

INTEGRATED CATCHMENT MANAGEMENT PLANNING: BENEFITS OF LOGIC MODELS

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ABSTRACT

Integrated catchment management plans (ICMPs) identify the issues and strategic management objectives for stormwater, wastewater and associated activities in a catchment, define a range of management options and the preferred management approach for avoiding, remedying or mitigating environmental effects and risks; and set out roles, responsibilities and tools for implementation and review. They involve long term outcomes, which are notoriously difficult to explain, understand, manage and measure. Two projects of the Auckland Regional Council (ARC) and its territorial local authorities aimed to build logic models and set measurable objectives to assess long term outcomes across multiple bottom lines such as those required by the Resource Management Act and the Local Government Act's four wellbeings (social, economic, environmental, and cultural). Logic models were built for the ARC to help it assess the effectiveness of its ICMP workstream. They help to summarise the workstream in a way that makes it easy to describe it to others; uncover different perceptions; highlight links between strategic and operational areas; clarify cause and effect relationships; reveal assumptions; and develop measurable ("SMARTER") objectives and programme performance measures. The models used a system of classifying orders of outcomes, including the essential institutional enabling conditions needed to achieve the longer term outcomes of reduced flooding, sedimentation and contaminant discharges in order to improve ecological and public health.

KEY WORDS

Integrated catchment management plans (ICMPs), logic models, measurable objectives, long term outcomes, monitoring, policy effectiveness evaluation, Resource Management Act (RMA), Local Government Act (LGA).

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1 INTRODUCTION

1.1 TECHNICAL AND REGULATORY CONTEXT

Stormwater is currently recognised as having the single biggest impact on Auckland's urban streams and marine ecosystems, which in turn has adverse impacts on the social, cultural and economic values of the regional community (Auckland Regional Council, 2005). To help address this problem, which is exacerbated by sustained urban growth, the Auckland Regional Stormwater Action Team (SWAT) was launched in early 2005. One of the Team's major activities is helping city and district councils in the Auckland Region prepare integrated catchment management plans (ICMPs) to manage the adverse effects of stormwater quality, flooding and associated issues. This work has also been used to enable planners and asset managers to manage the effects of growth via district and asset management plans and to support resource consent applications for the discharges from the councils' wastewater and stormwater networks.

However, managing a catchment is complicated, and it's hard for people to keep an overview of how all the different (and sometimes competing) issues fit together. The process of preparing ICMPs is further complicated by their need to meet the requirements of a large number of planning instruments under different pieces of legislation. They also need to be implemented via the provisions of these and a large number of other instruments.

This makes it very difficult to write a plan that can stay focused on its key issues, objectives and outcomes and sustain a narrative thread across these many requirements. This paper discusses tools to help simplify these complications and at the same time encourage the writing of straightforward ICMPs that are easier to produce, understand, implement and monitor.

1.2 PLAN-MAKING CONTEXT: HOW WELL ARE PLANS IN NEW ZEALAND WRITTEN?

Many regional policy statements, district plans and LTCCPs (long term council community plans) have been reviewed to better understand the links between environmental policy and outcomes, by studying the quality of the preparation and implementation of plans produced under the Resource Management and Local Government Acts (Ericksen et al, 2003). The research links the assessment of plan quality (PQ) to implementation quality (IQ) and, finally, to environmental quality (EQ), or outcomes. It found that the logical links are weak between high-level outcome statements, policy interventions and environmental and other indicators monitored at national, regional and local level (Ericksen et al, 2003). This finding was supported by further specific research work into the stormwater provisions of district plans. Furthermore, the Office of the Auditor General of New Zealand has identified similar issues with waste management plans, asset management plans and LTCCPs (see, for example, some of the reports at <http://www.oag.govt.nz/reports/by-sector/local-government/>).

It is consistent with these findings that the Auckland Regional Council identified that ICMPs, despite their sound technical basis, also share many of the same plan logic issues as other plans in New Zealand.

1.3 AIMS OF THE SWAT TEAM PROJECTS AND THIS PAPER

In light of the above, the SWAT team commissioned a project to help catchment managers improve the logical flow between clearly stated issues, purpose and outcomes and rigorous internal consistency (objectives clearly linked to issues; options to

objectives; methods to options; anticipated results, rules, monitoring and indicators to all the above) of their ICMPs. Part of this was developing a method of formulating measurable objectives that enabled them to work out well how their catchment management options were achieving the desired outcomes in terms of the social, cultural, financial and environmental outcomes requirements by the relevant legislation and regional plan provisions.

