on recycling facilities and services.
<b>Cultural</b>	Distance of landfill from waahi tapu or other culturally significant site.		
<b>Social</b>	Percentage of total households and businesses with access to recycling facilities.	<i>Number of complaints in relation to odour generated from landfills.</i>	Participation rates in municipal recycling schemes.

# Stage 4 – Design and Implement Monitoring Programme

## Introduction

Stage 4 provides the process and tools for determining *what to monitor, where, how and by who* for each of the potential indicators selected in Stage 4 above.

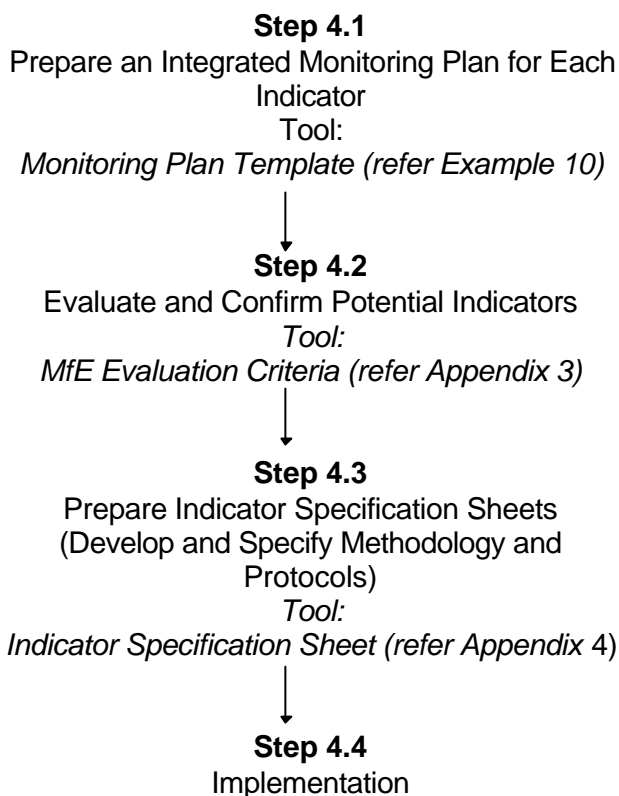
The first tool is the *Integrated Monitoring Plan*, which is to be developed for each issue. Completion of a monitoring plan for each issue will provide sufficient information for a robust evaluation of the potential indicators, using the MfE criteria. Once the final indicators have been selected, a more detailed explanation of each indicator, over and above that provided by the monitoring plan, is required to enable consistent data gathering and analysis.

A template for an Indicator Specification Sheet has been developed and is included here. It is based on a number of models used overseas, particularly in Australia, Canada and the United States. The Indicator Specification Sheet provides sufficient detail on the specifics of data gathering and analysis to ensure monitoring is carried out consistently over time and between agencies. This is important if data gathered is to be aggregated regionally, nationally or locally.

## Purpose

To design and implement an integrated monitoring programme for selected indicators, based on the monitoring plans for each issue and the individual indicator specification sheets.

## Method



### Notes for Implementation

Stage 4 will be iterative and is likely to require a number of meetings and a lot of brainstorming! It may be necessary to return to Stage 4 to identify additional potential indicators.

The design of monitoring programmes, including details such as the location and number of sites and monitoring methodology and protocols, will depend on the issue at hand and the indicators to be monitored.

#### **Step 4.1 Prepare an Integrated Monitoring Plan for Each Indicator**

- Prepare an Integrated Monitoring Plan for each issue, using the Monitoring Plan Template (refer Example 10). Identify:
  - a core set of pressure, state and response indicators (the most common indicators identified from the project partner indicator templates)
  - indicators, defining and describing them to ensure consistent interpretation
  - units of measurement
  - information availability and accessibility<sup>10</sup>
  - the organisation and contact responsible for data collection
  - location of monitoring (e.g. spatial area of consideration and sites where appropriate)
  - methods used to collect, analyse and interpret the information
  - frequency of monitoring
  - estimated costs of data gathering
  - the organisation and contact responsible for reporting and storing information

<sup>10</sup> Check against existing information (refer step 3.4), including information from external sources.

- any other comments.

#### **Step 4.2 Evaluate and Confirm Potential Indicators**

- Each participant undertakes a thorough, quantitative evaluation of the indicators using the MfE criteria (refer Appendix 3) to determine their policy relevance, cost effectiveness, simplicity and analytical validity. Individual evaluations are then combined to determine the suitability of each indicator. Some indicators may be discarded as a result of this evaluation.
- The evaluation results of the potential indicators for all three case studies undertaken by the SMF Project are included in the Resource Kit (refer inside back cover).
- Select indicators taking into account that the outcome of this evaluation will be a list of confirmed indicators.

**Example 10 – Integrated Monitoring Plan Template for the issue ‘Waste Generation and Disposal’ (one Indicator only)<sup>11</sup>**

**Desired State :**

- Reduction in the volume of solid waste disposed per annum
- Increase in the reuse, recycling and recovery of waste materials

**Pressure Indicator**

- Total quantity of waste (disposed at landfill and incinerated) from residential and business sources

Unit	Is the information currently available/ accessible (yes/no & comment)	Organisation & contact responsible for collecting the information	Methods used to collect, analyse, and interpret information (eg. samples, surveys etc)	Frequency of monitoring (eg. quarterly)	Location for monitoring (eg. area & site)	Cost estimate	Contact for reporting & storing info.	Comments
<b>Kg/capita/year</b>	Yes (landfills). A WAP survey was undertaken in 1995/96 of key landfills and transfer stations across the region.	Co-ordinated by EW for the region. Each TLA responsible for their disposal facilities. EW & TLA's provided with a report containing the results. Stats NZ collect population data at each Census (five yearly) and GDP at the regional level (quarterly).	Detailed method outlined in the Waste Analysis Protocol (WAP) Module C. Involves weighing vehicles, identifying source, sampling and weighing incoming loads and visually classifying the remaining loads. Weighbridges enable easy quantification of quantity but not source.	Waste quantity three yearly.	Waste (at each disposal facility).	Minimal if use weighbridge.	TLA contact.	WAP provides a robust method for quantifying waste at each disposal site and identifying source of waste. Sites with weighbridges can provide more frequent and lower cost quantity data, although not by source.
<b>Tonnes/GDP</b>	No for incinerators.			Population five yearly. GDP (regional) quarterly.	Population (at TLA boundaries and below). GDP (regional boundaries).	Slightly more if estimate on basis of vehicle counts. \$5K-10K if use WAP.		

Note:

1. Use kg as your base unit for measuring quantity.
2. Landfill includes Council run and privately run landfills.
3. Waste is all solid waste but should not include material composted for subsequent reuse. However green waste disposed of at landfill should be included in quantity.
4. Business waste is all waste other than residential waste, and includes commercial and industrial waste.
5. Per capita units enable standardisation of the data to enable comparison over time and between districts/regions.

<sup>11</sup> A similar process and template is used by MfE for the development of national environmental indicators (EPIp). Copies of both the Monitoring Plan Template used in the SMF Project and the template used by MfE's EPIp are included in the Resource Kit (refer inside back cover).

WAP = Waste Analysis Protocol.

### **Example 11 – The Indicators selected by the SMF Project Team for the Issue ‘Waste Generation and Disposal’**

#### **Pressure**

- Total quantity of waste generated from residential sources.
- Total quantity of waste disposed to landfill and incinerated, from residential and business sources.
- Composition of waste disposed to landfill (using 8 WAP categories<sup>12</sup> – paper, glass, plastic, metal, organic, C&D, potentially hazardous and other) from residential and business sources.

#### **State**

- Compliance of disposal and composting facilities with consent conditions relating to contamination of the environment.

#### **Response**

- Quantity of waste recycled from municipal facilities and all off-site sources.
- Quantity of green waste composted.
- Participation rates in municipal recycling schemes.

#### **Note:**

The selected indicators reflect the time and resource limitations of the Project. The list is not complete and the indicators do not currently provide for all of the information requirements associated with all aspects of the issue. The selected indicators have been included here as examples only. The practicality of some of the indicators developed during the SMF Project may need further thought and some may need refining. Ongoing modification and development of monitoring methodology is likely to be required.

Further details are included in the *Case Study Report* (refer inside back cover).

### **Example 12 – Provisional National Environmental Indicators ‘Solid Waste’ (MfE EPIp, June 1999)**

As a comparison to the indicators developed in this SMF Project, the provisional (May 1999) EPI for Solid Waste include:

#### **Pressure**

- Quantity of waste disposed to landfill.
- Composition of waste disposed to landfill.
- Composition of waste disposed at landfills from residential sources.

#### **State**

None.

#### **Response**

- Quantity of waste recycled/recovered: paper, plastic, glass, metal (including steel and aluminium), textiles, organic.
- Number of kerbside recycling schemes/drop off and recycling centres.
- Number of cleaner production projects undertaken per TLA.

### **Step 4.3 Prepare Indicator Specification Sheets**

- Prepare an initial draft specification sheet (refer Example 14) for each of the selected indicators:
  - What does the indicator mean? (Its background, what is it measuring, etc.).
  - Why is it important? (Is it an essential component of the conceptual PSR framework for this particular issue?).
  - What is its relevance? (How does it link to policy?).
  - What is the frequency and period of data collection.

<sup>12</sup> The WAP waste types were revised (MfE, 1998b) and now include: paper, plastic, glass, metal, organic, rubble/concrete etc), timber, rubber and textiles, potentially hazardous, other.

- How it is measured? (Sampling and analytical protocols and procedures).
- How are the end results derived from the raw data gathered? (Data analysis, units).
- How can the information be presented? (Data summaries in tabular or graphical form).
- What are the limitations of the indicators and what areas need to be further developed?
- Each Team member then reviews the draft specification sheets to:
  - check/test relevance and purpose of selected indicators
  - develop and agree on standardised methods and protocols for data collection.
- Produce final specification sheets, including:
  - site selection – *macro* level (areas), *micro* level (sites)
  - confirmed period and frequency of monitoring
  - confirmed monitoring methodologies and protocols
  - confirmed linkages with existing monitoring programmes.

Refer to Appendix 4 for an example of an *Indicator Specification Sheet* for one waste generation and disposal indicator.

### **Example 13 – An Implementation Plan for Integrated Intra-Agency Monitoring<sup>13</sup>**

Environment Waikato's *Information Gathering Plan (INGAP)* is an organisation-wide plan for the cost-effective gathering, provision and use of the environmental information Council needs to effectively carry out its functions. The plan provides a framework for an integrated and structured approach to the collection, prioritisation, reporting and review of policy-relevant information.

The analysis of information needs was driven by the following considerations to ensure that Council's information:

- is aligned with statutory functions and duties
- takes account of community concerns and values
- provides relevant baseline information
- is useful in achieving desired outcomes
- assists with reducing environmental risks.

The ten year plan specifies the type and extent of information needed, the timing (some information is more urgent than other) and the resources required. It provides a basis for the development of more detailed monitoring plans and work programmes, linking Council's Strategic Plan directions with its Annual Plan activities. Regular reviews are planned to ensure the ongoing relevance of the information.

<sup>13</sup> Refer also to Example 2. The Information Gathering Plan is one of three key elements of implementing Environment Waikato's Environmental Information Strategy.



