A NEW STRATEGY AND ACTION PLAN FOR RESEARCH WITHIN THE *Working for Water* PROGRAMME

Final Draft
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This document has been endorsed by the Working for Water Programme Senior Management and the Research Review Panel Chairs

CONTENTS

1. Executive Summary

This document presents a new strategy and action plan for the implementation of the research required for the *Working for Water* programme to achieve its overall goals. The point is stressed that research is not a diversion from the main management activities of the programme, but is in fact an essential requirement if these management activities are to be optimally effective.

The **strategy** has ten components:
* communicate the value of research to *WfW* at all levels within the programme,
* identify the issues limiting *WfW's* efficiency and effectiveness which require research solutions,
* establish a protocol to guide the allocation of funds to research within the overall WfW programme, and within the research programme, as the basis for a research business plan,.
* establish and then use the most cost-effective approaches for obtaining this research,
* ensure that adequate capacity is created to meet the programme's research requirements,
* have the priority research competently implemented, using peer-review throughout the process, and then have the research findings carefully documented and archived,
* ensure that the research capacity in *WfW* collaborates closely with the Monitoring & Evaluation Unit in the development of *WfW's* M&E programme,
* monitor and evaluate this research effort (in particular its cost effectiveness),
* ensure there is optimal two-way communication between research and management,
* set in place a procedure to review and update this strategy as and when necessary.

The strategy is followed by an **action plan** which lists the key tasks that have to be carried out in order to give affect to each of the above components. The lead person responsible for each task, the body responsible for monitoring its implementation and the date by which it should be completed, are indicated throughout the plan.

The strategy and action plan are supported by 13 **appendices** which provide background information relevant to the formulation of the strategy (Appendices 1 to 3), membership and terms of reference for the Research Advisory Panel which is the main organ for advising the few staff members of WfW's Research and Development Unit at a strategic level (Appendices 4 and 5), details of the priority research fields, topics and projects which have been identified for *WfW* over the last three years (Appendices 6 to 11), and some of the procedures that have been developed to assist in the contracting out of this priority research (Appendices 12 and 13).

WfW's priority needs in the field of research are as follows: **Firstly,** there is a need to convince all the relevant people within WfW and its parent departments of the essential nature of the programme's research effort. A series of short workshops around the whole country is proposed as an initial means of achieving this objective while at the same time obtaining "buy-in" to this new research strategy and action plan from managers throughout the programme. **Secondly,** there is an urgent need to secure a sound institutional base for, and to massively increase the human capacity for the research effort that will be necessary if *WfW* is to have any hope of achieving its long-term objectives. **Thirdly,** current knowledge on the resource economics of alien invasions in South Africa needs to be summarized (Appendix 8): this will not only provide *WfW* with the essential arguments required to answer the programme's detractors, but will also indicate which are the most important questions still needing research. **Finally,** there are a whole host of pressing management issues, in fields ranging from ecology, through sociology, to operational management, that have already been identified as being priorities for *WfW's* research. The challenge now is for *WfW* to find: the best approaches to having this research conducted, the best researchers, the most cost-effective research management procedures and, crucially, the resources required to have this priority research conducted.

2. Why a new strategy?

The *Working for Water* programme was initiated in 1995 and since that date the programme has been a rapidly evolving one. The programme has been recognized both nationally and internationally as a world leader, both in the field of the management of invasive alien plants and in the field of the management of a socially responsible public works programme. One of the factors that has been key to this leadership position is that the WfW programme has from the outset accepted that research is an integral component of the programme. This research has been conducted within the programme, as distinct from being conducted by an independent research organization, and this full integration of the research effort within the programme is seen as having been one of the factors contributing to its high level of success.

In August 2003 the programme held its inaugural research symposium and the proceedings of this conference were published during 2004 (Van Wilgen, 2004). Accordingly it was felt by the Research Management Committee that it was time to revise the original research strategy and a process was initiated in the last quarter of 2004 to do so. The current draft strategy is the result of this revision and should be regarded as a "work in progress". It is intended that this strategy will be finalized after the appropriate consultations and amendments have been made during the first quarter of 2005.

3. Approaches adopted in developing this strategy.

During the early stages of the revision process, it became clear that what had originally been called "the Research Strategy" was in fact a mixture of a strategy and a tactical plan. Accordingly, it was decided that in this revision it was to be made explicit what was the strategy and what was the action plan for giving effect to this strategy.

In order to arrive at the new strategy it was first decided to list the critical considerations that would need to be taken into account during its formulation. These are listed in Appendix 1. It was also considered necessary to place the *Working for Water* programme's research programme in the broader context of who else in South Africa is currently conducting research on alien plant invasions (Appendix 2). Finally, it was considered necessary to revisit the topic of why the *Working for Water* programme should be involved in research (Appendix 3).

Three key points were repeatedly stressed throughout the revision process.
* The first was that the *Working for Water* research programme could only be justified if the research was aimed at enhancing the efficiency and effectiveness of the overall programme.
* The second was that any research conducted under the auspices of the *Working for Water* programme would be held to the same standards of total accountability, commitment to transformation and social responsibility that underpin the programme as a whole.

* The third was that the *WfW* programme's research effort would be an integral part of the overall adaptive management approach that informed all aspects of the programme's implementation, *i.e.* that the programme was one of "learning by doing". Accordingly, although it is not explicitly stated (except in Strategy Component 7 and its action point, Section 5.8), it should be continually born in mind throughout this strategy that all points in the action plan will be fully monitored and evaluated and the results of this evaluation will then be fed back into improving both the strategy and the action plan.

Finally, the point was made that, even though there was currently considerable uncertainty as to the overall form that the *WfW* programme and its management would take in the future, this did not militate against the formulation of this new strategy at this time. Whatever form the overall programme took, research would still be required and there would be a need to have this research conducted strategically. In fact, the current uncertainties in the programme as a whole merely served to reinforce the need for such a research strategy.

Having considered all this background information, and building on the original research strategy, the following was formulated as the new research strategy and action plan.

4. The new strategy for research within *Working for Water*.

The new strategy is very simple, having only ten components:

Component 1: Convince every relevant person within *WfW* and its parent government departments of the importance of research to the success of the programme.

Component 2: Identify the key issues limiting *WfW's* efficiency and effectiveness that will require research to find their optimal solutions.

Component 3: Establish a protocol to guide the allocation of funds to research within the overall WfW programme, and to the various sectors within the research programme, as the basis for a business plan for research within *WfW*.

Component 4: Establish the most cost-effective approaches to having this research conducted.

Component 5: Ensure that adequate capacity is in place or, failing this, is established to meet the programme's research requirements.

Component 6: Have this priority research carried out and its findings properly documented, peer-reviewed and archived.

Component 7: Ensure that the research capacity in *WfW* collaborates closely with the Monitoring & Evaluation Unit in the development of *WfW's* M&E programme.

Component 8: Monitor and evaluate this research effort (in particular its cost effectiveness).

Component 9: Ensure there is optimal two-way communication between research and management.

Component 10: Put in place a mechanism to ensure that this research strategy is regularly reviewed and updated (when necessary).

5. The new research action plan.

The new research strategy has ten components. The action plan is structured to give affect to each of these components. In designing this action plan the approach has been adopted of taking advantage of those features of the existing *WfW* research implementation model that are working well, and dropping, amending or coming up with alternatives for, those features which are not. It is very important that the progress that has been made in *WfW's* research programme to date are not underestimated, that the lessons that have been learned in the implementation of this programme to date are not forgotten, and that the contribution of all those who have been involved with this research endeavour is appreciated and fully acknowledged.

5.1 Communicate the importance of research within *Working for Water* and its parent government departments.

The facts that the research budget was recently subjected to massive unplanned cuts and that the research strategy has remained incomplete for more than two years, are indicative of the fact that research is not considered a top priority area within the *Working for Water* programme. Unless this core problem can be satisfactorily remedied, all other strategies to improve the performance of research within the programme, and hence its contribution to the success of the overall programme, will be in vain.

5.1.1 Identify "champions" for research within *Working for Water*

Several individuals with the necessary status and communication talents need to be identified and then tasked with "championing" the cause of research within the senior management corps of the *Working for Water* programme and its parent government departments. Without the services of such individuals it is considered unlikely that research will, within the foreseeable future, realize its full potential in helping to ensure the overall success of the programme.

One of the first, and initially most important, tasks of this "research champion" should be to fully develop the logical argument as to why *Working for Water* programme should invest in research (see Appendix 3 for a first attempt in this direction). This "logical argument" must be developed before the second priority task for the "champion" (see

below) or the series of in-house workshops and presentations (see 5.1.2 and 5.1.3) are initiated.

The "champions" second priority task should be to ensure that those responsible for the financial allocations within the different funding sources that make possible the *Working for Water* programme (*i.e.* the DWAF trading account, partner government departments' budgets, overseas aid agency funds, *etc.*) are made aware of the fundamental role that research has to play in ensuring the long-term success of this programme. The champion should urge all the relevant decision takers to make appropriate allocations to the programme's research budget. Such budgetary allocations need to be assured for multi-year periods so as to enable a coherent research programme to be planned and implemented.

The "champions" third priority task should be to ensure that the research being carried out under the auspices of *WfW's* two sister programmes, *Working for Wetlands* and *Working on Fire*, is fully integrated into the *WfW* research programme. Nothing is to be gained by allowing these two sister programmes to generate their own totally independent research initiatives. Indeed there are considerable gains to be made if the three programmes all consolidate their research efforts. The *WfW* Research Advisory Panel should advise all three programmes on their research (rather than generate three separate such bodies).

Responsible persons: Ahmed Khan with the assistance of the Research Management Committee.
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: April 2005

5.1.2 As part of the process to build a consensus within the entire *Working for Water* staff around this new research strategy, a series of half-day workshops should be convened around the whole country.

These workshops should initially be aimed at the programme's senior staff (including those in the Communications Section) and the relevant senior staff of the programme's parent departments who are involved with decision making with respect to *WfW*.

The purpose of these workshops should be three-fold:
(i) to obtain the benefit of the organisation's collective wisdom in designing an optimal research strategy (*i.e.* do not present the strategy as a *fait accompli* but rather as "work in progress": this is key to getting future "buy in" to what should emerge as a consensual strategy),
(ii) to find out from people in all units of the programme what they think are the key problems they are facing which require research solutions,
and, (iii) to demonstrate the relevance of research to the success of the programme.

The effectiveness of these workshops should be assessed, possibly by using some form of questionnaire survey, pre- and post-workshop. The assessment should also provide a baseline against which progress in this field can be measured in future years.