Based on the results of this project, the SWAT team then applied this thinking to its own work and commissioned a second project set up a framework to evaluate the SWAT team's ICMP workstream and help it to become more rigorous by improving its internal logic and outcome measures.

This paper summarises key components of these two projects (Feeney et al, 2007a and b) in the context of plan-making in New Zealand. It aims to distil best practice in order to help catchment managers produce plans that are more straightforward to write, implement and monitor.

The main tools and approaches used, adapted and developed to this end that are summarised in the next sections include:

- use of programme logic models to help programme managers and stakeholders work out how to achieve their desired outcomes by sketching out the big picture underlying the scope of work, the key elements involved and the interlinkages and synergies between them
- use of a refined outcomes framework within the logic model, to capture the sequence of institutional, behavioural, social, environmental and other changes that can lead to more sustainable forms of development
- clarification of the difference between what was termed "strategic objectives" (which define the high level outcomes sought by relevant legislation, policies and strategies, and are not necessarily intended to be measurable) and operational catchment management objectives (which need to be measurable)
- use of multiple bottom line indicators that reflect the four wellbeings in the LGA and the aims of the RMA
- use of multi-criteria analysis to help assess different catchment management options across these multiple bottom lines
- adaptation of the "SMART" checklist of criteria for operational objectives (Specific; Measurable, Affordable, Realistic, Time-based – with the addition of two further criteria, Endorsed and Relevant) to enable progress to be measured against all the relevant bottom lines.

2 USING LOGIC MODELS FOR INTEGRATED CATCHMENT MANAGEMENT

2.1 LOGIC MODELS: STRUCTURE AND BENEFITS

Although they can be in narrative form, a logic model is more usually "a diagram that captures information about the main elements of the program being examined and describes in concise terms, how the program works. Through the depiction of the program's activities, outputs, immediate, intermediate and ultimate outcomes, the model enhances our understanding of what this program is meant to achieve" (Health Canada, 2003).

Logic models illustrate a sequence of cause-and-effect relationships, or in other words, a systems approach to communicating the path toward a desired result. Logic models can help summarise challenging programmes that cut across many workstreams and departments and/or agencies: they can help people find ways to articulate and guide planned activities, especially those aiming to disseminate information and encourage its use. Logic models can do this by encouraging people to plan for results by envisioning a 'big picture' view of a project's scope of work and key outcome areas. They also allow for ongoing checks on the internal logic of a programme.

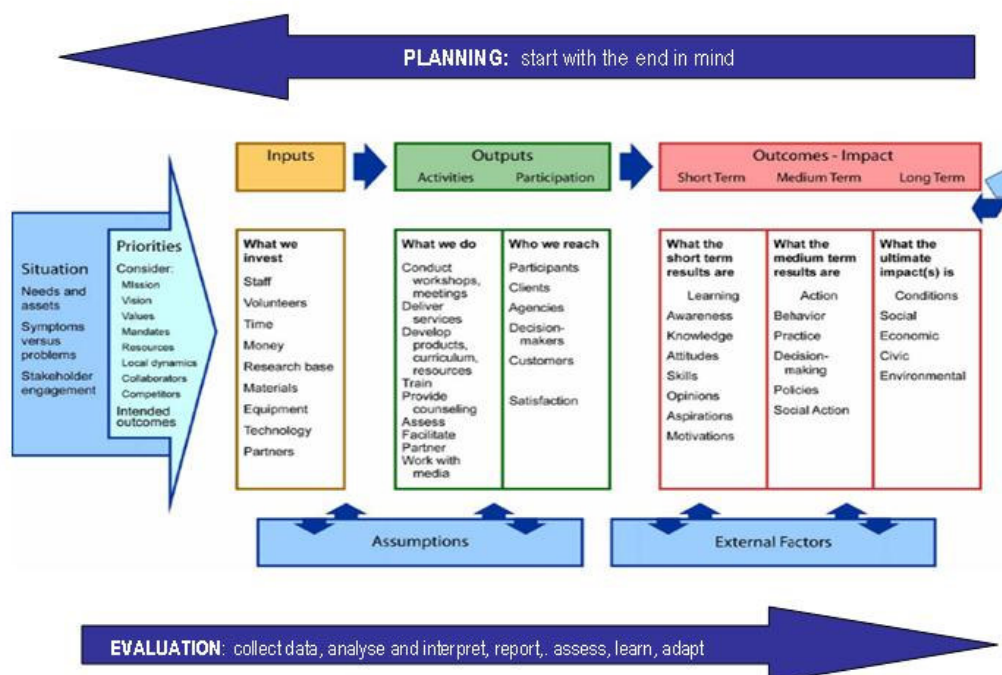
Logic models set out the logical linkages among programme resources, activities, outputs and audiences, and highlight different outcomes aimed at addressing the specific and defined problem or situation. Importantly, once a programme has been described in terms of the logic model, critical measures of performance can be identified.