# Stage 5 – Information Management and Reporting

## Information Management

A critical component of environmental monitoring and reporting is information management. Without workable and user friendly systems for storing and analysis of data, the transformation of monitoring results into useful information is problematic. Information management systems are required to share and cross-reference information and data. For example:

- data gathered by waste management contractors needs to be transferable to the local authority concerned and amalgamated for regional or national analysis
- water quality data gathered by the regional council may well be relevant for analysis and interpretation by territorial authorities
- biodiversity data gathered by DoC may be useful to territorial authorities, regional councils and MfE.

One of the key questions for resource management agencies is:

- Does the agency have the necessary information systems in place to ensure the cost effective storage, retrieval, transfer and analysis of data; and development and dissemination of information in user friendly formats?

Good, standardised and quality assured data collection and data storage systems for the receipt, storage, retrieval, analysis and dissemination of information will save time later on and make data access more efficient.

Our own studies have shown that spatial databases and GIS technology are becoming increasingly essential for the gathering, analysis, interpretation and reporting of environmental data in relation to indicators.

It is important to keep a data directory of all the databases maintained, including start date, type of data and location of collection (metadata). The directory will allow information to be accessed efficiently, avoids duplication, highlights monitoring gaps allows integration of historical and current monitoring efforts and assists in devising policy for future monitoring strategies.

### **Example 15 – Environment Waikato’s Regional Environmental Data Inventory (REDI)**

The REDI, established by Environment Waikato in 1996, comprises environmental data held by Environment Waikato, district/city councils, and other relevant resource management agencies in the Region (e.g. DoC, MfE, MAF, MoH, Statistics NZ, CRIs and universities).

The inventory contains information about sets of data or databases, including:

- what was measured where, how often and by whom?
- where the data are currently stored and in what form?
- whether the data are available and how accessible they are?
- who is the contact person knowing more about particular data?
- what data/information has been published (reports and documents)?

The inventory plays an important role in identifying current monitoring activities and existing information. By comparing existing data with the information needed any gaps can be identified. Ongoing maintenance and regular updating of the inventory is required to ensure its integrity and usefulness.

Other councils have also reviewed and documented their existing data and information (e.g. Taranaki, Manawatu-Wanganui, Hawke’s Bay, Northland; refer Example 2). The Ministry for the Environment (EPI) has prepared an electronic metadata directory of relevant information gathered by regional councils. The directory is available over MfE’s website (restricted to regional council use only).

## **Reporting**

Reporting is a critical part of closing the loop in the resource management process (refer Figure 1) yet traditionally has not done well, leading to the data-rich, information-poor situation that resource managers are currently faced with. Reporting is the mechanism by which data becomes an asset. Translating the raw data into information leads to knowledge, which provides the basis for informed decision-making.

Agencies involved in integrated monitoring are likely to find that a range of reporting products are required for different purposes and audiences. Examples of such reporting products include:

- SoE reports, Indicator bulletins, rapport cards, fact sheets
- policy/plan review reports (effectiveness and suitability of policies and methods)
- annual reports (Annual and Strategic Plan performance)
- reports on resource consent activities
- sector monitoring reports for major sector, industry or business groups
- operational reports (e.g. land transport, biosecurity, asset management, water supply/sewage treatment)
- technical reports suitable for specialists in particular fields of resource management
- summaries of monitoring activity – to keep internal and other agency staff aware of what is going on
- supervision and monitoring reports for major individual consent holders.

Agencies will need to identify timeframes and subsequent processes for the preparation of reports that are capable of:

- meeting agency specific needs
- ensuring that information can feed into district, regional and national reports.

In determining the type and scope of reports to be produced, agencies should first identify the purpose, audience and likely benefits associated with production and

dissemination. Alternative forms of dissemination, such as over the World Wide Web, could also be considered.

Monitoring is only useful if it leads to the necessary responses and actions. It is therefore important that appropriate review and policy responses are taken following the reporting stage (as is required by the RMA, S.35). As better information becomes available, policies and plans can be written in a way that they are more specific (e.g. clear targets) and hence better measurable. This is an iterative process requiring adaptive management as local government agencies go through the policy – information loop (refer Figure 1).

**Notes:**

The SMF Project did not trial the production and publishing of actual reports, although the Case Studies do include examples of how the information derived from the indicators can be presented (refer *Case Study Report*, see inside back cover). However, examples of SoE and Policy Review chapters were developed to illustrate the differences between them. Example 16 summarises these differences. Refer also to the *Waikato State of the Environment Report 1998* (Environment Waikato, 1999).

**Example 16 – Differences between SoE Reports and Policy Effectiveness Reporting**

**SoE Report**

External focus  
Wide audience (public, stakeholders)  
Informative and educational  
Jargon free, relatively simple language  
Visual and attractive (figures, graphs and maps)  
Factual analysis, no value judgement and no recommendations

**Policy Review**

Internal focus  
Narrow audience (resource users, sector groups, submitters to plans)  
Less background and basic information  
More technical and legal language  
Less visual  
More extensive analysis and interpretation, clear recommendations

**4**

# 5 Benefits for the Future

On completion, the Partners evaluated the Project by way of a questionnaire and follow-up interview. This evaluation highlighted the following lessons:

- Ensure organisational commitment – i.e. support from Councillors, management, and other staff. This will require education, senior level commitment and a strategic approach. For example, the development of a corporate *Environmental Information Strategy* (Environment Waikato, 1996).
- In the short term, the process and tools provided in this Manual are designed to help identify information that local government agencies should be collecting and the options for how to collect it. As such it provides the basis for programming future information collection.
- In the long term, the process and tools provided within this Manual will help provide *common indicators capable of measuring policy performance*.
- Monitoring projects cross normal functional and organisational boundaries. Managers need to be kept informed and updated as to costs and benefits for them.
- It is critical to involve a team both within and between local government agencies. Without this level of support and commitment the full benefits of an integrated approach are unlikely to be realised.
- Get started! – Don't wait for the perfect monitoring plan or indicators. The process is necessarily iterative. Indicators and monitoring plans can and should be continuously reviewed and improved to reflect new knowledge and concerns. The process of gathering data will necessarily help refine the process.

## Potential Benefits

Partners considered that the potential benefits of integrated monitoring include:

- Capacity building. The real sharing of information, ideas, knowledge and experience which can help to achieve a more complete and comprehensive approach, reflecting the complexity of environmental issues. This can lead to a greater understanding amongst all of the participants, both in terms of the issue and the perspectives and priorities of different agencies in relation to the issue.
- Cost effectiveness. Sharing of resources, effort and costs and avoiding duplication, in relation to the use of existing information, access to highly specialised skills, expertise, and knowledge, expensive instruments, tools, GIS layers and software.
- Integrated management. Agreeing collaborative management and monitoring of those issues where there are overlapping statutory functions/duties.
- Consistency. The sharing of effort with respect to common issues and the development of more consistent approaches to monitoring of relevant and comparable indicators (i.e. indicators that will demonstrate cause-effect relationships). This will ensure collection of information which is able to feed into district/city, regional and national reporting frameworks.

## Constraints

Constraints to be overcome by integrating monitoring within agencies are considered to be:

- lack of appropriate skills, expertise and resources to implement it (e.g. limited ecological, cultural, economic and social expertise)

- the difficulty in selling the concept to politicians (and in some cases senior staff) as monitoring is not easily understandable, is not a doing function and there is room for debate over the “*extent that it is considered necessary*” (Section 35, RMA)
- at present there is also little accountability if local government agencies do not monitor and understand the state of the environment
- the implications for technology and information system requirements (monitoring equipment, databases, GIS, Decision Support Systems, desk top publishing for data presentation).

Constraints facing the establishment of integrated monitoring between agencies include:

- different emphasis, needs and expectations from organisations, for example district/city councils, regional councils, DoC, MfE, in terms of outputs
- different levels of commitment and available resources from participating organisations and lack of involvement/support from more senior staff
- the difficulty in succeeding with such a comprehensive, integrated approach due to the complexity of environmental issues
- the difficulties associated with developing general indicators that allow for aggregation and comparison, yet which are still policy relevant in terms of individual district and regional plans
- the increasing move within local government towards contracting out that could be seen as a real threat for medium to long term integrated monitoring initiatives.

## **Regional Monitoring Forum – A Key Outcome of the Waikato SMF Project**

Having completed the SMF Project, the Partners agreed to promote the establishment of a Waikato Regional Monitoring Forum with the objective of raising the profile of monitoring in local authorities and facilitating a cost-effective, co-ordinated and integrated approach (both within and between agencies) to address and satisfy Section 35 of the Resource Management Act 1991:

- state of the environment monitoring
- policy effectiveness monitoring
- resource consent monitoring
- delegated functions.

The opportunity also exists to include aspects outside of resource management, that is aspects of the Local Government Act (e.g. waste, transportation), the Health Act (e.g. drinking water quality, contaminated sites), the Biosecurity Act (e.g. Tb control) etc.

It is proposed that the forum will include representatives from the Regional Council (Environment Waikato) and representatives from all of the constituent local government agencies. MfE should also be included with the role of co-ordinating information flow and expertise between national and regional/local (district/city) levels. Other external parties such as iwi, DoC, Non Government Organisations (NGOs), community interest groups, Crown Research Institutes (CRIs) and universities may also be included for specific projects.

It is intended that the forum will be established under a formal agreement such as a *Memorandum of Understanding*, with agreed goals and objectives (refer Stage 1, Steps 1.3 and 1.4).



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# Appendices

## Appendix 1 – An Ecosystem Approach to Environmental Management<sup>14</sup>

People have traditionally tended to view air, water, land, other organisms and themselves as separate components that could each be understood in isolation from the whole. In the past therefore, environmental planning and decision-making was often piece-meal. Special laws and regulations existed for different parts of the environment (e.g. air and water) with separate agencies responsible for their management.

Today, we have recognised how closely intertwined human, environmental and economic activities are. Our quality of life and economic wealth is intricately linked to a healthy, intact environment. Everything is connected to everything else. Simply put, all the components of an ecosystem are interdependent. If one component is adversely affected it can have repercussions for the entire system. Now, the Resource Management Act (RMA 1991) requires local government agencies to promote the integrated management of natural and physical resources.

This can be achieved using an **ecosystem approach**, which means:

- acquiring a good understanding of natural processes and the basic principles that support life
- taking into account the complex interactions between air, water, land and all living things (including humans)
- integrating environmental, economic, social and cultural values and concerns
- working in partnership with other resource management agencies, land owners, resource users and communities.