Responsible persons: Ahmed Khan and other RDU staff and a contracted party, with Ahmed Khan being responsible for the contract.
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: June 2005

5.1.3 At each of these workshops an illustrated presentation (or presentations) should be made which highlights how previous research has contributed (and continues to contribute) to the success of what is already being implemented in the *Working for Water* programme.

Responsible persons: Contracted party, with Ahmed Khan being responsible for the contract.
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: March 2005

(Note: if funding for this exercise is not readily available, then possibly the proposed second *WfW* research symposium should be delayed for at least a year and these workshops implemented in its place, using its funding. As can be recalled, the one key area in which the inaugural *WfW* research symposium failed was in its ability to solicit meaningful participation and contributions from *WfW's* managers [Macdonald, 2004].)

5.1.4 This topic should be made a standard item for reporting on at each of the monthly meetings of the Research Management Committee.

A decision should be made as to how best this strategically critical activity should be continued in the future (see also Sections 5.8 and 5.9 which might in time do away with the need to have a specific follow-on action under this heading).

Responsible persons: Ahmed Khan
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: August 2005

5.2 Identify the key issues limiting *WfW's* efficiency and effectiveness that will require research to find their optimal solutions.

There will never be enough resources to carry out the research necessary to answer every question that managers face within the diverse set of activities that make up the daily work of the *Working for Water* programme. A crucially important strategic activity is thus the prioritisation of management's needs for research solutions.

5.2.1 Set up a Research Advisory Panel composed of experts on each of the various legs of the *WfW* programme and senior managers from the programme.

(Note: this Research Advisory Panel [RAP] is to replace the six Research Review Panels and their "Panel of Chairs" that were formerly constituted to fulfill this function under the original research implementation model. These panels' terms of office all end in March 2005 and, apart from the Biocontrol Research Review Panel (which has been singularly

successful), have all had their problems. It is considered an unnecessarily cumbersome and expensive arrangement for the current size of the *WfW* research budget, and the realistic appraisal of the limited number of existing and new research projects that will need reviewing each year. A single Research Advisory Panel with experts (both from the RAP and outside the RAP) being contracted on a task-by-task basis to review project reports and new project ideas, and with the Research Advisory Panel using these reviews to inform their decisions on work in progress and future priorities, is considered a more appropriate arrangement. This decision is also aided by the realization that in future (as has recently been decided by the relevant state administrative structures) appointments to any such panel will have to go the route of public advertisement, review of nominations, *etc.* It will be much less onerous for the limited staff of the RDU to have to appoint, and service, only one such panel rather than the six that were originally intended and the three or four amalgamated review panels that were going to continue. The reality is that almost all of the six research fields have actually determined the top research priorities [or have instituted projects to identify these, as in the case of the Resource Economics group] and these will be enough to fill the full research budget for the foreseeable future – unless the activities under 5.1 end up securing a much enhanced budget for research in the next few years. The workshop process envisaged under Section 5.1.2 will also identify some future research priorities.)

Appendix 4 lists the members (or failing the identification of a suitable member, the field of expertise of such a still-to-be-identified member) of the Research Advisory Panel. Wherever possible these experts should be chosen so as to also provide representation on the RAP of the relevant government departments (*e.g.* DWAF, DEAT, DoA) and statutory research bodies (*e.g.* Water Research Commission). Where this does not prove possible it might well become necessary to appoint additional members to the RAP (with alternates to try to ensure regular attendance) with specific mandates to represent important stakeholder entities otherwise not represented on the panel.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: June 2005

5.2.2 Create the Terms of Reference (TORs) for the Research Advisory Panel.

These should clearly state the roles and responsibilities of the Chair and Members (ensuring that the identification and prioritisation of WfW's research needs is central to the panel's existence). Ensure that the chair and members of this panel all understand and have bought into these TORs.

The primary role of the RAP will be to advise the RDU on the policy/strategy aspects of the research programme. It will have the responsibility for providing an integrated multidisciplinary perspective of the entire WfW research programme, for both the RDU and the programme's senior management. In addition it should provide an overview function relating to the quality of the research being produced by the programme. By contrast the Research Management Committee (which is primarily made up of the RDU's staff members assisted by a few research advisors) will be mainly involved with the

implementation of the agreed research action plan, *i.e.* will focus on the tactical aspects of the research programme. The RMC will, for example, choose the peer reviewers for specific research proposals and products. The Research Management Committee will report to the RAP (*e.g.* the minutes of the monthly RMC meetings will be vetted by the RAP for any points worthy of its noting and comment as a standing item on every RAP meeting's agenda).

Appendix 5 presents the Terms of Reference for the Research Advisory Panel.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: First draft TORs by March 2005. Final version August 2005 (the first RAP should be given a chance to amend these before they are finally adopted). The TORs should thereafter be scrutinised and amended by the RAP in August of each year as changing circumstances and experience gained call for such amendments.

5.2.3 Review and update the existing research priority lists.

Appendices 6 to 12 record what the previous Research Review Panels had determined by 2004 as the research priority topics, and, in some cases, priority research projects under the six previously identified priority research fields for *WfW*. These will initially need to be updated by removing topics and projects where these have now been adequately researched and by adding in new topics as identified by the series of workshops with the programme's managers (see Section 5.1.2). Thereafter it will be one of the Research Development Unit's key responsibilities to ensure that these priority lists are updated annually - by convening structured annual workshops with managers, contracting expert reviews, *etc.* as deemed necessary. It might even prove cost effective to employ dedicated staff members within *WfW* (*e.g.* one per region) to provide the interface for improved two-way communication between the research programme and the operational management of *WfW*. Elsewhere such "runners" have been found to be of enormous value to such multifaceted dynamic programmes as is the WfW programme.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Advisory Panel (RAP).
Proposed date of completion: (1) First review and update by September 2005. Thereafter annual reviews to be completed by September each year (to allow for planning of the new research budget in time for it to be included in the overall programme's budget for the next financial year [which starts in April]). (2) The concept of employing dedicated staff to improve the research-management interface needs to be evaluated, motivated and this motivation considered by WfW's senior management by the end of 2005.

5.3 Establish a protocol to guide the allocation of funds to research within the overall WfW programme, and to the various sectors within the research programme, as the basis for a business plan for research within *WfW*.

Possibly the key decision determining the future of research within *WfW* is the decision as to what proportion of the total funds that are available for the programme should be

allocated to research. On this decision rests everything else. Accordingly, it should not simply be allowed to be a subjective decision of one or a few people in the senior management of the programme or of the programme's parent departments. A considerable effort should therefore be made to work out what would be an optimal allocation of resources to research within the overall programme. This is by no means an impossible task, as resource economic approaches and optimization procedures are now well established tools in organisational planning exercises. Once such a protocol has been devised it should be further developed such that it can be used to guide the RDU and its Research Advisory Panel in deciding what proportions of these research funds should be allocated to the various sectors within *WfW's* research programme, e.g. how much to biocontrol research versus research into social aspects, ecological aspects, *etc.*. Once completed, this protocol will provide the basis for developing a full business plan for research within the WfW programme. The completion of this business plan should then be the next priority for the research programme under this heading.

Responsible persons: Ahmed Khan and other RDU staff (and possibly contracted parties, where specific tasks in the development of this protocol and the subsequent research business plan can be contracted out).
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: (1) December 2005 for a first draft of this protocol. (2) March 2006 for a first draft of a business plan for research.

5.4 Establish the most cost-effective approaches to having this research conducted.

It should not be automatically assumed that the only way that *WfW* can obtain the research solutions to its priority management problems is by funding somebody or some institution to carry out this research. Although funding will often be required to obtain these research solutions, there needs to be a broader strategic approach to this matter.

5.4.1 Pursue appropriate collaborative and partnership relationships with other South African research organisations whose research interests overlap *Working for Water's* research agenda.

Undoubtedly one of the most cost-effective approaches to achieving *Working for Water's* research objectives, will be through actively promoting collaborative agreements with other bodies (such as the newly established DST/NRF-funded Centre for Excellence in Invasion Biology centered on the University of Stellenbosch, the South African National Biodiversity Institute, Water Research Commission, the Plant Protection Research Institute of the Agricultural Research Council, the Medical Research Council, the Human Sciences Research Council, *etc*.) that already have formal mandates to carry out research in areas which overlap with *WfW's* priority research fields. Already such an arrangement has been entered into with respect to research in the field of the hydrological impacts of invasive alien plants (in this case with the Water Research Commission). In some cases it might be most cost-effective to develop formal collaborative agreements with such bodies that exempt them from the normal bureaucratic procedures governing the

contracting out of research (as, for example, CSIR's Boutek Division has entered into with the Department of Housing).

The exceptional opportunities that *WfW* presents as an enormous "field experiment", with replication throughout the country's diverse ecosystems and human communities, needs to be actively promoted amongst these research bodies.

There are, for example, potentially significant new developments being made by certain universities in the field of biological control of invasive alien plants using unusual groups of organisms (*e.g.* nematodes) as the biocontrol agents. It is important that *WfW* evaluate possibilities for collaboration in such novel fields. Already several South African universities have aligned their post-graduate research programmes with *WfW's* priorities in the field of restoration ecology (Holmes *et al.*, 2004) and this could become a highly cost-effective approach for WfW to achieve its research objectives.

As a first step in the process of actively encouraging such expanded collaboration, it will probably be necessary to commission a study of all that is currently going on in the relevant priority fields in the statutory bodies (including tertiary training institutions) throughout the country. Following such a study, *WfW* should develop a strategy as to how best it can communicate with such potential partners, how best to bring them on board with *WfW's* research priorities (*e.g.* it might be useful and economically advantageous to create some dedicated research fellowship positions in certain of these bodies), and how best to make it easy for them to conduct research within the "*WfW* laboratory".