In this way logic models can be seen to support both planning and evaluation, as shown in the example in Figure 1.

Outcome-focused logic models differentiate between areas of control and areas of influence, in order to distinguish between programme efficiency and programme effectiveness (Watson et al. 2004). For example, because an agency has some control over its programme resources and planned activities and some of their short-term outcomes, the extent to which it produces its outputs is a measure of its efficiency. Effectiveness, on the other hand, indicates how well the agency succeeds in delivering its longer term planned outcomes. As one moves along the logic model, the degree of influence the agency has in encouraging others to take the desired actions diminishes. Intermediate and long term outcomes are strongly influenced by external factors beyond the agency's control, but it is still important to include them in the model to ensure their impact on programme effectiveness is considered.

Figure 1: Example logic model for programme planning and evaluation

Source: Adapted from Taylor-Powell, no date

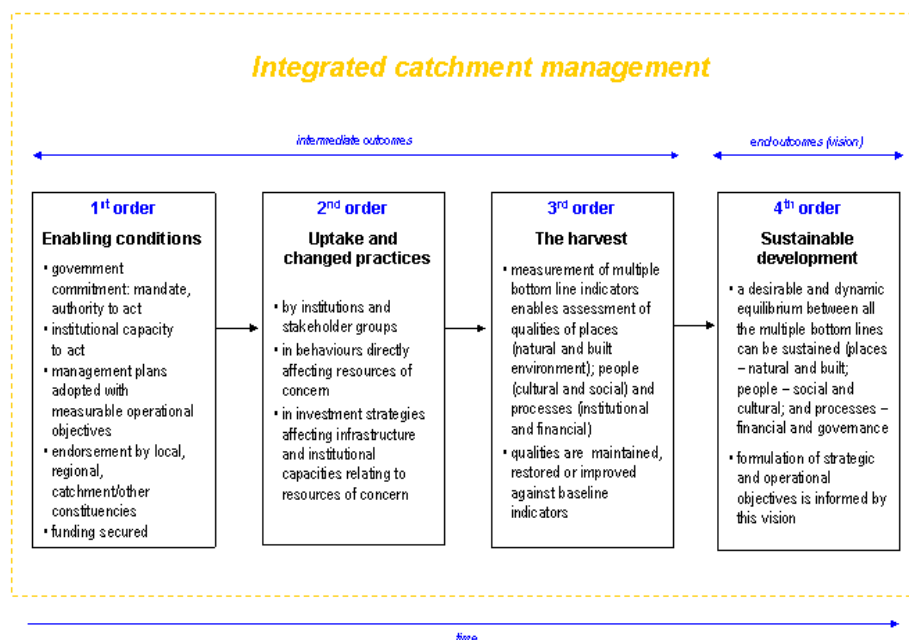


2.2 ORDERS OF OUTCOMES

Many environmental outcomes take time to become evident. A classification of orders of outcomes (Olsen, 2003 and UNEP/GPA, 2006) acknowledges the temporal and spatial dimension of the outcomes of successful integrated catchment management. The orders enable the measurement of outcomes over long periods of time through the sequence of institutional, behavioural and social/environmental changes that aim to promote more sustainable development.

The orders of outcomes model highlights the importance of changes in state (such as better environmental or social outcomes), but recognises that each change in state is associated with changes in the actions of key human beings. Importantly, the model helps managers plan their activities in sequence so they build on each other over time, as shown in Figure 2.