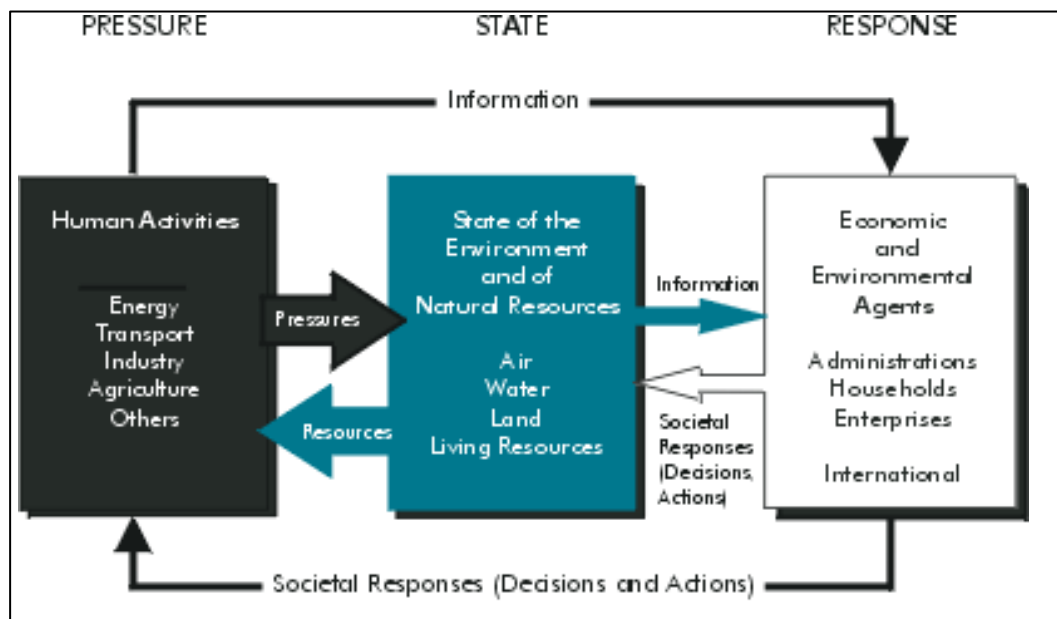
An ecosystem approach requires society to think, act, and plan in terms of ecosystems. Such an integrated ecosystem approach is consistent with the Maori view of the world (tikanga Maori) It aims to maintain, and where necessary enhance, the quality of our natural resources in the Waikato Region. This is essential for a sound and prosperous regional economy. However, traditional economic thinking has largely neglected environmental factors and the natural capital and services provided by properly functioning ecosystems.

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<sup>14</sup> For further details refer to *Ecosystem Report* (Resource Kit, inside back cover).

# Appendix 2 – Pressure-State-Response (PSR) Organisational Framework

An organisational framework is simply a tool which can help to model a process, or structure information. For example, it can act as a reminder or prompt as to what needs to be included in an environmental monitoring programme, and it can be used to structure data and information to assist analysis, interpretation and communication of results.



**Figure 5: Pressure-State-Response Organisational Framework**

The PSR Framework arises from a simple set of questions:

- What is happening to the state (the quality and/or quantity) of environment and its natural resources?
- Why is it happening?
- What are we doing about it?

Indicators of changes or trends in the bio-physical state of the natural world (state indicators) answer the first question.

Indicators of stresses or pressures from human activities that cause environmental change (pressure indicators) answer the second.

Measures of the policy adopted in response to environmental problems (response indicators) answer the third.

State refers to the bio-physical state and not the state of the pressure (cause or issue). However, in some cases it may be too difficult or expensive to actually monitor the state of the biophysical environment. It will therefore be necessary to rely on pressure information as the surrogate, and to make inferences about the effect that changes in

pressure will be likely to have on the biophysical state. It is also important to understand that there are proximate (immediate) pressures and ultimate pressures (social, cultural and economic pressures).

The real world is, of course, much more complex than the model implies. The point is, that the PSR framework can help formulate a conceptual cause-effect model of an issue, provide a structure to the identification of information requirements and indicators, and interpret and report results.

# Appendix 3 – Criteria for Indicators<sup>15</sup>

Indicators are information tools. They summarise data on complex environmental issues to indicate the overall status and trends of those issues. They can be used to assess national and regional (or local) performance, and to signal issues to be addressed through policy interventions and other actions (SBSTTA, 1997).

A good indicator should be:

## **Policy relevant**

- Able to monitor the key outcomes of environmental policy and legislation and measure progress towards policy goals.

## **Analytically valid (measure/method)**

- measurable
- representative of the issue/system being assessed
- reproducible and based on critical attributes of the issue/system
- developed within a consistent analytical framework
- scientifically credible and robust
- helpful in relating causes, effects and responses
- responsive/ sensitive to environmental change
- able to detect human induced change from natural variations
- predictive
- consistent in standards for data collection, analyses and data management
- repeatable
- have statistical integrity.

## **Cost effective**

- require limited numbers of parameters to be established
- based on, or use, existing data and information wherever possible
- simple to monitor.

## **Simple and easily understood**

- simple to interpret, accessible information systems, robust and appealing
- clearly display extent of issues.

## **Suggested Essential Criteria**

- **Measurable:** the indicator should be simply quantified, use standard methodologies with known accuracy and precision.
- **Data quality:** Data should be clearly defined, verifiable, scientifically acceptable, easy to produce, and have sound collection and management systems.
- **Importance:** The indicator must measure environmental quality of regional/ national importance.
- **Relevance:** The indicator should be policy relevant.
- **Appropriate scale:** The indicator measures changes on an appropriate geographic and /or temporal scale.
- **Trends:** Data collected should allow trend analysis or provide a baseline for future trends. The indicator should show reliability over time.
- **Decision Support:** The indicator should provide information to a level appropriate for policy decision making.

*From: MfE, Environmental Performance Indicators (EPI) Programme.*

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<sup>15</sup> Refer to Resource Kit (inside back cover) for Evaluation Template and examples (*Case Study Report*).

# Appendix 4 – Example of Indicator Specification Sheet for One Waste Indicator

	<b>Total Quantity of Solid Waste Disposed</b>			
	<ul style="list-style-type: none"> <li>• at landfills</li> <li>• at incinerators</li> <li>• from residential sources and business sources</li> </ul>			
<b>Type of Indicator:</b>	Pressure	✓	State	Response
<b>Classification:</b>	A	✓	B	C
<b>Units:</b>	Kilograms/Capita/Year Tonnes/GDP (regional figure)			
<b>Frequency:</b>	3 yearly			

**Note:**

A = adequate data available

B = data could be provided now, but considerable constraints (limited, costs, complexity, time)

C = no data available at present (significant further development and/or research required).

## Definitions

**Term**

**Definition**

Waste

Waste includes all solid materials deposited at recognised/consented facilities such as landfills and incinerators for disposal. It does not include material deposited at the facility for composting that is subsequently reused. However, green waste disposed of at the facility and used for cover or fill should be included as waste as it was deposited as waste and is not being reused.

Business Source

Business sourced waste includes all waste from non-residential sources and includes all industrial and commercial waste, including waste from shops, hotels and hospitals.

## Explanation of Indicator

This is a robust indicator that provides a measure of the total quantity of solid waste (tonnes) that is disposed of at key (i.e. consented and/or known) disposal facilities each year, including landfills and incinerators. While the indicator does not measure environmental effects it does measure the potential risk posed to the environment by understanding changes in the quantity of waste disposed.

When considered alongside data obtained on waste generation, the indicator provides a good understanding of the proportion of waste generated that is actually disposed of within a district at a recognised disposal facility. The indicator provides important information to assist in waste management planning, particularly regarding the life of landfills and the nature of waste disposed at specific facilities. The data enables the effectiveness of waste minimisation and management policies on disposal practices to

be determined (e.g. the introduction of disposal charges may lead to an increase in the quantity of waste disposed at *free* disposal sites or an increase in dumping).

The quantity of waste generated is influenced by changes in the population and economy. To enable comparison of the data gathered over time and with other regions it is necessary to report the indicator in terms of per capita/annum and against GDP at a given time.

The Local Government Amendment Act (No. 4) requires local government agencies to prepare waste management plans that are consistent with the waste reduction hierarchy. Understanding the quantity of waste disposed at key facilities enables effective waste management and minimisation policies to be developed. Many authorities have addressed this statutory requirement by including objectives in their district plans seeking a reduction in the quantity of waste disposed.

## Data Characteristics

### Source of data:

The Waste Analysis Protocol (WAP) Module C published by the Ministry for the Environment in 1992 provides the source for quantifying solid waste disposed per annum at transfer stations and landfills. The method does not quantify waste disposed at incinerators. In 1995/96, Environment Waikato co-ordinated a regional survey of waste disposed at key facilities within each district.

### Acquisition methods:

Surveys are undertaken at the level of specific disposal facilities, either transfer stations or landfills. The results of these surveys are then aggregated to obtain a total quantity of waste generated across the district. The larger landfills and transfer stations within each district are generally surveyed to obtain the most reliable data. The generally more sophisticated nature of consented incinerators is such that accurate measures of weight are generally obtainable. However, commercial confidentiality claims can restrict reporting of and access to this data.

### Protocols and procedures for collection and analysis of data:

Refer to *WAP Module C: Classification at Disposal Facility (MfE 1992)* for detailed information on data collection protocols and procedures. The method involves:

- weighing all or most large vehicle loads entering or using the facility and a proportion of the smaller vehicles
- identifying the source of incoming waste (in terms of business or residential waste and, where necessary, the geographic source of the waste) by surveying vehicle drivers
- sampling, sorting and weighing a proportion of the incoming loads in each category (municipal trucks, trucks, trailer, cars) to identify the average load weight for each category
- visually classifying the remaining loads (or a high proportion of them) where appropriate.

It should be noted that in larger facilities and most transfer stations it is reasonably easy to report the quantity of waste disposed given the existence of sophisticated weighing equipment. However, in smaller facilities it is necessary to use Module C to quantify waste.

Module C is also helpful as it quantifies waste on a source basis. Given the trend towards increased cross-boundary movement of waste for disposal it will be increasingly important to understand how much waste is being disposed at a particular facility from out of district sources and, conversely how much waste is leaving the district to be disposed elsewhere. A related benefit of using Module C is that it provides useful data on the composition of waste disposed (refer next indicator). Understanding this information is critical to effectively review and develop a waste minimisation and management policy.

### Data management

Data obtained from the 1995/96 survey exists for all districts within the Waikato Region. This data is held in report form only. AgFirst Consultants hold the actual data set. Population data is available from Statistics NZ at the district level and is updated on a five yearly basis following each Census. This can be purchased in electronic or hard copy form. Gross domestic product (GDP)

figures are reported in the National Bank Quarterly Reports on a regional level and are reported in dollar values and percentage change over specified periods.

### Reliability (quality control and assurance)

The WAP Module C protocol is reasonably robust and emphasises the role of statistical analysis in design of surveys and analysis of results. The application of statistical principles in the protocol enables users to get the most precise results for the least effort. The protocol also ensures representative sampling of the incoming waste and taking of samples twice yearly (in summer and in winter) to identify the seasonal influence on waste generation. It uses physical sorts to calibrate visual estimates. However, the procedure is only as good as the people using it. Surveys show that well trained WAP staff obtain more reliable results.

### Spatial Cover

Monitoring is undertaken at the disposal facility level and is then aggregated across the district.

### Frequency of monitoring

Surveys of waste disposal facilities using module C should be undertaken every three years given the high costs of data gathering. The three yearly cycle of monitoring appears practical as it is consistent with the cycle of long-term financial planning and provides three data points every decade. However, for larger facilities, which have weighbridges, the annual quantity of waste disposed should be reported.

### Data presentation methods

The information gathered can be presented in tabular and graphical form. Graphs are particularly effective at highlighting trends over time and between districts or regions, although units must be standardised. *See examples below.*

### Data Limitations

There are no significant limitations with the use of WAP Module C. However, reporting the quantity of waste disposed at larger facilities with weighbridges on an annual basis will provide a better understanding of the trends in waste disposal within the three year WAP survey period proposed.

### Linkages

This indicator is closely related to the indicators monitoring composition of waste disposed and quantity of waste generated. It is necessary to consider the data derived from these indicators to gain a more complete understanding of waste generation and disposal and enable the effectiveness of waste minimisation policies to be assessed.