Responsible persons: Ahmed Khan and other RDU staff (and possibly contracted parties, where specific surveys need to be conducted).
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: July 2005

5.4.2 Recruit research involvement from overseas research bodies in WfW's priority projects and programmes

The point has been repeatedly stressed in recent overviews that the *WfW* programme provides unrivalled opportunities globally for determining landscape-scale ecosystem responses to massive landscape-scale ecosystem perturbations. Similarly, as a massive national-scale "experiment", with many regional replications, in poverty alleviation, social upliftment and social transformation, its potential as a rich resource for social and economic research is also exceptional. The resources available for research in the wealthier nations overseas, dwarfs what could be made available for this purpose within the national fiscus. In several other fields of research and in numerous developing countries, enormous advances have been made by involving overseas institutions in nationally relevant research programmes. A concerted effort should be made to "sell" this unrivalled opportunity for directed applied research in all the fields in which *WfW* so desperately needs research-based solutions in order to improve its field performance. Directing this task should be included in the Research Advisory Panel's Terms of Reference and the topic should be a permanent item on every meeting of the RAP until

this panel decides that it has adequately fulfilled its brief in this regard and the process has become self-sustaining.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Advisory Panel (RAP).
Proposed date of completion: First plan of action to put into effect this idea by September 2005. Thereafter annual plan of actions for this initiative to be completed by September each year (to allow for planning of any budget that might be necessary to affect this "international marketing exercise" [*e.g.* sponsored attendance at relevant international symposia, sponsored publications on WfW's potential in international journals and magazines, lecture tours of relevant tertiary-training institutions, creation of appropriate website on the internet, *etc.*] in time for it to be included in the overall programme's budget for the next financial year [which starts in April])

5.4.3 Seek alignment with other bodies to achieve the desired research outcomes.

There is a need for a continuous awareness that the problems that *WfW* is facing are not necessarily unique to itself. Wherever possible the programme should enter into strategic partnerships with bodies such as the private sector (*e.g.* the forestry industry and private agriculture as represented by organisations such as the Forest Owners Association and AVCASA), other state departments (e.g. the Land Care programme of the Department of Agriculture and Land Affairs), provincial bodies (including parastatals such as South African National Parks, Cape Nature, Ezemvelo KwaZulu-Natal Wildlife), local authorities, and non-governmental bodies (*e.g.* NICRO, Treatment Action Campaign, etc.) and the larger ecoregion conservation programmes (e.g. the Cape Action Plan for People and the Environment [C.A.P.E.], the Succulent Karoo Ecoregion Programme [S.K.E.P.], the Succulent Thicket Ecoregion Programme [S.T.E.P.], the EU-funded Wild Coast Programme, the B.I.O.T.A. programme, and the South African Environmental Observatory Network [S.A.E.O.N.]. At an international level the WfW programme must continue to foster its links in the field of research with the umbrella body for work on biological invasions, the Global Invasive Species Programme (GISP) and its major constituents such as the World Conservation Union (IUCN) and other major international players in this field such as the World Wide Fund for Nature (WWF). Seeking this alignment and turning this into productive research partnerships should be an active responsibility of the RDU within *WfW*. The Unit currently does not have the manpower resources to achieve this objective, but the RAP should consider conceptualising, and motivating specific initiatives for this purpose and then funding specific contracts to achieve this end.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Advisory Panel (RAP).
Proposed date of completion: First plan of action to put into effect this idea by September 2005. Thereafter annual plan of actions for this initiative to be completed by September each year (to allow for planning of any budget that might be necessary to affect this national "marketing exercise" [*e.g.* sponsored attendance at relevant national symposia to make presentations aimed at securing this alignment, lecture tours of relevant tertiary-training institutions, sponsored articles in appropriate newspapers, magazines and journals, *etc.*] in time for it to be included in the overall programme's budget for the next financial year [which starts in April]).

5.5 Ensure that adequate capacity is in place or, failing this, is established to meet the programme's research requirements.

A considerable concern is that there is currently such a lack of capacity in several fields (*e.g.* biocontrol, resource economics, and hydrology) and even in the area of research management, that the research *WfW* requires to be carried out simply cannot be done before there is a concerted capacity-building programme. In particular, the following subsection has been identified as being the top priority in this field, but this factor must be borne in mind throughout *WfW's* research programme.

5.5.1 Ensure that there is adequate capacity (trained manpower, facilities and resources as well as institutional support) to produce biological control agents for South Africa's important established and emerging invasive alien plant species.

It has already been well established in South Africa and internationally that biological control is generally the only sustainable way to control major invasive alien plant species once they have established populations that are already so large or so widely dispersed that total eradication through physical or chemical means is no longer feasible. It has also been demonstrated that the investment in research required to identify safe biocontrol agents and then to develop techniques to mass rear them for release, is the most cost-effective use of alien plant control funds. Although South Africa is a world-leader in this field, it has recently started to lose capacity in this field and inadequate capacity has already been identified as a key constraint to the long-term success of *WfW's* efforts to control invasive alien plant species threatening South Africa's water resources and other ecosystem services.

5.5.1.1 Secure an institutional base for biological control of invasive alien plant species

With the recent quasi-privatisation of the former Department of Agriculture's research arm in the Agricultural Research Council, the long-standing secure institutional base for this biocontrol work, the Weeds Unit of the Plant Protection Research Institute, has been put at risk as the future institutional base for this crucially important research. As it is essential to *WfW's* long-term success that this biocontrol research effort be maintained (and in fact strengthened) in the coming decades it is crucial that a sound institutional base be found for this activity. Accordingly the *WfW* research action plan calls for the programme itself to take the necessary steps to ensure that such a base be established.

Responsible persons: Nceba Ngcobo.
Monitoring body: Research Management Committee (RMC)
Proposed date of completion: December 2004.

5.6 Have this priority research carried out and its findings properly documented, peer-reviewed and archived.

Using all the approaches outlined in Sections 5.4 and 5.5 (above), and in time having built up the knowledge as to which approach is the most cost-effective for *WfW* in the various fields and types of research in which WfW is interested, it is important that the priority research is carried out within time scales that are appropriate to meet the programme's management needs. This "research management process" is summarized in the diagramme below (Figure 1).

INSERT FIGURE 1

5.6.1 Set up and regularly update as appropriate a standard procedure for contracting-out priority research projects.

A standard procedure has already been developed within *WfW* for evaluating proposals for the contracting out of research projects (Appendix 12) and this is administered by the staff of the RDU. This approach needs to be continually reviewed to make sure it is meeting its objectives efficiently and effectively. At the present there is no reason to devote further effort to this aspect of the research management process as the current system is working well. The current role of the Research Review Panels in this procedure will in future (after March 2005) be taken over by the Research Advisory Panel.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Management Committee (RMC).
Proposed date of completion: Update the procedure to show the role of the new Research Advisory Panel by March 2005. Check that the procedure is still functioning optimally annually in March thereafter.

5.6.2 Ensure that all research projects are fully peer reviewed

The RDU (and in some cases the entire WfW programme) do not have staff that are experts in all the fields in which the programme will require research to be carried out. Accordingly, it is a crucially important step in the research management process that expert peer review be employed at the following stages in the research process (a) when tenders for research are submitted, (b) when approved researchers submit their research plans for particular projects for approval prior to implementation, and (c) when researchers submit their progress and final reports [in this connection it is important to note that, contrary to the general practice in this matter, the peer review of progress reports is probably even more critical than of final reports as there is still the chance to make adjustments to the research project in the case of the former]. The standard terms for the reporting on contracted out research projects have already been produced (Appendix 12).

Finally, it is absolutely essential that as a standard term of every significant research contract issued there should be the requirement that the research project's findings are published expeditiously in a peer-reviewed journal. The researchers should be made

aware that the standing of the journals in which they publish their results will be used in future evaluations of their applications to undertake further research for *WfW*.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: With immediate affect and continuous thereafter.

5.6.3 Archive all research data, reports and publications produced

It is essential that all the research that WfW has conducted on its priority projects (regardless of how this is achieved: see Section 5.2 above) is adequately documented (in both paper and electronic format wherever possible with suitable back-up copies of all electronic records) and that these records are safely stored. The archiving is not simply an end in itself but rather is an activity directed at ensuring that this information is never lost and that it continues to remain accessible to researchers and managers who might need to refer back to it at some time in the future. Without compromising long-term security and certain rights of authorship of the initial published research reports, the emphasis of this archiving activity should thus be on ensuring that the reports/data are readily accessible and retrievable. However, in terms of the master paper copies of reports the archive should not be a "lending library": these master copies of reports/data should not be allowed out of the archive except for copying by the archive keeper. The provision of a readily accessible and "user-friendly" source of information as to what is in the archive (possibly web-based) is crucial to the success of this archiving activity. The terms of all contracted research should ensure that the contracted party provides reports/databases etc. in suitable form for archiving and that there is clarity on all sides regarding the copyright restrictions relating to these records.

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Management Committee (RMC)
Proposed date of completion: With immediate affect and continuous thereafter.

5.7 Ensure that the research capacity in *WfW* collaborates closely with the Monitoring & Evaluation Unit in the development of *WfW's* M&E programme.

The M&E component of the overall WfW programme is a key element in the adaptive management process that links research into the programme's operational management. It is of fundamental importance that research informs the design of the M&E systems and that the results of M&E in turn inform the design of the research programme. It is only through the application of the detailed knowledge gained through research to the design of the M&E system that one will be confident that this M&E system will be able to deliver robust statistics in a cost effective manner. Huge sums of money can be completely wasted if an M&E system is suboptimally designed.

Responsible persons: Ahmed Khan and other RDU staff (one staff member should be given explicit responsibility for interacting with *WfW's* M&E Unit, and it is likely that the task of

ensuring that the best research findings are fully incorporated in the evolving M&E system will need to be contracted out by *WfW*).
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: With immediate affect the designated member of the RDU should be tasked with ensuring that the evolving *WfW* M&E system is designed so that it fully reflects the best findings of research to date and that it will deliver robust statistics in a cost-effective manner. The monitoring of the periodic updating of the evolving M&E system to reflect the latest research findings should become a continuous task thereafter.

5.8 Monitor and evaluate this research effort (in particular its cost effectiveness).

It is important that *WfW's* research programme is continuously monitored and evaluated to find out which approaches to research are delivering the best returns (see Section 5.4 for a discussion of some of the alternative approaches). It is also important to evaluate which projects and which contracted parties are performing best. Similarly, there needs to be continuous evaluation of which approaches are achieving the most effective end results in terms of rate of adoption of research findings. The research programme should itself become "a learning organisation", continually striving to improve its performance and delivery. Wherever possible, the results should be presented in economic terms, and in this connection it is important to cost the inputs required from RDU staff members, from the various committees, and from other contracted parties to the various approaches, projects and final research outputs.

This evaluation should form a section in the annual research report, even if initially the evaluations are, by necessity, light on data and heavy on opinion! In time this situation ought to improve as more concrete evaluations become possible.

Responsible persons: Ahmed Khan and other RDU staff (one staff member should be given explicit responsibility for leading the compilation of this section of the Annual Research Report, and accordingly for the assembling of the necessary data throughout the preceding year, using contracted experts to help as appropriate).
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: The first such evaluation should be presented in the 2004/2005 Annual Research Report and as such will need to be completed by February 2005. therafter the evaluation report should be produced annually by December, vetted by both the RMC and RPA, prior to its inclusion in the Annual Research Report.

5.9 Ensure there is optimal two-way communication between research and management.

Research is only conducted within the *Working for Water* programme so as to improve the programme's management. It is thus crucially important that there be unhindered communication, both from management to research as to what requires researching, and from research to management as regards the answers it is providing to management's

problems. As has previously been proposed (see Section 5.2.3), this communication is so important, that one or more dedicated "runners" should be appointed within the programme. Such a "runner's" primary function would be to facilitate this communication.