Figure 2: Orders of outcomes approach to monitoring and evaluation
Source: Adapted from Olsen (2003) and UNEP/GPA (2006)



2.2.1 ENABLING CONDITIONS

First order outcomes are the organisational conditions that must be present at the start of any programme to successfully bring about a change such as those envisaged by ICMPs. First order outcomes include the institutional and societal conditions that must be present for a plan to succeed in getting a sustained plan of action carried out to influence the course of events in a catchment. The setting of clear, measurable goals is a key element. For ICMPs, such "enabling" conditions would include:

- government commitment: mandate, authority to act
- institutional capacity to act
- management plans adopted with measurable operational objectives
- endorsement by local, regional, catchment/other constituencies
- secure funding.

2.2.2 CHANGES IN PRACTICE

Second order outcomes are evidence of successful plan implementation such as collaboration among institutions or funding provision. These outcomes reflect stakeholder uptake as evidenced by observable changes in practice by institutions, stakeholder groups and individuals, such as:

- evidence of new forms of collaborative action among stakeholder groups
- changes in practice of actors in response to policy, regulation or voluntary initiatives
- investment strategies affecting infrastructure
- institutional capacities and practices directly affecting resources of concern.

2.2.3 THE HARVEST

Third order outcomes are the socio-economic, structural and environmental outcomes that define the ultimate effectiveness of the programme. These must be defined in unambiguous terms early on in any management process: vague or conflicting objectives and outcomes produce inefficiency and ineffectiveness and make it difficult to assess how successful a programme is being.

Third order outcomes characterise the achievement of identified human and ecosystem objectives, milestones, targets or outcomes – or the rewards of the sustained behavioural change by the institutions, groups and people concerned. Indicators of third order outcomes include multiple bottom line indicators that enable assessment of the qualities of places (natural and built environment); people (cultural and social) and processes (institutional and financial) – the considerations listed in the RMA and the four LGA well-beings. Termed “the harvest”, improved third order outcomes show that qualities are maintained, restored or improved against baseline indicators of the state of the environment, quality of life and other multiple bottom line indicators.

2.2.4 SUSTAINABLE DEVELOPMENT

In the end all of our different activities and policies collectively contribute towards an enhanced future. This ultimate vision or goal of sustainable urban development is recognised as a fourth order outcome. Rather than being seen as a state that we are currently able to define and achieve in measurable terms, sustainability is better viewed as a desirable and dynamic relationship that can be sustained amongst all the multiple bottom lines, including people and the environment. Formulation of strategic and operational objectives can be informed by this vision, as it is sometimes useful as a goal. In this sense, then, we come full circle and acknowledge policy development as an ongoing iterative process, with continuous policy cycles.

2.3 MEASURING ICMP OUTCOMES

Effective plans and programmes enable measurement of their progress towards achieving the desired outcomes. Both the Resource Management and Local Government Acts set out several outcome areas, as does the ARC’s Proposed Regional Plan: Air, Land and Water (ARC, 2004). ICMP outcomes should therefore be measurable across all the relevant bottom lines (social, economic, environmental, and cultural) and reflect the objectives of the relevant legislation, policies and plans.

The project team therefore considered how to frame measurable outcomes that reflected catchment management objectives, multiple bottom lines and the different orders of outcomes. This included an assessment of the use of multi-criteria analysis to help catchment managers weigh up different aspects of a management option across the multiple bottom lines and the selection of indicators.

2.3.1 CATCHMENT MANAGEMENT OBJECTIVES

An ICMP (like any other environmental management tool) must give effect to the relevant objectives of the various instruments that influence it. However, it also sets out management objectives for its catchment, and this is a potentially confusing double use of the term.

The term 'objective' is widely used in New Zealand environmental and local government legislation and statutory tools, but in a different way than in business management tools. Business plans often use layers of terms such as vision, goal, objective and target, usually in such a way that only the latter two are intended to be measurable.

While it would create confusion to recommend use of language that is not consistent with tools relevant to ICMPs, the project team nevertheless needed to distinguish between the objectives in the documents that guide an ICMP from the objectives of the ICMP itself.