### Further Work Required

Some improvement in data quality could be achieved by quantifying the waste disposed at smaller landfills within each district and making an attempt to understand the quantity of waste which is disposed within the district from outside sources (i.e. adjacent districts).

### References and Contacts

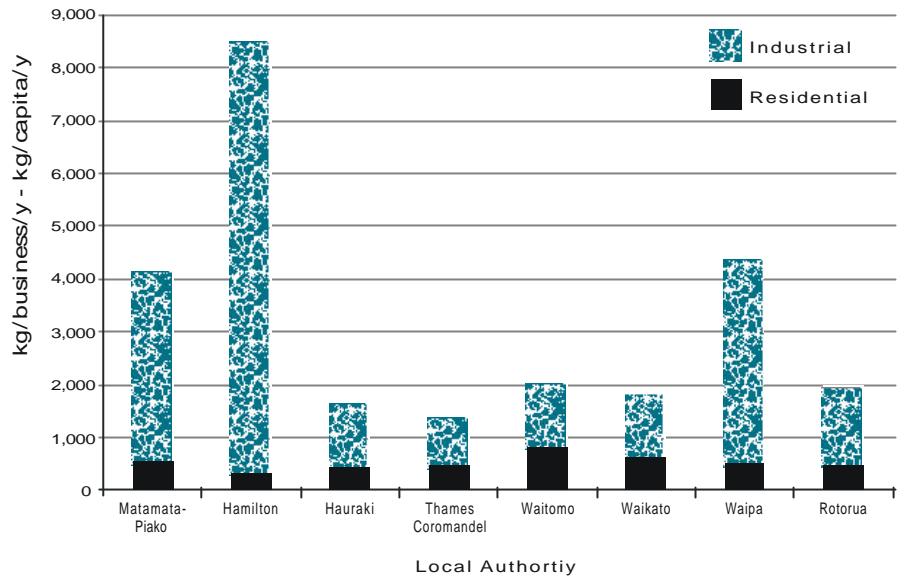
Regional Council	District Councils	Other
Robert Brodnax (07) 856 7184	Leigh Robcke/Mike Safey Waikato District (07) 824 5806  Paula Rolfe/Mike Brook Matamata-Piako DC (07) 884 8179  Tegan McIntyre Hamilton City Council (07) 838 6818	Ministry for the Environment Heather Cook (04) 917 7400 Tui Gilling (04) 917 7400

- Regional WAP Surveys (1995/96) – Complete set held by Environment Waikato. Relevant copies held by each district.
- Waste Analysis Protocol, Ministry for the Environment, 1992.
- First National Waste Data Report, Ministry for the Environment, 1997.

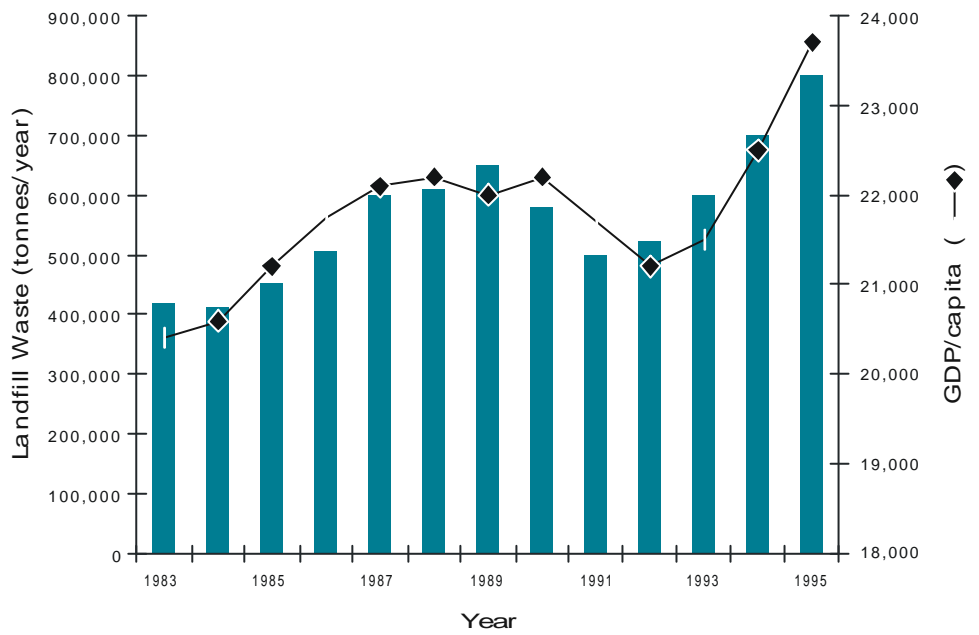
### Example Datasets

<b>Regional Comparison of landfilled Waste per Capita (1996)</b>		
<b>Region</b>	<b>Industrial Waste (kg/capita)</b>	<b>Residential Waste (kg/capita)</b>
Northland	333	223
Auckland	402	354
Waikato	647	308
Bay of Plenty	601	371
Gisborne	439	244
Hawke's Bay	341	484
Taranaki	324	264
Manawatu Wanganui	419	457
Wellington	893	402
Nelson/Marlborough	456	226
West Coast	104	390
Canterbury	337	519
Otago	604	678
Southland	305	327

*Data source: New Zealand Waste Data Report, MfE.*



Source of Waste Disposed by Local Authority



Economic Growth and Waste Disposal at Auckland Landfills

Data Source: New Zealand Waste Data Report (MfE) and Statistics New Zealand (GDP data).

# Appendix 5 – Integrated Monitoring: A Case Study (Natural Areas)



## 1 Introduction

This appendix describes the Natural Areas Case Study undertaken as part of the Waikato Integrated Environmental Monitoring Project. For further details refer to the *Case Study Report* (see inside back cover) which includes:

- *specification sheets* for each indicator
- environmental data (tables and graphs of results)
- a detailed evaluation of the usefulness of the tools used.

The **purpose** of the case studies was to:

- determine the usefulness of an integrated approach to environmental monitoring
- test the effectiveness of the framework and tools developed as part of the project
- identify opportunities for implementing and improving our approach taken to achieve integrated monitoring.

The **evaluation of the tools** developed and approach taken to achieve integrated monitoring in this project was undertaken in two parts:

- 1 First, as part of this case study partners provided an intuitive evaluation of the tools and approach.
- 2 A second more structured evaluation was undertaken following the case-study using a written survey, and following up with interviews which asked partners to rate the effectiveness and describe the strengths and weaknesses of the specific tools and approach taken through the project. These results are presented in chapter six and will be used to amend the tools and approach taken.

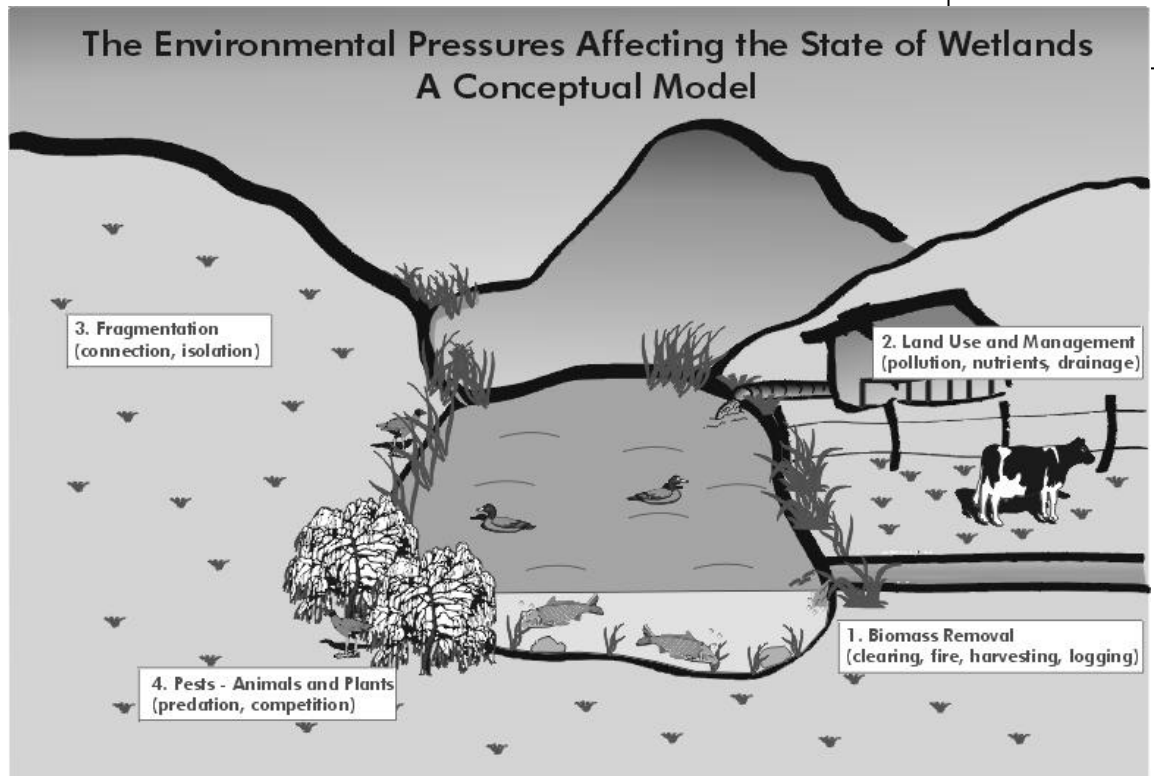
## 2 The Issue of ‘Natural Areas’

The term ‘Natural Areas’ refers to indigenous ecosystems including wetlands, lakes, scrub, forests and geothermal areas. Natural Areas, such as wetlands, are a unique but scarce resource nation wide. Despite this they are being placed under increasing pressure from development, land drainage, pests and farming practices.

As wetlands and other natural areas are such unique habitats, we often have little understanding of their ecological functioning. As a consequence, in addition to the specific indicators of the ecosystem functioning, knowledge of the extent, distribution and type of ecosystem is also important.

In the Waikato Region, the focus is on maintaining and enhancing biodiversity and protecting indigenous vegetation and habitat of indigenous fauna. This requires the protection of significant natural areas in the Region from adverse effects as a result of land management practices and environmental pressures.

Figure 6 illustrates the pressures affecting the state of wetlands.



**Figure 6: A Conceptual Model of a Natural Area (Wetland)**

## 2.1 Definitions

### Issue – Natural Areas

- Protection of Indigenous Vegetation and Fauna.

### Desired Outcome

- Biodiversity within the Waikato Region maintained and enhanced.
- Indigenous vegetation and habitat of indigenous fauna protected from adverse effects.

**Natural Area** means indigenous ecosystems, such as wetlands, lakes, scrub, forests, geothermal areas etc. It includes the physical as well as biological components of natural areas, but does not include amenity values.

**Indigenous** means naturally occurring in a region (e.g. the Waikato).

**Protection** refers to protection by statutes as well as a range of other legally binding documents or agreements ranging in scale from international obligations to local covenants.

**Significant** was not defined, as it was agreed that for the purpose of the case study all remaining indigenous natural areas are considered significant<sup>16</sup>.

<sup>16</sup> 'Significant' will be defined via the public policy process as a variation to Environment Waikato's Regional Policy Statement (RPS).