5.9.1 Make all research findings accessible in user-friendly forms so that they can be readily implemented in management.

If research is to attain its rightful place within the *WfW* programme it is very important that research findings that improve the programme's efficiency and effectiveness are implemented widely and rapidly. However, it is outside the power (and mandate) of any research unit to ensure that its findings are implemented by the management sections within the organisation. All that the research programme can realistically do in this respect is to ensure that research findings are communicated rapidly and effectively and in user-friendly formats to the rest of the organization. However, **this aspect of the research strategy is nevertheless crucial to its long-term success** (and to the success of the overall programme: if *Working for Water* fails to become what in recent parlance is termed "a learning organisation", it will almost certainly fail to achieve its full potential and, in the extreme case, could fail entirely in achieving its mission). The following practical steps can be taken to facilitate the uptake of research findings by management.

5.9.1.1 Take steps to ensure that the relevant managers are involved in the planning of research relevant to their portfolios.

This can be done by (a) creating opportunities for managers to be involved in the generation of the organisation's research programme (see section 5.1 for example), (b) holding workshops at the initiation of major new research projects to which the relevant managers are invited (e.g. Holmes *et al.*, 2004), (c) writing into the TORs for all contracted research that the researchers actively engage the relevant managers in their planning activities (and field programmes wherever appropriate) and (d) fully involving the senior management representatives on the Research Advisory Panel in this aspect of the research process (they should be given the responsibility of ensuring that the research commissioned or stimulated does in fact meet the organisation's priority management needs).

Responsible persons: Ahmed Khan and other RDU staff.
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: With immediate affect and continuous thereafter.

5.9.1.2 Ensure that all research projects deliver their findings in formats and via communication channels that are accessible to all the relevant managers

This should wherever possible be written into the TOR of research projects (*e.g.* the condition that the findings be produced not only in peer-reviewed scientific journals but also in "popular" form, such as manuals, expert-systems and even as articles in popular

magazines. However, it should be acknowledged that not all competent researchers are good at communicating to non-specialist audiences (although most really good ones are!). The role of *WfW's* Communications Division in making these research results accessible to the organisation's managers should also be born in mind (see Section 5.9.2 below).

Responsible persons: Ahmed Khan and other RDU staff (one staff member should be made responsible for liaising with the WfW Communications Division to obtain this communication via formal *WfW* channels, such as the Annual Research Report, *WfW's* Annual Report, *WfW* internal and external newsletters, the *WfW* website, *etc.*).
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: With immediate affect and continuous thereafter.

5.9.1.3 Put in place a mechanism to bring to the attention of the relevant senior managers any observed failures to implement a useful research finding.

It is not good enough to simply be able to observe that a research finding is not being implemented (or is not being implemented fast enough or thoroughly enough). What is needed is an established route whereby such a failure can be brought to the attention of the programme's senior management so that they can take the appropriate steps to rectify the situation. If the programme is going to be prepared to invest significant funds in research then it is essential that such a senior management check on the implementation of the research findings is actively promoted.

Responsible persons: Ahmed Khan should take the need for this mechanism to his immediate superiors for onward transmission up to *WfW's* EXCO.
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: By the end of 2004 such a mechanism should be agreed upon by WfW's EXCO.

5.9.2 Work out an optimal relationship between the WfW research programme and the WfW Communications Division

Their needs to be a formal agreement between the *WfW* research programme and the *WfW* Communications Division regarding the respective roles of these two arms of the organisation as regars the communication of research results. What should be avoided is unnecessarily wasting the time and resources of the research programme (including that of RDU staff members, the research committee members – RMC and RPA, and contracted parties be they project researchers or others) in producing communication tools and products that are suboptimal in terms of their communications value. Similarly the resources of the Communications Division should not be wasted in the production of communication products which do not adequately cover research topics. Experience has shown that the communication of research findings is a complicated business and it requires special approaches to make it succeed (see also Section 5.9.1.2).

Responsible persons: Ahmed Khan and other RDU staff (one staff member should be made responsible for liaising with the *WfW* Communications Division).
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: Formal agreement between RDU and Communications Division by January 2005. Update this annually thereafter in the light of experience and changing circumstances: a half –day workshop to create this agreement would probably be a good idea, at least initially.

5.9.3 Conduct an audit of the available communication resources, approaches and tools and decide on a research communications strategy and a suite of these tools which will best meet the organisation's needs

What is required is a careful analysis by both parties as to what their respective needs are and how these can best be met to the maximum advantage of the *WfW* programme. The anlaysis should take the form of "zero budgeting" approach where the value of all established tools is put up for inspection. Possibly some should be discarded completely and totally novel approaches adopted in their stead. For example, how useful do people in the organisation find the Annual Research Report? Who is reading it and what are they doing with the information they obtain from it? How is it influencing their future decision making with respect to research and with respect to management? Having completed such an analysis, there is a need to create a short research communications strategy as a subcomponent of this strategy.

Responsible persons: Ahmed Khan and other RDU staff (one staff member should be made responsible for liaising with the *WfW* Communications Division).
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).
Proposed date of completion: April 2005 for the first draft of this Research Communications Strategy. Thereafter it should be revised annually.

5.10 Put in place a mechanism to ensure that this research strategy is regularly reviewed and updated (when necessary).

A strategy such as this is never static: circumstances change, knowledge as to what works and what does not is continually increasing. Accordingly, it is essential that the WfW research strategy never be simply accepted as being "the final answer". It should always remain subject to scrutiny and adjustment as and when necessary. This is not to say it should be continually changing: it is important to decide on one particular course of action and then to stick with this long enough for its success or otherwise to be evaluated.

Responsible persons: Ahmed Khan (who as the senior member of the RDU staff should carry overall responsibility for the Research Strategy).
Monitoring body: Research Management Committee (RMC) and Research Advisory Panel (RAP).

Proposed date of completion: This strategy should formally be adopted in April 2005, as soon as the first Research Advisory Panel has had a chance to vet and approve it. Monitoring and evaluation of the effectiveness of the overall research strategy should start immediately with the first report to the RAP on its effectiveness being made in early 2006. It would be appropriate that the first major improvements to the strategy be made in about April 2006 and annually at this time thereafter.

6. Acknowledgements

This strategy has "evolved" from the previous versions of the strategy. Accordingly, the compilers of the current strategy wish to pay tribute to all those who have helped shape the *Working for Water* research programme over the last decade, in particular the chairs and members of the Research Review Panels, the programme's research advisors, Prof Roy Siegfried and Dr Brian van Wilgen, the programme's small but dedicated research staff team and, in particular, the two team leaders Dr Christo Marais and Mr Ahmed Khan. The compilation of this version of the strategy was led by Dr Ian Macdonald.

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8. List of appendices

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Appendix 1 to the New *Working for Water* Research Strategy

Strategic considerations underpinning the new research strategy.

3.1 The research strategy will have to be fully supportive of, and, in fact, rapidly become an integral part of, *Working for Water's* overall strategy.
3.2 Creation of new knowledge on alien plant invasions and their management is not a primary goal of the *WfW* programme in terms of its agreed programmatic strategy.

Therefore research will not be carried out by WfW *as an end in itself.*
3.3 As *WfW* is a pioneering initiative, continually "breaking new ground", existing knowledge will frequently be found to be inadequate to ensure that the programme's management is optimal.

Therefore it is certain that research will be needed to fill these knowledge gaps.
3.4 Because the implementation of suboptimal management policies, procedures and technologies inevitably results in wastage of *WfW's* resources, investment in directed research which leads to significant improvements in any of these aspects of management will prove to be a highly cost-effective use of *WfW's* resources.

Therefore it is essential that research receive an appropriate share of WfW's *resources.*
3.5 The existing research effort external to the *WfW* programme within South Africa is currently insufficient, and inadequately aligned with *WfW's* research needs, to fill important knowledge gaps within a realistic time period (see Appendices 2 and 3).

Therefore it is incumbent on WfW *to take appropriate measures so as to increase the amount (and quality) of relevant (aligned) research so that these knowledge gaps can be filled rapidly.*
3.6 It has already been demonstrated that, despite the substantial annual budget that *WfW* currently receives, if it continues to operate at its current levels of funding and current levels of efficiency, it will take too long for it to achieve its strategic objectives (Marais *et al.*, 2004), particularly given the predicted worsening of the problem as a result of rapid human-induced climate change in the decades ahead (Rutherford *et al.*, 1999; Mooney and Hobbs, 2000; Macdonald, 2004).

Therefore WfW *has no "surplus funds" to squander on suboptimal approaches to filling these knowledge gaps. All* WfW's *research must be highly cost effective.*
3.7 Several resource economic analyses have already shown extremely high returns on investment in research where this research is aimed at the development of biological controls for invasive alien plants (Van Wilgen *et al.*, 2004: Zimmermann *et al.*, 2004).

Therefore WfW *must guard against making the mistake of assuming that the most useful employment of its resources is simply in "getting on with the job" of managing invasive alien plants, i.e. that research is a diversion away from the rapid attainment of the programme's goals. Instead* WfW *must aim at achieving an optimal mix of expenditure on management and expenditure on research.*
3.8 The type of management problems that will require research solutions range from short-term to long-term (in particular given that *WfW* is planned to be at least a twenty-year programme, and, given new invasions, will probably turn out to be even longer).

Therefore WfW *must have a research strategy which is flexible enough to provide rapid answers to immediate management questions while also having the capability to provide the sustained research necessary to provide long-term solutions (e.g. biocontrol).*

Appendix 2 to the New *Working for Water* Research Strategy

Who else is researching invasive alien plants in South Africa?

In the past most of the research on alien plants was conducted by the research divisions of the Department of Water Affairs and Forestry and the Department of Agriculture and Land Affairs (or their predecessor departments). In the more recent past this research was mainly taken over by the Environmentek Division of the CSIR and by the Weeds Research Division of the Plant Protection Research Institute (PPRI) of the Agricultural Research Council (ARC). These semi-state bodies require external funding for them to be able to carry out research on invasive alien plants and, in recent years much of this has been funded by *Working for Water* (with a lot of the research on the hydrological impacts of alien plants being jointly funded by the Water Research Commission).

A lot of the basic taxonomic and spatial inventory work on invasive alien plants has historically been carried out by the National Botanical Institute (or its predecessor institutions). Most recently this work has been taken over by the PPRI in the form of the Southern African Plant Invaders Atlas (SAPIA) project. The educational aspects of the management of invasive alien plants has also recently been handled by the PPRI..