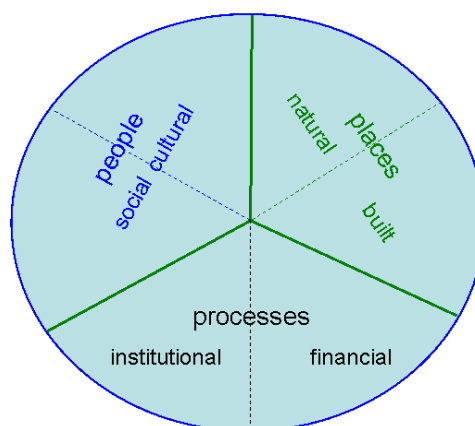
We therefore distinguished two levels of objectives:

- **strategic objectives** define the high level outcomes set out in the objectives, policies and sometimes in other parts of the instruments that influence an ICMP (legislation, regional plans, growth strategies and so on) and are not necessarily intended to be measurable
- **operational objectives** are the catchment management objectives that contribute towards achieving strategic objectives. They set out the practical tasks that an ICMP recommends be implemented by influencing other instruments (district and asset plans and so on) and should be measurable

2.3.2 MULTIPLE BOTTOM LINES

To avoid debate about the respective merits of triple or quadruple bottom lines, the multiple bottom lines (MBLs) model developed by Kettle (2006) was used, as illustrated in Figure 3. This has successfully been used in the Auckland Region for decision-making about urban water asset management and our work with the ARC and other councils showed it could also work well for integrated catchment management. It meets the needs of internal stakeholders by helping to clarify internal capacity issues to resource various options, and it can be a helpful tool for community consultation on issues and options.

Figure 3: Multiple bottom lines for integrated catchment management



Source: Kettle, 2006

2.3.3 MEASURABLE OBJECTIVES

An objective may be defined as the state of affairs that a plan is intended to achieve that is reached by a definite time via tasks and deadlines. There is a vast literature on setting objectives and management by objectives. Fortunately much of it is focused on simple formulae and checklists that are readily applicable to development of measurable operational objectives for typical catchment management issues and options.

Objectives framed in positive terms facilitate options analysis (2.3.4) and development of indicators to monitor progress towards achieving them.

In the context of ICMPs, operational objectives need to reflect and relate to the flow of programme logic throughout the:

- high-level policy requirements (strategic objectives)
- local catchment issues and management option/s
- management option/s
- institutional capacity (internal and inter-agency)
- desired MBL outcomes / anticipated environmental results
- best practicable options for achieving these.

The simplest and most comprehensive set of criteria for measurable objectives was deemed to be the "SMART" set: Specific, Measurable, Affordable, Realistic and Time-based. The earliest use of the 'SMART' acronym for objectives seems to have first been outlined by Peter Drucker in his 1954 book 'Management by objectives'. The final terms for 'E' and 'R' (Endorsed and Relevant) have been adapted by the authors for the purposes of this project. The terms are explained further in Table 1.

Table 1: "SMARTER" objectives checklist

Specific	<input type="checkbox"/> outcomes and methods are precisely defined <input type="checkbox"/> key responsibilities for action are stated clearly in positive terms <input type="checkbox"/> stated in concrete terms using active verbs
Measurable	<input type="checkbox"/> achievement of the objective can be unambiguously measured <input type="checkbox"/> indicator/s of achievement relate to issues, outcomes and methods <input type="checkbox"/> indicators may be qualitative or quantitative (numeric or descriptive) and may include cost
Affordable	<input type="checkbox"/> able to be done with the budget available to both internal and external parties in the required timeframes
Realistic	<input type="checkbox"/> appropriately limited in scope <input type="checkbox"/> achievable in the time, at the cost and with the resources available
Time-bound	<input type="checkbox"/> set an agreed time/deadline for completion <input type="checkbox"/> may include interim milestone dates towards completion
Endorsed	<input type="checkbox"/> internal and external parties involved in identifying and managing the issue, signing off on relevant authorisations and helping to meet the objective agree to their respective roles
Relevant	<input type="checkbox"/> clearly within the duties and powers of those responsible for action <input type="checkbox"/> set out sensible and defensible things to do <input type="checkbox"/> clearly relate to the identified strategic objectives, issues, options and outcomes

When using the SMARTER checklist, we advise users to consider all the "Ws" – what, how, why, who, when, where – while always thinking across the multiple bottom lines in