## 3 Case Study Planning

The Case Study Team 'Natural Areas'<sup>17</sup> involved the following project partners:

- Environment Waikato (Beat Huser, Karen Denyer)
- Department of Conservation (John Gumbley, Lisette Collins, Avi Holzapfel)
- Waikato DC (Leigh Robcke, Allan Turner)
- Waipa DC (Ross McNeil)
- Hamilton City Council (Alasdair Craig, Matthew Vare)
- Thames-Coromandel DC (Graeme Lawrence)
- University of Waikato.

Meetings were held to define the issues involved and the desired outcomes (*see box on next page*), evaluate a selection of indicators (from task three) and to devise an integrated monitoring plan for the collection and analysis of the data.

### 3.1 Mini Case Studies

Some Project partners undertook additional work to explore specific aspects of achieving integrated monitoring. This provided very useful practical examples of applying the project concepts.

#### **Wetlands – Waikato District**

- Testing the issue of 'scaling' by assessing the suitability of using 1:15,000 aerial photographs to determine wetland area and type, and comparing this to the results of using 1:50,000 aerials.
- Trial the Natural Area assessment method developed by DoC (Theo Stephens) to test its suitability as a relatively simple field method to evaluate the status of Natural Areas, sites or ecosystems (Indicator #5).
- Refer to *Case Study Report* (Appendix 2E).

#### **Integrated Peat Lake Monitoring – Waipa District**

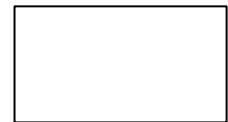
- Examine current approaches to the monitoring of peat lake status, and identify potential indicators.
- Propose a strategy for the co-ordination and integration of monitoring requirements between agencies.
- Refer to *Case Study Report* (Appendix 2F).

#### **Native Bush Covenants – Thames-Coromandel District**

- Trial the Natural Area assessment method developed by DoC (Theo Stephens) to test its suitability as a relatively simple field method to evaluate the status of Natural Areas, sites or ecosystems (Indicator #5).
- Integrate compliance monitoring of bush covenants provisions in District Plan with SoE and Policy effectiveness monitoring.
- Aggregate local/site-specific monitoring data to district, regional and national level.
- Refer to *Case Study Report* (Appendix 2G).

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<sup>17</sup> The original issue followed the RMA (S6) wording of 'Protection of Indigenous Vegetation and Habitat of Indigenous Fauna'. The group decided to change this to the simpler and easier to communicate term of 'Natural Areas'.



## 4 Case Study Outputs

Key outputs produced by the Natural Areas Issue Group include:

- A core set of pressure, state and response indicators relevant to the agreed desired outcomes or goals (refer Tables 2 and 3)
- A detailed indicator specification sheet for each of the agreed Natural Areas indicators (refer *Case Study Report*, Appendix 2A)
- An integrated monitoring plan relevant to the agreed set of Natural Areas indicators (refer Table 4)
- Indicator evaluation material, including a summary table showing individual ratings of the group members for each indicator (Table 3, and *Case Study Report*, Appendix 2C).

**Table 1: Planning the Case Study – What Needs to be Done, When and by Who?**

Step	Actions	By When and Who	Refer To <sup>18</sup>
1	Meeting to discuss and confirm: <ul style="list-style-type: none"> <li>• The desired state/outcome of the issue.</li> <li>• A conceptual 'environmental model' of the issue, based on PSR</li> <li>• The selection of a set of the most suitable indicators.</li> <li>• The definition of any terms that need clarification.</li> <li>• The detailed steps to be followed for the case study and the allocation and scheduling of the various tasks.</li> </ul>	End January to 31/3/1998  <i>Team</i>	Appendix 2D <i>Figure 2</i>  <i>Table 2</i>
2	Test the suitability of the selected indicators against the MfE criteria of what makes a good environmental indicator. NOTE: <i>These were reviewed and confirmed at the end (Step 11)</i>	20 April <i>Team</i> End June	<i>Table 3</i>  Appendix 2C
3	Establish an inventory of relevant existing information that supports the selected indicators.	31/3 <i>Each member</i>	Appendix 2A
4	Identify any significant data/information gaps, and – if practicable – gather the information needed.	31/3 – 30/4 <i>Team</i>	Appendix 2A
5	Prepare an 'Integrated Environmental Monitoring Plan', and refine the list of indicators.	20 April (ongoing) <i>Team</i>	Appendix 2B
6	Gather and collate the available information.	31/3 – 30/4 <i>Team</i>	See 'Results'
7	Analyse, interpret and present the information in accordance with the PSR model, taking into account the spatial differences in ecosystems within the case study area.	30/4 – 31/5 <i>Team</i>	See <i>Waikato SoE Report</i>
8	Assess data and information co-ordination/integration issues (costs, data management, quality control procedures, data/information sharing etc.)	31/3 – 31/5 <i>Team</i>	Appendix 2A & 2B
9	Assess the linkage to MfE's EPI Programme by testing the local/regional set of indicators for each issue for consistency and possible aggregation to the national level.	30 April <i>Beat/Camille/MfE</i>	Appendix 2C
10	Produce output reports for each Issue, i.e. 'Indicator Information Sheets' (SoE Chapter and/or a Policy Review?).	31 May <i>Team</i>	Appendix 2A

<sup>18</sup> For the Appendices refer to *Case Study Report* (see inside back cover).

Step	Actions	By When and Who	Refer To <sup>18</sup>
11	Document the case study (process, methods, results etc.) and discuss findings in relation to the project objectives and the criteria established for the case study.	30 June <i>Beat</i>	Case Study Report
12	Integrate case study report with 'Manual for Local Authorities'	July/Aug <i>Camille/Ruth/Beat</i>	<i>Manual</i>

## 5 What Indicators Were Developed?

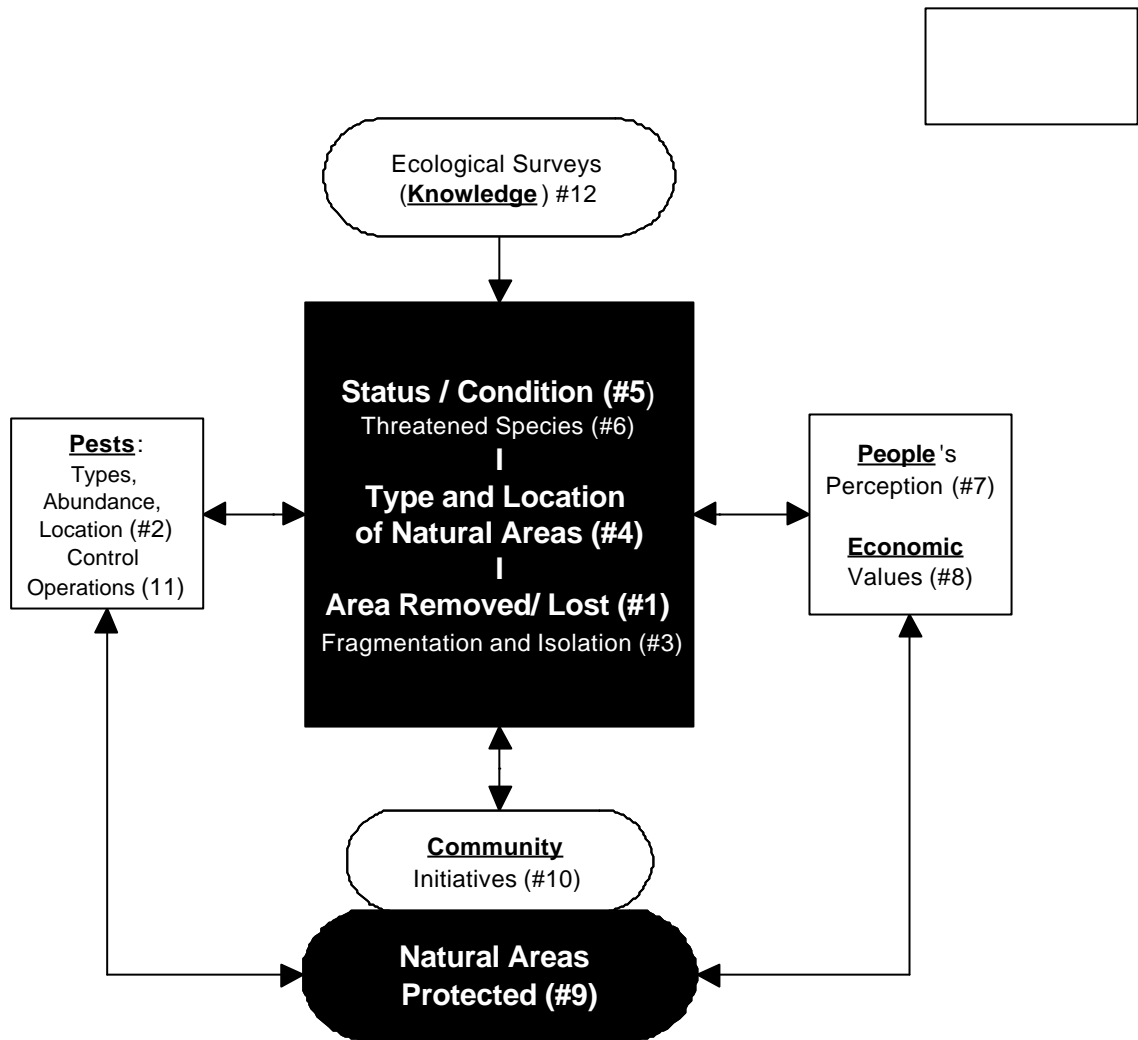
Having confirmed the desired outcomes or goals it was then possible for the Natural Areas Issue Group to identify, discuss and refine a core set of relevant pressure, state and response indicators for Natural Areas. The final set of agreed indicators are listed below.

**Table 2: The Final List of Indicators for 'Natural Areas'**

<p><b>Pressure Indicators</b></p> <ol style="list-style-type: none"> <li>1) Area of Indigenous Vegetation Removed</li> <li>2) Abundance and Distribution of Pests</li> <li>3) Habitat Fragmentation and Isolation</li> </ol>
<p><b>State Indicators</b></p> <ol style="list-style-type: none"> <li>4) Area and Distribution of Indigenous Vegetation</li> <li>5) Status of Natural Area</li> <li>6) Number and Distribution of Threatened Species(*)</li> <li>7) People's Perception of Natural Areas</li> <li>8) Economic Value of Ecosystem Services (*)</li> </ol>
<p><b>Response Indicators</b></p> <ol style="list-style-type: none"> <li>9) Area Protected (legally)</li> <li>10) Community Initiatives and Participation</li> <li>11) Location, Area and Type of Pest Control Operation</li> <li>12) Natural Area Ecologically Surveyed</li> </ol>

(\*) *Indicators #6 and #8 are not supported by DoC.*

The selected indicators can also be summarised schematically to illustrate the linkages between them (Figure 7).



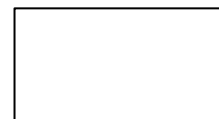
**Figure 7: Links Between the Selected Indicators for Natural Areas**

## 5.1 Why These Indicators?

While individual indicators may provide useful information (e.g. undertaking ecological surveys increases our knowledge of natural areas), the real strength of policy relevant indicators is their complementary nature. The information provided by a set of indicators that effectively describes an issue is much more useful than the sum of individual data. The indicators can be divided into three groups:

- 1) **Core Set of Indicators** (shaded black in Figure 3).
  - Area of Indigenous Vegetation Removed (# 1).
  - Habitat Fragmentation and Isolation (# 3).
  - Type and Location of Natural Area (# 4).
  - Status/Condition of Natural Area (# 5).
  - Number and Distribution of Threatened Species (# 6).
  - Area Protected (# 9).
  - Natural Area Ecologically Surveyed (# 12).