A number of South African universities (in particular Rhodes [RU] and Cape Town [UCT]) have played an important role in fostering research on alien plant invasions and their control. The biocontrol programme in particular has benefited enormously from a long history of collaboration between universities and the PPRI. The PPRI's Weeds Research Division was recognised in 2001 as being the institution which had made the greatest contribution to South Africa's wellbeing in any of the fields of science, engineering and technology over the last decade (van Wilgen, 2004). However, before it is concluded that the alien plant biological control function in South Africa is well handled without any need for input from *Working for Water*, it needs to be pointed out that since 1995 "funding from *Working for Water* has been the principal support for weed biological control in South Africa" (Zimmermann *et al.*, 2004).

In recent years the Institute for Plant Conservation at UCT has played an important role in fostering ecological research on plant invasions in South Africa. However, with the move from UCT to the Univesity of Stellenbosch of the research leader in this field at UCT, Prof Dave Richardson at the end of 2004, it is likely that this institute will markedly reduce its research contributions in this field.

In 2004 the Department of Science and Technology (DST) and the National Research Foundation created a multi-organisation "Centre of Excellence for Invasion Biology (CIB)" centred on the University of Stellenbosch. The CIB will, for at least the next decade and with major funding coming predominantly from the DST, have as its major roles the execution and coordination of research, student training, and community interaction in the field of invasion biology throughout the country. The vision of the CIB is to provide the scientific understanding required to reduce the rate and impacts of biological invasions in a manner that will improve the quality of life of all South

Africans. In addition, the Cape Action for People and the Environment (CAPE) programme will be modestly funded by the Global Environment Facility (GEF) for at least the next five years (and possibly for the full duration of the CAPE programme of 15-20 years) to help stimulate Centres of Excellence for research in this field within the Cape Floristic Region. This CAPE project is likely to work in closely with the CIB initiative.

It is important that *Working for Water* work closely with all other alien plant research initiatives in South Africa, and possibly further afield, *e.g.* those of the Global Invasive Species Programme (GISP) in the development and execution of its research strategy.

Appendix 3 to the New *Working for Water* Research Strategy

Why does *Working for Water* need to invest in research?

The *Working for Water* programme is a bold attempt to deal with a range of significant environmental and social problems that affect the well-being of all South Africans. As with most such programmes, there is a need for sound knowledge on which to base management actions. Where knowledge is lacking or incomplete, research will be needed to fill important gaps. As the programme is developmental in nature, and is often breaking new ground, research will also be necessary to provide guidance to managers.

It might appear to an outside observer that the basic rationale underlying the *Working for Water* programme is so well established (*i.e.* that invasive alien plants are wasting South Africa's precious freshwater resources, and that it has been proven that their control or removal is one of the best investments we can currently make) that the programme could function quite adequately without any further research. However, this is not the case as there are still many unanswered questions such as: (1) How should we best control particular species of invasive alien plants? (2) How should we prioritise our control programmes? (3) How can we prevent reinvasion of cleared areas? (4) How should we carry out control programmes so as to maximise the rate of recovery of the natural vegetation (and so as to minimise adverse impacts such as biodiversity loss, water pollution, accelerated soil erosion, etc)? (5) How can we prevent new species of alien plants from invading South Africa? (6) What levels of alien plant invasion can be tolerated in particular ecosystems if eradication of the alien plant species involved is no longer an option? These are just a very small sample of the type of unanswered questions that require answers if the *Working for Water* programme is to be able to function at optimal effectiveness.

In a programme as extensive as the *Working for Water* programme even a small improvement in our ability to control a particular species can mean a difference of millions of Rands in long-term costs of control. The massive returns on investment that have already been demonstrated for the research required to produce well-tested and effective biocontrol agents for some of South Africa's most important plant invaders, provide striking examples of this point (van Wilgen *et al.*, 2004).

There is also a need for *Working for Water* to invest in basic research in alien plant invasions as our understanding of the invasion phenomenon is far from robust: For example, we still lack any practically useful predictive ability as to which species of alien plants will or will not prove to be invasive if introduced to South Africa. One only has to consider the enormous value that we have gained from the basic research that was initiated in the 1930s on the water-use of alien trees in SA's mountain catchments (Görgens and van Wilgen, 2004), to realise that we simply cannot afford to stop doing such research now. In other parts of the world, there is still uncertainty in the minds of decision-makers as to whether or not the planting of alien trees increases or decreases water production from mountain catchments. We are extremely fortunate that in South

Africa the catchment research required to answer this question unambiguously was initiated more than half a century ago.

In so far as *Working for Water* is not simply an alien plant control programme but also has a strong emphasis on economic empowerment and social upliftment, it is also essential that the programme's research covers these fields as well, so as to ensure that the programme effectively and efficiently meets its objectives in these fields. Because *Working for Water* constitutes an entirely new approach (*i.e.* the national-scale implementation of a socially relevant approach to the resolution of an environmental problem in a developing nation), it is certain that the programme will need to invest in relevant applied social and economic research.

In general, *Working for Water* will need to invest most of its research funding at the level where the knowledge generated through **basic research** (which will mostly be conducted by other institutions such as the new Centre of Excellence for Invasion Biology centered on the University of Stellenbosch, see Appendix 2) is translated into technologies which managers can then apply to solving the types of real problems they face. The products of this **applied research**, together with the knowledge gained from the systematic monitoring and evaluation of *Working for Water's* ongoing programmes, must then be used to produce new materials, products and devices, to install new processes, systems and services, or to improving substantially those already produced or installed. This last step in the research and development process is termed **experimental development** and *Working for Water* must invest heavily in this step if it is to translate its investment in research into real gains in the effectiveness of its various programmes.

Appendix 4 to the New *Working for Water* Research Strategy

Membership of the Research Advisory Panel (proposed).

(1) Panel Chair: An experienced expert in the field of the prevention and management of invasive alien species, preferably with a broad knowledge of the topic AND an excellent meeting chair.

(2) Expert on invasive alien plant biological control using insects as biocontrol agents.

(3) Expert on invasive alien plant biological control using pathogens as biocontrol agents.

(4) Expert on ecology of biological invasions in southern Africa (could possibly be the representative of the Centre for Invasion Biology but does not have to be).

(5) Expert on the hydrological impacts of alien plant invasions in southern Africa.

(6) Expert on the resource and development economics of alien plant invasions.

(7) – (9) Three experts on the range of social aspects relevant to poverty relief programmes.

(10) High level representative of the Centre for Invasion Biology [unless handled by (4)]

(11) – (14) Four high level *Working for Water* staff members, preferably the Programme Leader, General Manager, Head of Strategic Services and Head of Communications Section. EACH OF THESE TO HAVE A DESIGNATED ALTERNATE and one of the two to be present at every meeting of the RAP. The duty to pass information from the RAP upwards to the WfW EXCO and downwards to the relevant sections' staff must be written into each of these staff members' terms of employment.

(15) Head of the Research and Development Unit should be an *ex officio* member of the RAP. This staff member to act as the "Secretary" for the RAP although he/she should be assisted by a competent minutes secretary at every RAP meeting.

Appendix 5 to the New *Working for Water* Research Strategy

Terms of Reference for the Research Advisory Panel.

These terms of reference (TORs) lay out the roles and responsibilities of the Chair and Members of the Research Advisory Panel (RAP).

Overall role of the RAP.

The major function of the RAP is to advise on the identification and prioritization of the Working for Water programme's research needs.

To fulfill this function the RAP will advise the RDU to ensure that all the necessary tools are utilized in assisting with the prioritization. The RAP will also be called on to advise on the results of the monitoring and evaluation initiative of the WfW programme.

Secondary role of the RAP.

The second most important role of the RAP is to assist the RDU in ensuring that the value of research to the WfW Programme is fully understood and appreciated at every level within the organization and at the relevant decision-making levels in its parent departments.

Subsidiary roles of the RAP.

The following are also seen as being important roles of the RAP:
* To assist the RDU in "selling" of the idea to potential research providers, nationally and internationally, that the WfW programme provides unrivalled opportunities for directed applied research in all the fields in which WfW needs research-based solutions in order to improve its field performance.

* To assist and advise the WfW programme's efforts to seek alignment with other bodies in South Africa so as to achieve WfW's desired research outcomes in the most cost effective manner.

* To monitor and review the cost effectiveness of the various approaches being used to obtain the research that WfW requires, and to feed the information from this review into the evolving WfW research programme.

* To assist in the procedures required for contracting out priority research projects, as and when required by the RDU.

* To assist the RDU in ensuring that all research projects are fully and competently peer reviewed (at all the relevant stages in the research

process, i.e. the contracting out process, the formulation of research plans, the review of mid-term progress reports, the review of final progress reports, and the publication of research results).

* To assist in ensuring that research projects remain true to their management-related goals.

* To assist the RDU in ensuring that all research projects deliver their findings in formats and via communication channels that are accessible to all the relevant managers.

* To assist the Programme in ensuring that WfW monitors and evaluates the programme's overall research effort and, in particular, its cost effectiveness.

* To advise the RDU such that any research conducted under the auspices of the *Working for Water* programme conforms to the same standards of total accountability, commitment to transformation and social responsibility that underpin the programme as a whole.

Appendix 6 to the New *Working for Water* Research Strategy

Priorities for ecological research as at 2004.

The goal of research in this field is to improve our understanding of ecological processes that affect, or are affected by, invasive alien plants, so that we can (i) develop best management practices for the control of invasive alien plants in South Africa; and (ii) assess accurately the type and magnitude of the impacts arising from these invasions.

1. Background and rationale

An understanding of the ecology of invasive alien plants, and of the impacts that they have on ecosystem function, is central to the development of an effective control programme. In the first instance, a thorough understanding of the life cycle of the target alien plant, its mechanisms and rates of spread, and its vulnerability to various forms of treatment are needed to design and improve control methods. In the second instance, the impacts of invasive alien plants on ecosystem features such as susceptibility to fire and soil erosion are critical areas that need to be understood. Much of an ecosystem's ability to deliver those "goods and services" from which humans benefit (such as riverflow stabilisation, water purification and pollination), is dependent on retaining the biodiversity that supports such goods and services. An understanding of the impacts of invasion on biodiversity, and hence on ecosystem function and stability, is therefore necessary for prioritising control interventions. It is worrying that even after years of recognition of the seriousness of the invasive alien plant problem in South Africa, our understanding of their impacts is fragmentary at best and completely lacking in certain areas (Richardson and van Wilgen, 2004).