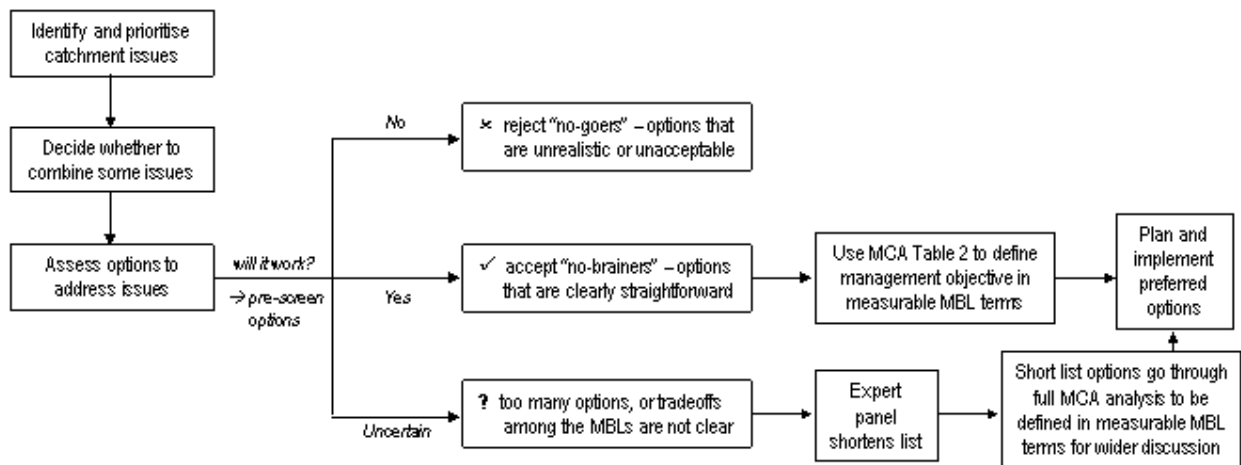
terms of first, second and third-order outcomes. This naturally leads into a consideration of indicator selection and integrating the monitoring of the outcomes across all the bottom lines between regional and district level to meet the requirements of both the LGA and RMA.

2.3.4 MULTI-CRITERIA ANALYSIS

Catchment managers routinely consider multiple bottom lines when assessing various management options in terms of their environmental and economic performance as well as their social and cultural acceptability. However their balancing of these considerations is not always documented, so the decisions and any trade-offs made in arriving at them are not always transparent or contestable, and with turnover of both staff and service providers, much valuable information can be lost. Moreover, this information is also needed for setting objectives that are measurable across all bottom lines.

Multi-criteria analysis (MCA) is another proven tool (e.g. Maunsell AECOM, 2002), and while a full MCA would only be needed to help decision-making in situations where trade-offs among catchment management options are complex and difficult to identify (as shown in Figure 3), the six bottom lines or outcome areas can be used as the basis of formulating measurable objectives for management decisions.

Figure 4: When to use multi-criteria analysis for ICMPs



Considerations before doing an MCA include:

- (i) identifying and prioritising the important issues in a catchment
- (ii) deciding whether to analyse each issue individually or whether to combine some
- (iii) identifying all the options that could be employed to manage the issue
- (iv) screening the issues to identify those that need MCA and those that don't
- (v) shortlisting the number of options for each issue submitted for detailed consideration by way of the full multi-criteria analysis.

Steps in the MCA process itself are:

1. Identify multi-bottom-line impacts of each option.
2. Develop an options analysis matrix.
3. Predict the likely performance of each option for each impact.
4. Assess the impacts against a defensible benchmark.
5. Weight each impact based on the likelihood of its occurrence.
6. Determine the likely performance score and compare options to help select a preferred option or options.

The MCA process is recommended as an *aid* to decision making, *not* a decision-making tool: it is a process for analysing – not selecting – management options. It is therefore quite legitimate in some cases to select an option that has not been ranked the highest.

The thinking behind the options selected and their ranking by the MCA process should be summarised in the ICMP (with a full reference to detailed source materials). Such summaries and resources are invaluable for revisiting options in future or assessing ongoing options implementation, especially after any turnover in council or consultancy staff. They also support consent applications by showing that alternative options were considered before one or more best practical options were selected.