These represent the 'bone' of what one needs to know about Natural Areas: the type, location and extent, their status, health and condition, including whether the areas are isolated or fragmented. Indicators #6 and #12 indicate the state of our knowledge about natural areas and threatened species (however, information on the latter is only useful if it provides a link to the reason(s) of whether certain species are present/absent). It is also important to know what natural area is actually protected.



## 2) Pest Indicators

- Abundance and Distribution of Pests (# 2).
- Location, Area and Type of Pest Control Operations (# 11).

The 'Pest' indicators provide information about one of the major threats for Natural Areas, and how effective we are in eradicating or controlling important pests. However, current methods to quantify and map pests are generally inadequate and relatively costly. The emphasis is on managing pests in areas of high priority for protection and/or areas particularly vulnerable to high impact pests.

## 3) Economic and Social Indicators

- Economic Value of Ecosystem Services (# 8).
- People's Perception of Natural Areas (# 7).
- Community Initiatives and Participation (# 10).

The indicators in this group aim to complement the 'biophysical' data by capturing economic and social information. Estimating the economic values of Natural Areas and the services they provide (e.g. resources and raw material, maintaining global cycles) is important to ensure the 'costs' of protection are fair compared with the 'benefits' of use and development<sup>19</sup>. People's perceptions, their attitudes, awareness, and actions concerning the protection of Natural Areas are a key factors to achieve their successful protection.

It was observed that there is a heavy bias toward biophysical or environmental indicators, and a lack of considering suitable economic, social and cultural<sup>20</sup> information. This reflects partly the current availability of data and information, but also an approach of ignoring economic, social, and cultural aspects in managing natural and physical resources.

## 5.2 Evaluating The Indicators

An assessment of the usefulness of the selected indicators was undertaken using the evaluation criteria developed by MfE as part of the National Environmental Performance Indicators, including:

- cost-effective
- policy relevant
- simple and easily understood
- analytically valid.

The results of this evaluation undertaken independently by each project partner are summarised in Table 3.

**Table 3: Summary of Indicator Evaluation**

INDICATOR	SCORE				
	Policy relevant	Cost effective	Easily understood	Analytic. valid	Total
<b>Maximum Score</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>72</b>

<sup>19</sup> It is impossible to estimate the 'true' (ie. including intrinsic) values of Natural Areas and ecosystems from a human perspective.

<sup>20</sup> Cultural aspects of Natural Area and Heritage, while recognised as important values, were not considered for the case study because of a lack of skills and expertise available to the project team. Access to economic and social expertise were limited.

(shading indicates a score of greater than 75% of maximum)					
<b>Pressure Indicators</b>					
1) Area of Indigenous Vegetation Removed	18	14	18	18	<b>68</b>
2) Abundance and Distribution of Pests	14	6	12	8	<b>40</b>
3) Habitat Fragmentation and Isolation	16	13	9	14	<b>53</b>
<b>State Indicators</b>					
4) Area and Distribution of Ind. Vegetation	18	18	18	18	<b>72</b>
5) Status of Natural Area	18	10	14	14	<b>56</b>
6) Number and Distrib. of Threatened Spec.	11	9	16	16	<b>52</b>
7) People's Perception of Natural Areas	9	14	14	15	<b>52</b>
8) Economic Value of Ecosystem Services	4	6	10	8	<b>28</b>
<b>Response Indicators</b>					
9) Area Protected	18	18	18	14	<b>68</b>
10) Community Initiatives and Participation	16	15	16	7	<b>54</b>
11) Location, Area and Type of Pest Control	8	17	15	9	<b>49</b>
12) Natural Area Ecologically Surveyed	11	7	13	11	<b>42</b>

Generally, there is reasonable consistency in the application of the criteria, i.e. good agreement between the project partners about what constitutes a good indicator. The majority of the indicators that were selected scored well (i.e. >75% of maximum score) for policy relevance, are easily understandable and use established methodology (Table 3). The cost-effectiveness of many indicators is somewhat less certain, possibly reflecting a lack of hard facts.

The following indicators scored consistently well for all criteria, and can therefore be considered a core set of indicators for Natural Areas:

- Area removed or lost (#1).
- Total area and distribution (#4); => maximum score!
- Area status (#5).
- Area protected (#9).

Although not all indicators were necessarily policy relevant to all the project partners, the evaluation highlighted the need for an integrated approach to monitoring natural areas across agencies with different roles and responsibilities. The project partners agreed that such an integrated approach would enable efficient use of existing information and expertise held across a number of different organisations and agencies.

In addition to assessing the usefulness and practicality of each individual indicator there is also the need to evaluate their combined performance, i.e. as an entire set of indicators which provide adequate and useful information about a particular issue or problem. This should include project-specific criteria, such as the ability to achieve an integrated ecosystem approach, or the usefulness of the PSR framework. Some observations on these aspects are discussed in the evaluation of key project objectives.

### 5.3 Aggregation at Local, Regional and National Level

In principle, the transferability of the selected indicators between local and central government is not considered problematic: the same indicators can be used. However, the extent to which the data gathered for each indicator meets the different local (TLA/sites/ecodistrict), regional (Environment Waikato/DoC Conservancy/ecoregion) and national (MfE/DoC) requirements depends on the scale used and needs to be considered (refer to *Case Study Report*, Appendices 2E and 2G for a discussion of scaling problems).

It requires:

- clear identification of what is needed by each agency or organisation (the purpose and what it means for the information needed and how this translates to the collection of data).
- early co-ordination and integration, i.e. at the planning and design stage of monitoring programmes, so that the most cost-effective means of meeting all information needs can be identified.

A Regional Monitoring Forum may provide a suitable means to address such issues, allowing appropriate solutions for different issues in different regions. Regional councils will also assume a responsibility to provide environmental information to MfE to meet national and international reporting needs (e.g. OECD). A Regional Monitoring Forum can therefore address issues most effectively so that information collection can be relevant at the district, regional and national level.

The collation and aggregation of data may also be a problem within organisations and/or local, regional or national levels, for example:

- the integration of consent monitoring data with environmental monitoring information
- the use of different methods to encourage and record protection of Natural Areas between the TLAs within the same Region
- the lack of standardised procedures, databases and computer systems between DoC Conservancies; and the lack of co-ordination and integration between central government departments such as MfE, MAF, DoC etc.

MfE were invited to comment on the consistency with the indicators developed during this project and the national indicators being developed as part of the EPI programme. However, the work of national biodiversity indicators was not sufficiently advanced to make any comments and the time of this report.



## 6 Monitoring Plans

INTEGRATED MONITORING PLAN – Protection of Indigenous Vegetation and Fauna <sup>21</sup>									
Issue	Unit	Is the information currently available/ accessible (yes/no, comment)	Organisation and contact responsible for collecting the information	Methods used to collect, analyse, and interpret information (e.g. samples, surveys etc.)	Frequency of monitoring (e.g. quarterly)	Location for monitoring (e.g. area, site)	Estimated costs	Contact for reporting & storing information	Comments
<b>Protection of Indigenous Vegetation and Fauna</b>									
<b>Desired State</b>									
<ul style="list-style-type: none"> <li>- Biodiversity within the Region maintained and enhanced.</li> <li>- Indigenous vegetation and habitat of indigenous fauna protected from adverse effects.</li> </ul>									
<b>PRESSURE INDICATORS</b>									
<b>1. Area of indigenous vegetation removed (or natural area lost).</b>  <b>Note:</b> 1. Measured by type of vegetation, as classified and defined in EW survey (Landcare 1995). 2. Expressed as both 'hectares cleared' and 'percentage of remaining area' (by type). 3. Includes both 'permitted' (resource consent granted, or permitted by a rule in a regional/district plan) and 'non-permitted' activities. 4. The precision of this indicator is given by the resolution of the monitoring technique used to detect change.	ha  (% of remaining).  (% of pre-human).	Benchmark survey done (1995).  Re-survey needed to measure loss (by difference).  (Comparison with 1840 available => pre-European; extending to pre-human desirable).	EW, DoC, TLA (consortium).	Remote sensing, analysis using GIS.  Ground checks necessary.  For analysis: use standardised system (eg. Leathwick et al. 1995).	Ten yearly (regional EW survey).  (to coincide with review cycle of Policy documents => RPS, DP).	Regional (based on 1:50,000).  Use larger scale (1:5,000 – 1: 10,000) for specific areas/sites (e.g. small wetlands).	See under State Indicator 'Area and Distribution of Indigenous Vegetation'.	EW.	This indicator is derived from repeat surveys over time (see indicator 4), by calculation of the differences in extent/area of vegetation types.  Scale (1:50,000) may limit detailed assessment. Eg. at the district level.

<sup>21</sup> Indigenous vegetation (including wetlands) is taken as a surrogate for 'Natural Areas' in general. Other types of natural areas (e.g. lakes, estuarines, coastal waters, rivers/ streams, geothermal features) would require a similar set of 'Pressure–State–Response' indicators.



Issue	Unit	Is the information currently available/ accessible (yes/no, comment)	Organisation and contact responsible for collecting the information	Methods used to collect, analyse, and interpret information (e.g. samples, surveys etc.)	Frequency of monitoring (e.g. quarterly)	Location for monitoring (e.g. area, site)	Estimated costs	Contact for reporting & storing information	Comments
<p><b>2. Abundance (density) and distribution<sup>22</sup> (presence/absence) of relevant animal and plant pests.</b></p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>Monitoring dependent on <i>type</i> of pest.</li> <li>The distribution of pest numbers needs to be correlated to the susceptibility to pest damage, and to the significance/priority of an area for protection.</li> <li>Highest pressures are posed by pests occurring in natural areas that are identified as having highest priority for protection and/or areas that are highly susceptible to pest damage.</li> <li>The relevance of any particular pest is site- and area-specific.</li> <li>It may be preferable to limit an assessment of pressure to simple presence/absence and combine it with indicators of response actions (e.g. pest control : yes or no =&gt; see indicator 9) and an assessment of the condition/state (e.g. health of vegetation).</li> </ol>	<p>plants: number per ha (per pest)</p> <p>animals: residual trap catch % (RTC%)</p> <p>Presence/absence of pest species (in given area).</p>	<p>Some.</p> <p><b>Distribution:</b> Mapped for four plant pest (1994):</p> <ul style="list-style-type: none"> <li>Old man's beard</li> <li>Woolly nightshade</li> <li>Lodgepole pine</li> <li>Wild ginger</li> </ul> <p>=&gt; <b>no more mapping undertaken (unreliable)</b></p> <p>Animal pests: – mainly regional distribution.</p> <p><b>Abundance:</b> Possums in operational areas.</p>	<p>EW, DoC.</p> <p>(AHB =&gt; in Tb control areas).</p>	<p>Variety of methods (pest-specific)<sup>23</sup>.</p> <p><b>Plant pests:</b> Mainly by filed assessment and complaints.</p> <p><b>Animal pests:</b> Standardised methods for possums and mustelids. No standardised monitoring protocols for other pests (in progress).</p>	<p>Varies (Pest-specific).</p>	<p>Focus on vulnerable areas, DoC land.</p> <p>Note: 'vulnerable area' differs for each pest.</p>	<p>For animal pest control operations: up to \$ 27 per hectare (possum).</p>	<p>EW, DoC (AHB =&gt; in Tb control areas).</p>	<p>The initial focus should be on presence/absence because:</p> <ul style="list-style-type: none"> <li>limited precision and accuracy of current methods</li> <li>impact generally not related to pest density</li> </ul> <p>Monitoring needs to target 'vulnerable areas'.</p>

<sup>22</sup> It is important to monitor the arrival of a pest (e.g. deer, possum) rather than rely on changes in vegetation (i.e. significant damage may have occurred already).