As was emphasised in the first multi-stakeholder workshop on *Working for Water's* ecosystem repair project in September 2004 (Holmes *et al.*, 2004), it is crucially important for the future of the whole programme that we provide quantitative proof that we are achieving the primary goals of the *Working for Water* programme. To date, there is very little real evidence that the third goal (ecological integrity) is being met. In fact - there have been complaints in the media that removal of invasive alien vegetation by *Working for Water* is causing erosion, damaging the landscape and marring the scenery. It is the task of the Ecology Research Review Panel to ensure that the *Working for Water* Programme contributes to ecological integrity, and to provide evidence that it has done so. It is only very recently in *Working for Water's* history, that systematic recording of the alien plant control programme has reached the level at which we can even begin to provide summary statistics with confidence on the areas, species and densities of alien plants controlled (Marais *et al.*, 2004). Now that these data are available it is imperative that we develop, through relevant applied research, the technologies necessary to estimate the ecological impacts of the programme.

2. Strategic approaches

The basic strategy to be employed in this field is that of working in partnership with other organisations which are researching the ecology of alien plant invasions in South Africa. In this respect the recently established Centre of Excellence in Invasion Biology, centred on the University of Stellenbosch needs to be emphasised. However, there are numerous other partner organisations such as various other universities and technikons, the national department of Agriculture, the Agricultural Research Council, South African National Parks and the various provincial and local government conservation agencies that need to be kept in mind in this connection.

A strategic consideration that emerged strongly from *Working for Water's* first national research symposium concerns global climate change (Macdonald, 2004). It is now widely acknowledged that the problem of alien invasion will be seriously exacerbated by climate change – and other components of "global change" - in the future (see papers in Mooney and Hobbs, 2000). The predicted effects over the coming decades of rapid human-induced climate change in South Africa are so profound (Rutherford *et al.*, 1999) that all researchers undertaking projects in this field must take steps to ensure that such effects are considered when designing any research project, so that at least some meaningful predictions can be made in this connection, when ultimately the research project's outputs are formulated as recommendations for management.

3. Research priorities

The following five broad categories of research were considered **the priority areas** for *Working for Water's* ecological research contribution:
(a) Vectors and pathways of invasion of invasive alien plants (IAPs);
(b) Prevention mechanisms and tools that can be utilised in the management of IAP's;
(c) Control options in managing IAP's;
(d) Rehabilitation options to be considered where clearing is taking place;
(e) Ecological impacts of IAP's (range, abundance and effect).

Within these broad priority areas, the following were considered the seven **top priority research projects** in this field for the period 2005 to 2007:
(a) Accurately assess at a scale of 1:250 000 the extent of invasion of the 25 most important invasive alien plant species in the country.
(b) Develop models that will enable the rate of spread of the country's ten most important invasive alien plant species to be predicted
(c) Establish protocols for clearing in savanna and grassland ecosystems.
(d) Establish protocols for setting achievable targets for ecosystem repair (with priority being accorded to riparian ecosystems in the first instance).
(e) Develop models to enable the quantification of impacts of pines, Australian acacias and myrtles.
(f) Develop models to enable the quantification of (i) the impacts of a range of types of alien plants on fire regimes in the major fire-prone biomes, and (ii) the effects of fire on these alien plants' invasions.
(g) Develop a strategy for the management of mesquite (invasive hybrids of *Prosopis*).

The terms of reference for some of these projects are presented below.

4. Terms of reference for the priority projects.

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4.1 An assessment of the rate and potential of spread of invasive alien plants in South Africa.

- Provide a list of invasive alien plant species both in terms of species that have already become a problem, and species already present in South Africa that could potentially become a problem in future.
- Provide a description of the determinants of distribution and mechanisms of spread, and the potential impacts of each of these species.
- Rank these species in terms of their importance. The magnitude of potential impact will be the most important criterion to consider.
- Provide generic and mathematically explicit models that describe the rate of spread of the most important species as ranked above. Wherever possible, the models should be based on data on actual spread rates as observed in South African ecosystems as a first priority, and from other parts of the world.
- Provide estimates of the potential area that would be impacted by the most important species, and the time that it would take for each species to reach the full extent its invasion potential.
- Provide a report detailing the results of the above-mentioned tasks. It is expected that this project will be completed within 18 months of signature of the contract.

4.2 An assessment of the current extent of invasion in South Africa.

- Establish the existing status of data sets of alien invading plant distribution in South Africa, by means of a desktop survey that should include data residing with Working for Water, Agriculture, Land Affairs, Conservation agencies, Water Boards, Private Sector, Academic institutions and any other sources, and the existence of any current mapping initiatives.
- Identify gaps in existing data sets.
- Workshops with Working for Water personnel to prioritise gaps in terms of their importance to the Working for Water Programme.
- Produce report on the above-mentioned tasks.
- Identify appropriate survey methods to adhere to Working for Water mapping standards (A guideline document can be obtained from the National office) in the areas where important gaps in information have been identified. Provide an estimate of the expected costs of surveying (using the appropriate methods) those areas where important gaps have been identified.
- Produce report on the above-mentioned task.

It is expected that the above work should be completed within 6 months of signing of contract. Upon completion of the above tasks, the Working for Water Programme intends to commission a survey/s of important areas in order to map the extent of invasion by invading alien plants. The successful consultant in this work will be considered for the next phase of mapping work, but Working for Water reserves the right to appoint alternative consultants for all or part of this work. At this stage consultants are not required to present proposals for undertaking the survey/s.

4.3 A desktop study of international best practice in identifying and screening potential invaders.

Tenders are invited from suitably qualified service providers to assist the Working for Water Programme in a review of international best practice with regard to the identification and screening of potentially invasive alien plants. The purpose of such screening would be to assess the invasive potential of alien plants with a view to supporting a permit system that would reduce the risk of accidentally introducing invasive species, while at the same time allowing for the introduction of useful and non-invasive plants. The following needs to be done:

- Provide a review of the legal requirements for the import of alien plants to South Africa;

- Provide a list of all available models that seek to predict the invasive potential of plants, and assess their effectiveness;

- Provide a review of procedures followed in various countries where invasive potential of plant species is assessed, and where permits are issued for the importing of plants. Special attention should be given to procedures in the United States, Australia and New Zealand;

- Investigate feasibility of customising existing Australian screening procedure. Consultation with developers of Australian protocols for weed risk assessment and the Australian Quarantine and Inspection Service is required (e.g. PC Pheloung AQIS; CS Walton Dept Natural Resources Qld; DJ Kriticos CSIRO Entomology and CRC Weed Management Systems; RP Randall Agriculture WA)

- Provide a review of available databases of invasive and potentially invasive plants that could support a decision support system for assessing invasive potential;

- Provide a report on the pathways whereby alien plants arrive in South Africa. This should include assessing import by sea, land and air (from customs records), and from post (mainly through the postage of seeds). An assessment should also be made of the potential for the import of plants and seeds via the internet; and

- Provide recommendations for the adoption of a suitable system in South Africa.

4.4 The development of a clearing protocol based on ecological criteria for mesic savannas and sweet grassveld.

Tenders are invited from suitably qualified service providers to assist the Working for Water Programme in the development of a clearing and follow-up management protocol based on ecological criteria for mesic savannas and sweet grassveld. The following needs to be done:

- Provide an overview of the effectiveness of clearing methods (mechanical, chemical and biological) currently used for major invasive species in South African mesic savanna and sweet grassveld ecosystems. The species should include at least black wattle (*Acacia mearnsii*), lantana (*Lantana camara*), and triffid weed (*Chromolaena odorata*), and any other species identified as important by Working for Water management staff;

- Assess the degree to which ecosystems can recover after clearing. This assessment should take account of the density of cleared invasives, the time the site had been invaded prior to clearing, and features of the ecosystem and indigenous vegetation (such as soil stability, indigenous seed pools and so on) that affect recovery.

- Develop protocols for follow-up clearing for various habitats and invasive alien plants

- Based on the above, develop a protocol that will enable managers to assess the best approach to clearing invasive plants. The protocol should allow managers to select appropriate combinations of mechanical, chemical and biological control, based on ecological features of the site.

4.5 An assessment of the fuel properties of important invasive species.

Tenders are invited from suitably qualified service providers to assist the Working for Water Programme in an assessment of the fuel properties of important invasive alien plant species. The species assessed should include black wattle (*Acacia mearnsii*), rooikrans (*Acacia cyclops*), pines (*Pinus* species), and Spanish reed (*Arundo donax*). The following needs to be done:

- Assess the physical fuel properties of stands of the above species, including fuel loads by size class, amounts of dead and live material, and the spatial distribution of fuel;
- Monitor the moisture contents of live fuel over one year;
- Assemble fuel models that simulate the combined impacts of invasion on fuel properties at a stand level;

- Use fire behaviour simulation techniques to assess the effects of changes in fuel properties on fire regimes (including the likely frequency, temperature, behaviour and impacts of wildfires); and
- Where possible, verify the assessments in the field, either by conducting experimental burns or making opportunistic use of prescribed burns of accidental fires.

4.6 An assessment of the threats posed by invading grasses to the Nama-Karoo, Succulent Karoo and Fynbos biomes

Tenders are invited from suitable qualified service providers to assist the Working for Water Programme in an assessment of the threats posed by invading annual grasses in the Karoo and Fynbos biomes. Experience in arid ecosystems in other parts of the world suggests that such invasion by grasses into non-fire prone arid ecosystems can lead to the occurrence of fires, with serious consequences for biodiversity in a species-rich ecosystem that is not adapted to fire. Grass invasions may also directly influence plant and animal diversity and the grazing value of rangeland. The following needs to be done:

- Assess the species that are invading, or may invade, these biomes;
- Estimate the extent of such invasion, the determinants of spread, and the likely extent of invasions at different times in the future;
- Make an assessment of the likely future occurrence of fires in the biome, based on an assessment of fuel properties, irregular rainfall patterns, the occurrence of weather that would be conducive to the occurrence of fires, and any evidence of fires where grasses have already invaded;
- Estimate economic and ecological costs and benefits of grass invasion in terms of forage availability and performance of indigenous plants
- Assess the likely impacts of fire on biodiversity in the biome; and
- Make proposals for mitigating the impact of predicted invasions.

4.7 An assessment of the impacts of invasion of savanna and grassland ecosystems by black wattle on fire regimes.

Tenders are invited from suitably qualified service providers to assist the Working for Water Programme in an assessment of the impacts of invasion of savanna and grassland ecosystems by black wattle on fire regimes. The following needs to be done:

- Assess the degree to which fires occur in conservation areas, mountain catchment areas, farms and communal land where black wattles have invaded;

- Assess the impacts that invasion has had on the intensity and/or severity of fires in these areas, compared to the intensity of similar fires in indigenous vegetation;

- Assess the impacts of changes in fire intensity, if any, on the soil properties and recovery of vegetation in burnt areas, compared to fires in indigenous vegetation; and

- Make recommendations for the mitigation of impacts of invasion on fire regimes.