2.3.5 INDICATORS AND MONITORING

Much work has been done and is continuing on choosing indicators and setting up monitoring programmes. For catchment managers, this is particularly complex because most of the technical recommendations of ICMPs can only be implemented through other land use and asset management tools under the RMA and LGA. Many of the desired outcomes also need to be defined, monitored and reported under both Acts, for example district plans and LTCCPs. Where network discharge resource consents are issued, compliance monitoring also needs to be done, and outcomes may also need to be captured via state of the environment monitoring by both the territorial local authority consent holder and the regulating regional council.

Workshops on integrated monitoring of this nature have been held in Auckland and Wellington as part of ongoing work as part of the Landcare Research/University of Auckland low impact urban design and development (LIUDD) research programme. As with many of the reports cited in Feeney and Greenaway (2006, 2007) and on the PUCM and ANEW websites (www.waikato.ac.nz/igci/pucm and www.anewnz.org.nz), there is concern that many monitoring programmes are not comprehensive, robust or integrated, or consistent with related or adjacent programmes.

ICMPs that aim to measure their outcomes in multiple bottom line terms have real potential to make a difference to the quality and cost-effectiveness of outcome definition, implementation and monitoring.

2.4 AN INTEGRATED LOGIC MODEL

As part of the second project for the ARC SWAT team, we built all of the factors discussed in section 2.2 into a logic model that combined the best features of those used by the social scientists (e.g. Watson et al, 2004) together with the environmental outcome monitoring framework developed for managers of complex coastal ecosystems (Olsen, 2003 and UNEP/GPA, 2006). This is shown in Figure 5.

This logic model and a number of activity-specific submodels have enabled the SWAT team to:

- set up and conduct an evaluation of the effectiveness of their own ICMP workstream, and
- work with the TLAs in the Auckland Region to help frame catchment management objectives so as to enable catchment management options and outcomes to be measured in a way that meets the requirements of both the Resource Management and Local Government Acts.