<sup>23</sup> Variety of different methods used to estimate pest numbers. The accuracy/precision of current methods, as well as the comparability between methods, is generally low and therefore may not warrant extensive efforts and region-wide coverage.

<p><b>3. Habitat fragmentation and isolation.</b>  <b>Note:</b>  1. Quantitative measures for fragmentation includes a variety of measurements, all derived from a GIS database (area per type), including:  <ul style="list-style-type: none"> <li>• <b>Fragmentation:</b> Size/ frequency distribution, per type (number of sites versus range of areas).</li> <li>• <b>Isolation:</b> Distance to nearest neighbour, per type.</li> </ul> 2. There are a number of other possible parameters (e.g. shape to take into account edge effects) that could be measured and combined into a 'Fragmentation Index'.</p>	<p>?  (index?)</p>	<p>Limited information available on specific components of the 'index':  – size/ frequency distribution  – Isolation (raw data available, but need analysing).</p>	<p>EW, DoC, TLAs.</p>	<p>Remote sensing, GIS analysis to calculate index (and its components).   But: No standard methodology available yet to derive 'index'.   Scale important (for small fragments).</p>	<p>Ten yearly  (to coincide with Policy Review cycle).</p>	<p>Regional (focus on vulnerable areas).</p>	<p>5 – 6,000 (2 weeks work)   <b>Note:</b> derived from indicator 4.</p>	<p>EW, DoC, TLA.</p>	<p>Further work required for the procedures and protocols to calculate this indicator/index. (Future surveys and maps need to include outermost boundaries of natural areas as a GIS layer).</p>
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Issue	Unit	Is the information currently available/ accessible (yes/no, comment)	Organisation and contact responsible for collecting the information	Methods used to collect, analyse, and interpret information (e.g. samples, surveys etc.)	Frequency of monitoring (e.g. quarterly)	Location for monitoring (e.g. area, site)	Estimated costs	Contact for reporting & storing information	Comments
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**STATE INDICATORS**

<p><b>4. Area and distribution of indigenous vegetation (natural areas), by type and by administrative boundary (TLA, RC, DoC), tenure, ecosystem/ecoregion.</b></p> <p><b>Note:</b></p> <p>1. Measured by type of vegetation, as classified and defined in EW survey (Landcare 1995).</p> <p>2. The area and distribution will also be used to assess significance and representativeness, i.e. to identify priorities for protection.</p> <p>3. <b>Note:</b> The indicator 3 ('Habitat Fragmentation and Isolation') and 1 ('Area Removed') will be derived from this indicator.</p>	<p>ha</p> <p>(% of total area)</p> <p>(% of pre-human).</p>	<p>Yes</p> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>- link to property info deficient</li> <li>- not by administrative boundaries (eg. DoC)</li> <li>- scale (1:50,000) limits level of classification and resolution (25 ha).</li> </ul>	<p>EW, DoC, TLAs (consortium).</p>	<p>Remote sensing and GIS analysis.</p> <p>First survey to establish classification (types) and provide benchmark. Subsequent surveys to assess change (see Indicator 1).</p> <p>Use larger scale (1:5,000 – 1: 10,000) for specific areas/sites (e.g. small wetlands).</p>	<p>Ten yearly.</p> <p>(to coincide with Policy Review cycle).</p>	<p>Regional.</p> <p>(or as required for specific surveys).</p>	<p>Benchmark survey: ~ \$100,000.</p> <p>Subsequent surveys: ~ \$50,000.</p>	<p>EW, DoC, TLAs.</p>	<p>Significant natural areas (eg. as defined in District Plans) and DoC's Protected Natural Areas (PNA) and Recommended Areas for Protection (RAP) are currently not included in EW GIS system.</p>
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<p><b>5. Status of indigenous vegetation (natural areas).</b></p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>1. See Note 1. Above.</li> <li>2. There is no standardised method to assess ecosystem health. This may include a number of specific parameters (e.g. for wetlands: nutrient status, water level, pH, dissolved oxygen) that may be combined into a single index (e.g. for streams: macroinvertebrate community index).</li> <li>3. Needs target values, i.e. guidelines or standards of what is 'healthy'. Only very few such guideline values are available.</li> <li>4. Here a site assessment protocol that includes site and representativeness was trialed (developed by DoC =&gt; Stephens 1998).</li> </ol>	<p>area x mean condition<sub>now</sub> / area<sub>pre-human</sub> (per ecosystem type).</p>	<p>For some sites  (needs collating, analysing &amp; interpretation, Info very scattered).</p>	<p>Consortium (DoC, EW, TLAs).</p>	<p><b>Collect</b> (for representative sample only):</p> <ul style="list-style-type: none"> <li>- literature rev.</li> <li>- GIS Db with text annotations</li> <li>- landowner surveys/ interviews</li> </ul> <p><b>Analyse:</b> apply DoC methodology to assess condition.</p> <p><b>Store:</b> on GIS Vegetation Db (field available now for code inputs).</p>	<p>Ten yearly (as above)</p> <p><b>or:</b> as appropriate or required for site-specific status assessments.</p>	<p>Regional, but selection of sites from each district.</p>	<p>\$ 10,000 (to gather data).</p> <p>\$ 20,000 to (analyse and store on GIS).</p>	<p>EW, DoC, TLAs.</p>	<p>Based on:</p> <p>The Status of Natural Heritage (Theo Stephens, March 1998, DoC unpublished document).</p>
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Issue	Unit	Is the information currently available/ accessible (yes/no, comment)	Organisation and contact responsible for collecting the information	Methods used to collect, analyse, and interpret information (e.g. samples, surveys etc.)	Frequency of monitoring (e.g. quarterly)	Location for monitoring (e.g. area, site)	Estimated costs	Contact for reporting & storing information	Comments
<p><b>6. Number and distribution of threatened species.</b></p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>1. Threatened species is a generic term that includes vulnerable, rare, and endangered species (IUCN).</li> <li>2. A list of relevant organisms are listed in Mulroy &amp; Davies, 1997: <i>Setting Priorities for the Conservation of NZ's Threatened Plants and Animals</i>.</li> <li>3. This was not considered necessary in our first meeting. It was argued that safe-guarding the health of ecosystems or natural areas should also protect its biota.</li> <li>4. However, it is proposed to include it as a useful 'cross-check' for the above assumption and as an indicator of other potential causes that have not been considered in assessing ecosystem health.</li> </ol>	numbers	<p>Yes</p> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>– species are listed by DoC conservancy (not RC/TLA boundaries).</li> </ul>	DoC.	<p>Various methods.</p> <p>DoC prepares 'Recovery Plans' for each threatened species.</p>	Varies.	Areas where Active management takes place or is being contemplated	?	DoC.	<p>The important aspect is the status of threatened species (and changes in their status). Numbers and distribution, while easier to measure, may simply reflect the effort put in.</p>
<p><b>7. People's perception of the value of indigenous vegetation (natural areas).</b></p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>1. This will be based on regularly undertaken 'Perception Surveys', targeting people's awareness, attitudes and actions toward environmental issues.</li> <li>2. EW is planning the first survey in June/July 1998.</li> <li>3. May include more specific surveys targeting land owners reasons for destroying/modifying indigenous vegetation (natural areas), e.g. clear bush, drain wetlands).</li> </ol>	% (of respondents)	<p>Some</p> <p>(e.g. Waikato County survey on Native Vegetation); survey of wetlands in the Lower Waikato; Franklin DC); EW surveys (Biosecurity Group).</p>	EW, DoC, TLA, NGOs etc.	<p>Perception survey methodology (telephone surveys, questionnaire, focus group discussions etc.)</p>	Three yearly?	Regional, by conservancy, TLAs (depending on policy focus/objectives)	?	EW, TLA, DoC etc.	<p>EW will undertake regular (3-yearly) perception surveys covering a wide range of environmental issues.</p> <p>The first (benchmark) survey is planned for 1998.</p>

Issue	Unit	Is the information currently available/ accessible (yes/no, comment)	Organisation and contact responsible for collecting the information	Methods used to collect, analyse, and interpret information (e.g. samples, surveys etc.)	Frequency of monitoring (e.g. quarterly)	Location for monitoring (e.g. area, site)	Estimated costs	Contact for reporting & storing information	Comments
<p><b>Protection of Indigenous Vegetation and Fauna</b></p> <p><b>8. Economic value of ecosystem services.</b></p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>This indicator estimates the monetary value of direct and indirect services the ecosystems provide (e.g. amenity, re-cycling of nutrients and other elements, water purification, climate regulation).</li> <li>Also still somewhat controversial when used as absolute figures, it recognises the value our natural resources that is not included in the GDP.</li> <li>EW has initiated a project to get some estimates for the Waikato Region. Although they results will not be available for the case study they can be included later in the project. It was therefore decided to add this indicator.</li> </ol>	\$ (per ecosystem type).	(Some).	National: MfE/DoC.  Regional: EW.	Environmental accounting and valuation methods are used to provide an area-based summation of average ecosystem value estimates.  Ecosystem types and areas from NZLRI/Vegetation Cover Database.  Value estimates largely based on overseas information.	10-20 yearly.	Regional.	~\$10,000.	MfE/EW.	
<b>RESPONSE INDICATORS</b>									
<p><b>9. Area of indigenous vegetation (natural areas) legally protected, by type.</b></p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>Measured by type of vegetation, as classified and defined in EW survey (Landcare 1995).</li> <li><b>Legally</b> protected includes areas such as TLA covenants, QEII, reserves, esplanade strips/reserves, water conservation orders, rivers/streams classified for ecosystem protection). See the following indicator for an estimate of the more difficult to measure <u>voluntary</u> initiatives and actions.</li> </ol>	ha  (% of remaining)  (% of pre-human).	Some.  <b>Limitations:</b> problems with DoC boundaries (GIS system constraints).	TLA, DoC (EW).	GIS analysis of digitised data.	Ten yearly.  (to coincide with Policy Review cycle).  <b>or:</b> as appropriate or required.	Regional (by TLAs); by ecoregion ecodistrict, ecosystem?	?	TLA, DoC, EW.	