4.8 An assessment of seed longevity of invasive hard-seeded legume species in a range of biomes.

Tenders are invited from suitably qualified service providers to assist the Working for Water Programme in an assessment of seed longevity of invasive Australian Acacia species in the fynbos, grassland and savanna biomes. The seeds of invasive Australian Acacias are long-lived and accumulate over many seasons in the soil. The soil-stored seed pools are a source of re-invasion of cleared sites over many decades. However, there are very few data on seed longevity, and it is important to quantify rates of seed decay in order to effectively plan for follow-up operations after clearing. In addition, the recent introduction of a range of biological control agents on Australian Acacias has resulted in dramatic declines in seed production rates. A baseline assessment of soil-stored seed pools under established stands of Australian Acacias is needed for in order to assess the impact of this reduction in seed production on soil-stored seed pools. The following needs to be done:

- Review available information on soil-stored seed pools and seed decay in Australian Acacias;

- Assess the size of soil-stored seed pools at a range of sites in the fynbos, grassland and savanna biomes invaded by Australian Acacia species, including all of those Acacia species against which biocontrol agents have been released. Assess the percentage viability of soil-stored seeds at different soil depths;

- Simulate the impacts of fire on seed pools by assessing the impacts of heating at different depths on seed mortality and germination rates;

- Assess the impacts of biological control agents on soil-stored seed pools by comparing sites where biocontrol agents have been released with sites free of biocontrol agents;

- Assess the rate of decay in viable soil-stored seed over a three-year period, and over longer time-scales by re-sampling sites where seed banks of alien acacias

have previously been assessed (e.g. Dr P Holmes study sites) and determine the factors contributing to changes in the rates of decay;

- Make recommendations for managers on how to most effectively prevent excessive germination following clearing by developing protocols for the timing of follow-up treatments in combination with the introduction and maintenance of populations of biocontrol agents.

- Develop monitoring protocol which managers can use to assess the threat of soil stored seed over time.

The successful service providers will be required to consult with service providers appointed to investigate the biological control of invasive Australian Acacia, to prevent duplication of work.

4.9 An assessment of suitable targets for ecosystem repair in a range of ecosystems, and the development of criteria for gauging whether targets have been met.

Tenders are invited from suitably qualified service providers to assist the Working for Water Programme in an assessment of suitable targets for ecosystem repair in a range of ecosystems, and the development of criteria for gauging whether targets have been met. This project should focus on riparian areas in fynbos, grassland and savanna ecosystems. Service providers should indicate in their proposals the degree to which they are familiar with the concepts of restoration, rehabilitation, revegetation and ecosystem repair. In each of these ecosystems, the following needs to be done:

- Assess the degree to which cleared riparian ecosystems in each of the above biomes has been achieved following clearing operations undertaken by the Working for Water programme, and provide a report on this;

- Establish achievable goals for repair, and provide measurable criteria for assessing the success of repair operations;

- Identify the impacts of invasion on riparian ecosystems, and the factors that will limit the ability of ecosystems to recover;

- Develop protocols for the incorporation of repair goals into management programmes, and for the monitoring of variables to assess the achievement of goals.

4.10 The development of a strategy for the management of mesquite (invasive hybrids of *Prosopis*).

These terms of reference will follow a workshop to be held shortly with major stakeholders, led by the Department of Agriculture.

Appendix 7 to the New *Working for Water* Research Strategy

Priorities for hydrological research as at 2004.

The goal of *Working for Water's* hydrological research is to improve our predictive capability with respect to the impacts of invasive alien plants on water resources, so as to enable the creation of improved *Working for Water* management tools.

1. Background and rationale

A major justification of the *Working for Water* programme is the detrimental hydrological effects of alien invasive plants. Perceived negative effects relate to increased evapotranspiration (leading to reduced catchment yields and groundwater recharge), but also include increased sediment loads in streams and rivers, increased risk of flooding and disproportionate low flow reductions. It is important to be able to accurately estimate the positive hydrological effects of alien clearance in all regions where *Working for Water* teams are active. The principle of increased water use by invasive trees and shrubs, especially in higher rainfall areas, is generally not disputed. However, it is often not possible to provide accurate estimates of these impacts, because data have only been collected from a few sites, and for a few species (*e.g.* pines, gums and black wattle [e.g. Dye and Jarmain, 2004]). There are also massive gaps in knowledge relating to the impact of alien plants on groundwater and how these impacts might affect streamflows in the long-term. In addition, our ability to estimate the magnitude of impacts, and extrapolate predictions to a range of sites, is constrained by a lack of suitable predictive models (Görgens and van Wilgen, 2004).

A very practical example of the need for improved understanding of the hydrological impacts of invasive alien plants, and consequently of their removal, is the current initiative to ensure that water users pay for the ongoing control of alien plants in water catchments through appropriate levies built into the water tariffs. Without a much-improved predictive understanding of these water-use relations, such a funding mechanism will simply not be possible. Similarly, long-term planning of water resource management in the country will not be accurate unless the hydrological impacts of invasive alien plants and their control can be effectively incorporated into such planning.

2. Strategic approaches

It has been proposed that the overall strategic approach to funding research in this field will be developed using the "FAIM" framework (Görgens and van Wilgen, 2004).
The research in this field will be carried out in close collaboration with the Water Research Commission which will manage the funds earmarked for hydrological research by *Working for Water*. It should wherever possible, build on existing centres of excellence. *Working for Water's* contribution should serve to plug gaps (*e.g.* certain species for which data are lacking and certain areas such as medium rainfall areas) and to build models. The possibility of using the programme's catchment-scale clearing operations to yield empirical hydrological data with which to test these models should be

thoroughly investigated (Macdonald, 2004). Capacity building in this field should be achieved by providing research opportunities in new catchment experiments.

3. Research priorities

The three top priorities identified for this 2005-2007 period are:
(a) Improve our understanding of water use by triffid weed (*Chromolaena odorata*), mesquite (invasive hybrids of *Prosopis* species), and black wattle (*Acacia mearnsii*).
(b) Develop a GIS-based model for the prediction of hydrological impacts of invasive alien plants throughout South Africa[*].
(c) Establish two catchment experiments in medium-rainfall areas (800 – 1000 mm MAR) where model predictions can be verified.

4. Terms of reference for the priority projects.

The detailed terms of reference for these projects have still to be generated.

[*] the update of WR90 for strategic level planning in terms of the national water balance currently includes streamflow reduction by invasive alien plants – it will be important to link up with these larger models first to ensure that we do not duplicate effort

Appendix 8 to the New *Working for Water* Research Strategy

Description of the initial resource economics project.

(A) Overall background to WfW's approach to the field of resource economics

The goal of resource and development economics research is to develop an ecological-economic model that incorporates environmental and social benefits of the *Working for Water* projects into a cost-benefit analysis framework that will enable holistic appraisals and comparisons to be made.

1. Background and rationale

Although the initial emphasis of *Working for Water* was on water conservation, it also has other important environmental benefits, and the programme makes a significant contribution to the welfare of its employees, contractors and their families, who are often from very poor rural communities. In many cases, it contributes a significant proportion of the cash income of those communities and has the potential to provide members of the communities with opportunities for investment.

The success of *Working for Water* is widely acknowledged, and, given the extent of alien plant invasions in South Africa, its services are in demand throughout most of the country. Thus the programme managers have to prioritise the potential projects, which usually operate at a quarternary catchment-level, for implementation.

Project appraisal is usually carried out by means of Cost-Benefit Analysis (CBA) or Multi-Criteria Decision Analysis (MCDA), the former being the most common method: a relatively straightforward comparison of economic costs and benefits. However, CBA is conventionally applied to projects without taking environmental and social benefits into account. In the case of *Working for Water*, both environmental and social benefits are a major output of the projects, and it is thus imperative that they be considered fully in the project appraisal process.

The fields of welfare and environmental economics have advanced over the last 20 years to the extent where such external costs and benefits can now be expressed in conventional (monetary) terms, and are now commonly used in project appraisal. Moreover, the advancement of the trans-discipline of ecological economics has led to the development of ecological-economic models, in which the linkages between ecosystem functioning and economic outputs are explicitly described. Research in this field conducted under the auspices *Working for Water* will aim to develop an appraisal system for *Working for Water* projects which takes the full costs and benefits of these projects into account.

Research in this field will also aim to provide the overall economic evaluation of the true value of the *Working for Water* programme to South Africa, an evaluation that will become increasingly important as the total costs of the programme come under ever increasing scrutiny from parties that will question the value of this extremely expensive

national programme. Fortunately, preliminary analyses of just the water benefits alone already demonstrate that the expenditure on the programme is easily justified (Görgens and van Wilgen, 2004; Turpie, 2004; Macdonald, 2004).

2. Strategic approaches

The completely novel strategic approach that has been adopted for this field by this research review panel is that it has decided that as a first step it will commission the compilation of a book on the topic of the economics of the invasion of South Africa by alien organisms, and the economics of the prevention and control of these invasions. The book will incorporate all the lessons learned to date in this field through the *Working for Water* programme, and will end up in the book's final chapter by indicating where research is most needed to fill important gaps in our understanding within this field.

3. Research priorities

No specific research priorities have accordingly yet been set for this field, but the various chapters that have been commissioned for this synthesis volume and the project's overall rationale and approaches are detailed below in subsection (B).

(B) The initial priority project in this field

This project is aimed at producing a book on the economics of alien invasions in South Africa: it is the first project of the Resource Economics Research Review Panel which will itself help identify research priorities in this field.

THE ECONOMIC VALUE OF CONTROLLING INVASIVE ALIEN SPECIES IN SOUTH AFRICA
(This section endeavours to provide a roadmap towards compiling a book with this title)

1. Introduction

The World Bank, through the Global Invasive Species Programme (GISP) (www.gisp.org <http://www.gisp.org>) in partnership with the *Working for Water* programme, has commissioned a book investigating the economic value of controlling invasive alien species. The process found its inception during September 2003 and gradually gained momentum. The project is co-funded by GISP (supported by the World Bank) and the *Working for Water* programme. An editorial team (James Blignaut, Jane Turpie, Christo Marais and Brian van Wilgen) and a team consisting of collaborating specialists (see task teams below) have been formed.

This document details the task ahead of the team as discussed during a workshop held on 12 December 2003 and various subsequent discussions among those concerned.

2. Objective, problem statement, methodological issues and definitions

The objective of the book is formulated as follows: to compile a user friendly synthesis of the economic value of controlling invasive alien species, based on existing information, and incorporating lessons learnt during the operations of the *Working for Water* programme.