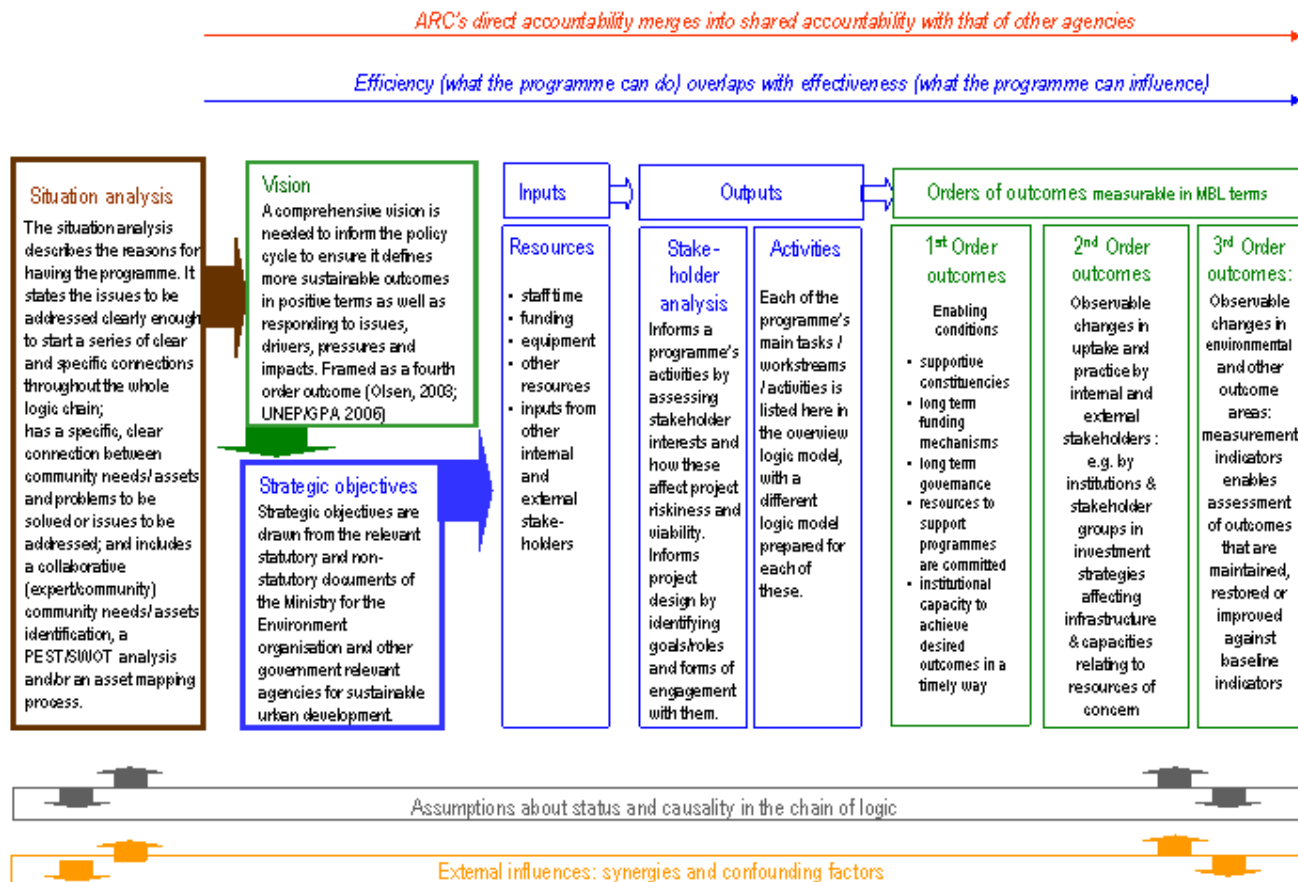
3 DISCUSSION AND CONCLUSIONS

This paper aimed to distil best practice in order to inform catchment managers of some significant research and learnings that could help them produce plans that are more straightforward to write, implement and monitor. We believe that catchment managers can achieve this by drawing on extensive research into plan preparation and implementation in New Zealand, as well as the wealth of social science expertise available world-wide and in New Zealand in building logic models that also incorporate acknowledged frameworks for monitoring complex environmental outcomes.

Key findings were that:

- the orders of outcomes model was readily grasped by all players. It was found to be extremely useful in categorising outcomes and planning the different activities needed to achieve them, as well as clarifying the sometimes long timeframes needed for monitoring purposes
- the distinction made between high-level (strategic, not necessarily intended to be measurable) and operational objectives (which do need to be measurable) was again readily grasped and found to be helpful for catchment management plans
- the "SMARTER" criteria were also found very helpful for councils in assessing their capacity to implement the recommended catchment management options, as well as for framing objectives in measurable terms
- using the six bottom lines proposed by Kettle (2006) in combination with a multi-criteria analysis to assess long term outcomes across the outcomes required by the Resource Management Act and the Local Government Act's four wellbeings (social, economic, environmental, and cultural) was a challenging process, and revealed the benefits of involving many disciplines within the TLAs, such as planners and asset, parks and roading managers, as well as community representatives in framing catchment issues and assessing management options
- using logic models did help clarify the thinking process and make it easier to maintain the flow of logic throughout a project. Logic models could be useful to catchment managers
- the project methodology was one of consultation and collaboration with a wide range of stakeholders within the ARC and among the TLAs, and this resulted in constructive feedback and some prompt application of the tools developed.

Figure 5: A logic model including orders of outcomes model approach to monitoring and evaluation



We note also that government agencies are highly dynamic, with many people and a rich diversity of activities, some of which cross many policy frameworks and may even compete with each other. That creates complexity. Programmes that help improve the implementation of such policies therefore need to take account of:

- measuring progress of both process and tasks in intra- and inter-agency initiatives
- the value of participatory approaches in order to build the relationships that are needed to progress such collaborative programmes
- the need to provide for learning and adaptation to new challenges and opportunities
- the development of a wide (but manageable) range of different indicators that can reflect the different reasons groups taking part will have for being there
- the need for evaluation frameworks that can help us evaluate over time, because we are seeking to evaluate changing institutional cultures and practices, which takes time, in order to achieve outcomes that may take many years to emerge
- the policy cycle model, which acknowledges that successful programmes advance and change through successive policy cycles of planning, implementation and reassessment. Successive generations of such programmes address an expanding agenda of issues and/or a larger geographic area, so the key is to start small, and learn the way to expand the programme over time.

ACKNOWLEDGEMENTS

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