Issue	Unit	Is the information currently available/ accessible (yes/no, comment)	Organisation and contact responsible for collecting the information	Methods used to collect, analyse, and interpret information (e.g. samples, surveys etc.)	Frequency of monitoring (e.g. quarterly)	Location for monitoring (e.g. area, site)	Estimated costs	Contact for reporting & storing information	Comments
<p><b>10. Number of community groups (e.g. Landcare, Streamcare, Beachcare) concerned with the protection, restoration or enhancement of natural areas.</b></p> <p>Or: area covered? number of people involved? outputs achieved?</p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>While the total number of groups is the simplest information to collect, it is not very meaningful.</li> <li>The number of people involved provides a useful indication of community participation.</li> <li>Output measurements, such as the number of trees planted, the area fenced, or length of dune stabilised can also be readily obtained.</li> <li>In terms of effects on the environment, the total area covered by Care/Community Groups is probably most relevant (could also be expressed as the proportion of the total catchment).</li> </ol>	<p>number of groups (by type)</p> <p>or: ha, % of total,  number of people.</p>	<p>Some (numbers of groups).</p>	<p>EW, TLAs.</p>	<p>Specific surveys.</p> <p>A formal process and a standardised reporting format for Care Group activities aimed at providing useful information needs to be developed.</p>	<p>Annual reporting.</p>	<p>Regional, focusing on: area of interest.</p>	<p>?</p>	<p>EW, TLAs.</p>	<p>Information collected and reported by type (Beach/Dunecare and Land/Streamcare)</p>
<p><b>11. Area of total indigenous vegetation (natural areas) covered by pest control operations (for each pest).</b></p> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>Level of control grouped into: <ul style="list-style-type: none"> <li>'nuisance' control</li> <li>vegetation health/ condition control</li> <li>threatened species control</li> <li>[Tb control]<sup>24</sup></li> </ul> </li> </ol>	<p>ha</p> <p>(% of total).</p>	<p>Yes.</p>	<p>EW, DoC (MAF =&gt; Tb).</p>	<p>GIS analysis.</p>	<p>Annual.</p>	<p>Control area.</p>	<p>Minimal (data from Indicator #2).</p>	<p>EW, DoC.</p>	<p>Area covered by control operations includes both initial operations as well ongoing maintenance efforts.</p>

<sup>24</sup> Generally, Tb control areas are not in ecologically significant areas.

<p><b>12. Proportion of indigenous vegetation (natural area) for which a comprehensive ecological survey has been undertaken.</b></p> <p><b>Note:</b></p> <p>1. Criteria for 'comprehensive' need to be defined.</p>	<p>ha (% of total).</p>	<p>Some.</p>	<p>DoC, (EW, TLAs =&gt; consents?)</p>	<p>GIS analysis.</p>	<p>Five yearly.</p>	<p>Regional.</p>	<p>?</p>	<p>DoC (EW, TLAs).</p>	
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## 8 Evaluation of Key Project Objectives

This section discusses the effectiveness of the tools developed and approach taken (modified PSR framework and ecosystem approach), based on the experience of the Natural Areas group, in achieving integration across environmental media, between agencies and between influences (social, economic, cultural and environmental factors).

### 8.1 Integrated Ecosystem Approach

An integrated approach to resource management means integration across environmental media (air, water, land); integrating relevant environmental, economic, social and cultural aspects; integrating functions and duties by considering all relevant statutes; and the integration and co-ordination between the activities of different agencies and organisations.

Some observations with regard to 'integration' are:

- The team focused on indigenous vegetation (including wetlands) as a surrogate for natural areas (the term 'Natural Areas' includes both terrestrial and aquatic – marine and fresh water-ecosystems). This is reflected in the predominantly land-based nature of the indicators selected.
- The integration and interactions of water/land is best reflected in the mini case study work undertaken with Waipa DC on the 'Waipa Peat Lakes', where an integrated catchment approach is promoted. This includes, for example, the monitoring of land-based activities (e.g. land use/cover) as pressure indicators to assess or predict the state/condition of the water quality in the lakes.
- Numerous "pressure – state – response" links were identified with other related issues, e.g. 'Rural Area Development' and the use of protective covenants through the subdivision process.
- The selected indicators primarily include environmental (biophysical) measurements, but also include some social and economic perspectives (e.g. people's perceptions, values, awareness, attitudes, behaviours, actions and participation, or the economic value of ecosystem services).
- There is an absence of cultural indicators, e.g. information based on traditional knowledge (matauranga). While recognising the importance of such values, the team felt that such indicators need to be developed by tangata whenua. However, constraints in time and resources for the project did not allow for iwi/ tangata whenua involvement.
- The effective management/protection of natural areas requires considerable liaison and co-ordination between resource management agencies (RC, DoC, TLAs, Fish & Game etc.). A narrow interpretation and focus on statutory duties and functions, the lack of clear guidance on respective responsibilities, and limited resources were identified as important constraints to the co-ordination and integration of monitoring activities.

### 8.2 Ecosystem Classification – A Spatial Framework

Currently, Landcare Research (Hamilton) is developing an ecosystem classification framework ('*environmental domains*') for the Waikato Region. This uses climate data (temperature, solar radiation and moisture), landform information (slope, drainage, parent material) and 'disturbance' (natural and human impacts and events) to group the

Region into areas of similar environmental characteristics or, implicitly similar biotic patterns, i.e. ecosystems.

Ecosystem classification can assist in the management of natural areas by:

- providing an understanding of ecosystem structure and functional processes
- providing a framework for the development and selection of appropriate indicators
- setting appropriate, ecologically-based target levels ('biophysical bottom lines')
- providing a rational approach to the design of environmental monitoring programmes
- selecting representative benchmark or reference sites to enhance cost-effectiveness of monitoring (extrapolation of data/information) and targeted, interdisciplinary research.

How was the ecosystem classification approach used for the case study?

Although the Landcare Research project was not sufficiently advanced to be fully applied and tested, some of the concepts of ecoclassification were used as follows:

- As an integral part of vegetation classification and surveys, particularly to assess significance/ representativeness (indicators #5 and #6) and habitat fragmentation and isolation (#3). It will also be used to select suitable benchmark sites.
- To assess areas/ecosystems most vulnerable to pest infestations and any resulting adverse effects (i.e. enabling the cost-effective prioritisation of pest control efforts and resources).
- Waipa peat lakes management (refer *Case Study Report*, Appendix 2F): => use of spatial framework to select representative lake(s) for undertaking extensive investigations and monitoring (and then extrapolate findings to other lakes).
- Assessment of the ecological status/health of a site or ecosystem (refer *Case Study Report*, Appendix 2E)  
=> used to identify relevant pressures, threats and attributes, and the calculation of scores.

### **8.3 The 'Pressure-State-Response' (PSR) Framework**

The PSR framework presents a relatively simple (perhaps too simplistic?) model to consider environmental issues. It enables to take into account our best current knowledge about cause/effect relationships, provides a robust basis to identify information needs, develop and select indicators, for comprehensive and policy relevant analysis and reporting of the information gathered.

Initially, the team had considerable difficulty grouping the information (or indicators) needed to manage/protect natural areas into the 'pressure', 'state' and 'response'. However, during the course of the case study it was increasingly realised that the indicators need to be considered in combination, as a set rather than as individual indicators, or as direct causal links.

The PSR framework proved especially useful in formulating a conceptual model of an issue and for the interpretation and structured reporting of the results (e.g. are our policies working or not; are we using the best method to achieve the desired outcomes?).

## **9 Conclusion and Recommendations**

The following conclusions can be made about the Natural Areas case study.

- The development of indicators for 'natural areas' is a challenging task, because of the different focus and priorities of the various agencies involved and the complexity of the technical/scientific understanding required. It is therefore important to identify and involve the relevant specialist expert staff at an early stage.
- Due to the above, the discussion and communication of issues relating to natural areas is a lengthy, time consuming process that needs expert input and an adequate timeframe for the design and planning of monitoring programmes.
- Spatial databases and GIS technology is essential for the gathering, storage, analysis and interpretation of information and indicators for 'Natural Areas'.
- There is a high demand for training and the transfer of knowledge and technology in the area of environmental monitoring and indicators.
- Lack of commitment, staff skills and other resources for monitoring activities (especially at the TLA level) is a real concern. The project has identified several opportunities for greater integration between resource management agencies and organisations (both on a one-to-one basis, as well as in larger groups with multiple agencies involved).
- In many cases there is a lack of relevant, comprehensive and detailed information in individual agencies. An integrated approach enables best use to be made of information across several agencies.

For future integrated indicator development, it is recommended that:

- 1 The initial focus of indicator development should be on:
  - clearly defining the issue
  - establishing a conceptual model (or framework) for the issue under consideration (including the
  - identification or hypothesis of cause/effects), and
  - identification of information needs (at the 'parameter' level, rather than focus too early on
  - selecting aggregated, high level indicators or indices)
  - establishing an inventory of existing data/information (including availability and accessibility),
  - and identify all the relevant agencies and organisations, and their specialist expert staff.
- 2 Scale and resolution is an important aspect that needs to be addressed when co-ordinating monitoring programmes between different agencies. Considerable opportunities exist for leverage of information outputs with relatively minor additional expenses (e.g. Agribase).
- 3 A comprehensive, regularly up-dated meta database (= inventory) of monitoring activities across the region be assembled so that everyone knows what is monitored by whom.
- 4 The establishment of a Regional Monitoring Forum that facilitates the co-ordinated and integrated planning and implementation of monitoring programmes should be considered.

# Resource Kit

The Project outputs, including background reports, a summary of the Project, templates used in the process, case study reports of three issues (Solid Waste, Natural Areas, Rural Development) with proposed indicators and monitoring plans, and an evaluation of the Project were collated into a 'Resource Kit'. This is available on the Ministry for the Environment's (MfE) website **Error! Bookmark not defined.**

1. Davis, P. and Astbury, C. 1997: *State of the Environment Reporting in New Zealand: A Review of Current Practice*. Report prepared for Environment Waikato by Opus International Consultants, Wellington.
2. Beanland, R.A. 1998: *An Ecosystem Approach to State of the Environment Monitoring and Reporting*. Ruth Beanland and Environment Waikato, Hamilton.
3. Davis, P. and Astbury, C. 1997: *Integrated Environmental Monitoring and Reporting - Resource Management Issues: Discussion Document*. Prepared for Project Group by Opus International Consultants, Wellington.
4. Davis, P. and Morgan, Y. 1997: *Integrated Environmental Monitoring and Reporting: Indicator Development. Preliminary Selection*. Prepared for Project Group by Opus International Consultants, Wellington.
5. Astbury, C.; Morgan, Y.; Huser, B.A.; Cochrane, P. and Beanland, R.A. 1999: *Integrated Environmental Monitoring Project: Stage 4 - Data Planning, Gathering and Collation. Case Study Report*. Prepared for Project Group by Opus International Consultants, Wellington. February 1999.  
This includes the following Appendices: Solid Waste; Natural Areas; Rural Development; Evaluation Survey.
6. Beanland, R.A. 1998: *Integrated Environmental Monitoring Project: Evaluation Report*. Prepared for Project Group by Ruth Beanland Planning and Resource Management Consultants, Turangi.
7. Huser, B.A. 1999: *Integrated Environmental Monitoring Project: Final Project Report*. Prepared for Ministry for the Environment - Sustainable Management Fund by Environment Waikato, Hamilton.
8. Beanland, R.A. and Huser, B.A. 1999: *Integrated Monitoring: A Manual for Practitioners*. Environment Waikato, Hamilton.
9. **Templates.** This includes the following templates developed and used by the Project:
  - *PSR Template*
  - *Indicator Development Template*
  - *Indicator Evaluation Template*
  - *Integrated Monitoring Plan Template*
  - *Indicator Specification Sheet Template.*

Also included are similar templates currently used by MfE for the development and selection of national environmental performance indicators (EPIs):

  - *MfE EPI Templates.*

**All documents are accessible via the Ministry for the Environment's website:  
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