The aim is therefore to compile a user-friendly (i.e. not a scientifically technical document, but an accessible document based on sound scientific evidence) synthesis (*i.e.* the pulling together of various research endeavours into one sensible unit) of the economic value of controlling invasive alien species (both fauna and flora), and appropriate control strategies for the management of invasive alien species. The target audience will be policy- and decision-makers at all spheres of government as well as the private sector.

To give effect to this objective, the following serves as the problem statement: What is the economic value of controlling invasive alien species in terms of the contribution towards water, land and biodiversity conservation, and towards poverty alleviation, and what is the strategic importance thereof?

To answer this problem statement the book will first, in Chapters 2 through to 8, address the biophysical consequences and economic impacts of invasive alien species in various different ecosystems or biomes (taking both the costs and benefits of these species into consideration). The changes in value will be assessed using a natural resource accounting framework. Chapter 9 will consider the cost and benefits of controlling invasives, while Chapter 10 will discuss the link between biodiversity conservation and rural poverty alleviation and assesses various policy options to give affect to the optimal control of invasives, while at the same time contributing to poverty alleviation. Chapter 11 will present the conclusions to be drawn from all the preceding chapters.

Throughout the book, cognisance of the following issues will be taken, and where appropriate and applicable, be alluded to:
* Inclusion of quality of life and health effects (i.e. rural poverty issues) and its link with biodiversity conservation;
* Define and establish a clear link between macroeconomic objectives and local economic development initiatives;
* It has been decided that, where possible, the effects of all invasive species, not just plant species, be included in the analysis;
* The book will not try to be comprehensive, issues that are not readily available will just be mentioned, but not research, i.e. invasive cats of Marion Island;
* It should be noted that just the process and methodology in itself is a very valuable effort and Chapter 1 should capture these;
* The value of the prevention of invasions is to be dealt with in Chapter 9;
* Controlling invasives contributes to value for whom? Equity and distributional issues, linking macroeconomic and strategic considerations with that of local economic development priorities. Chapter 10 should address this issue.

Appendix 9 to the New *Working for Water* Research Strategy

Priorities for social research as at 2004.

The goal of social, development and occupational health research is to improve our understanding of the socio-economic impacts of the *Working for Water* programme on participants and local communities, so as to devise approaches which will ensure their effective development and sustained well-being.

1. Background and rationale

Social development forms an integral part of the *Working for Water* programme, and is aimed at ensuring a legacy of social equity, economic empowerment and transformation within the programme. The programme has created over 20 000 temporary jobs per annum, which equates to about 15 000 person-years of employment per annum. Although the programme mainly targets the removal of invasive alien vegetation throughout South Africa, it has a broader focus on the socio-economic challenges facing the majority of formerly disadvantaged communities around the country.

The programme aims to optimise the social benefits that are possible from such a community-based public works programme by investing in the most marginalised sectors in South African society and by enhancing their quality of life.

To achieve this aim, the following principles are implemented throughout the programme:

- To prioritise marginalised groups, notably the "poorest of the poor" namely women, disabled people, the youth, those living in single-headed households, those living with HIV/AIDS, ex-offenders, those living in rural communities, and victims of crime.
- To optimise participation in the projects, for example by establishing Advisory Committees, and providing opportunities and guidelines for the joint sharing of costs and benefits;
- To enhance access to information (e.g. on reproductive health and HIV/AIDS, financial management and business skills), thereby improving the life skills of people, and improving the status of women, and
- To contribute to the alleviation of poverty.

Many of these initiatives are new, and have not yet been implemented on a large scale, or for any length of time. Research is therefore needed to establish principles of best practice to guide programme managers.

2. Strategic approaches

Wherever possible, the programme will partner with other institutions (government departments, tertiary training institutions, non-governmental, community-based and faith-

based-organisations), which specialise in a particular field of social developmental research in order to carry out investigations on any of these aspects of the programme. Particular care will be taken to ensure that research designs are such as to be able to yield unequivocal and value-for-money results in what are often extremely complex fields.

3. Research priorities

The four research priority areas for the period 2005 to 2007 in this field are as follows:
(a) Improving the way in which HIV/AIDS is addressed throughout the programme and costing the impact of the pandemic on the programme's core activities.
(b) Understanding and optimising the socio-economic impact on of employment and training on households of beneficiaries.
(c) Developing a protocol for effectively managing the exit strategy that applies to all programme participants and locating and understanding local job opportunities in areas when the programme operates.
(d) Augmenting the existing occupational health and safety database and understanding the perceptions of the contractors and workers in respect of health and safety issues.

The terms of reference for these projects are presented below.

4. Terms of reference for the priority projects.

4.1 HIV/AIDS

The services of a professional service provider are required to conduct a rapid appraisal of how the *Working for Water (WfW)* programme addresses issues of HIV/AIDS with its beneficiaries.

Objective

To understand to what extent *WfW* strategies in respect of HIV/AIDS and the employees (especially including contractors and their teams) of *WfW* are in line with current best practices in the workplace setting in South Africa.

Scope of Work
The study should cover the following aspects:

- What is *WfW* currently doing with respect to HIV/AIDS in the workplace, and what are the implicit and explicit costs?
- What are the feasible best practices for *WfW*, again looking at both implicit and explicit costs?

The study should examine the match, or lack of match, between stated policy, practice, and expected impact. It should look at whether and how *WfW* and beneficiaries take advantage of services offered by other players, whether inside or outside government, and how this affects impact and cost. It should explore reasons why some *WfW* projects are

performing better than others in terms of dealing with HIV/AIDS. The study should make conclusions and give concrete, practical, feasible and affordable recommendations regarding HIV in the workplace that *WfW* management structures can implement.

Methodology

The study should draw on in-depth interviews and documentary review. Documentary review should study the following internal *WfW* documents:

- Reports on what is being done regarding HIV within *WfW*;
- Strategy documents;
- Plans;
- Any other relevant reports.

The study should focus on interviewing informants at the national and provincial level rather than project or beneficiary level. Where, however, provincial or head office informants point the investigator to project-level of best practice, these should be followed up.

Outputs

The proposal is to include measurable outputs and means of verification. It must include a list of tasks to be performed, and an indication of time to be spent per task or cluster of task.

Time Frames

The project should be completed in **three months** time.

Capacity Building

Preference will be given to an organisation that, *inter alia*, seeks to build the capacity of young social scientists drawn from the ranks of South Africans who, in the past, were educationally disadvantaged by law and resource allocation. The organisation should undertake to provide recent graduates with real opportunities to develop skills in a practical rather than in an academic environment, and the capacity, developed in this way, should contribute to transformation at a different level. The proposal should clearly spell out how this process is going to effected.

4.2 Socio-economic Impact on households

The services of a professional service provider are required to undertake a study on the socio-economic impact of the *Working for Water (WfW)* Programme on the households of beneficiaries.

Objective

To understand the socio-ecconomic impact on households of members being employed on a *WfW* project and develop a methodology which can form the basis of a regular barometer of household-level impact on *WfW* beneficiaries.

Scope of Work
The study should build on previous research commissioned by *WfW*, and, in particular, gender studies of the *WfW* in Mpumalanga and Limpompo provinces by teams of researchers familiar with the respective regions. The study should cover the following aspects:-

- What is the impact of both cash and non-cash income and benefits of the *WfW* programme?
- What is the income and expenditure of surveyed households?
- How has income and expenditure changed since the members' employment on *WfW*?
- What are monetary and non-monetary differences between sole proprietary and co-operative contractors?
- What is the role played by or effects of intra-household dynamics and
- What are possible differences in the impact on households for different types of households and/or of those in which members with different characteristics (e.g. male or female, young or old) are employed?

Methodology
The study should be survey-based and must cover all provinces including a control group of households with no members employed on *WfW*. The proposal must specify how the sample will be drawn and the expected level of precision.

Outputs
The proposal must include an indication of the tasks to be completed by the service provider, and the time to be spent per task or cluster of task.

Time Frames
The project should be completed in **six months** time.

Capacity Building
Preference will be given to an organisation that, *inter alia*, seeks to build the capacity of young social scientists drawn from the ranks of South Africans who, in the past, were educationally disadvantaged by law and resource allocation. The organisation should undertake to provide recent graduates with real opportunities to develop skills in a practical rather than in an academic environment, and the capacity, developed in this way, should contribute to transformation at a different level. The proposal should clearly spell out how this process is going to effected.

Criteria for Evaluation of Proposals
The *WfW* programme supports the concept of affirmative procurement and proposals reflecting equity and capacity transfer will be considered favourably. The evaluation will be based on a points system. The table below shows the criteria and the weights allocated to each.

4.3 Exit Strategy

The services of a professional service provider are required to undertake the First Phase of a study of the efficacy of the exit strategies currently used in the *Working for Water (WfW)* programme in respect of beneficiaries.

Objective
To inform *WFW's* strategy of endeavouring to empower participants through training, skills and adult basic education and training to ensure their sustainable social and economic development.

Scope of Work
This study forms Phase 1 of a larger initiative. Its aim is to explore examples of current best practice in respect of exit strategy within *WfW*. Later phases of the initiative are envisaged as entailing action-research projects which test the recommendations emerging out of the First Phase. The study should cover the following aspects:

- What is being done for current contractors and workers to prepare them for when they have left the Programme?
- What has happened to past contractors and workers on the project?
- What activities are feasible for *WfW* in terms of an exit strategy?
- What are recommended best management practices that exist for *WfW* and
- What constraints are envisaged around the development of contractors with respect to the anticipated legal and operational challenges and/or framework strategy?

The first two questions should be answered through qualitative and quantitative investigations conducted in selected areas where *WfW* operates. The selected areas should be those where *WfW* is thought to have undertaken innovative initiatives or achieved interesting results. The rest should be answered through interviews with key stakeholders, including *WfW* managers and planners, *WfW* social development staff, representatives of key potential employers, contractors and workers. The case studies should be supplemented with documentary review of past studies, *WfW* policy documents, and other relevant policy documents, laws and regulations. The report should include recommendations as to feasible, practical ways that *WfW* can improve its operations in respect of exit strategy. These recommendations, if accepted, will form the basis of Phase 2.

Methodology
The sample should include at least one project per province in both rural and urban settings.

Outputs
The proposal should include measurable outputs and means of verification. It must also include a list of tasks to be performed, and an indication of the time to be spent per task or cluster of task.

Time Frames
The project should be completed in **six months** time.

Capacity Building
Preference will be given to an organisation that, *inter alia*, seeks to build the capacity of young social scientists drawn from the ranks of South Africans who, in the past, were educationally disadvantaged by law and resource allocation. The organisation should undertake to provide recent graduates with real opportunities to develop skills in a practical rather than in an academic environment, and the capacity, developed in this way, should contribute to transformation at a different level. The proposal should clearly spell out how this process is going to effected.

4.4 The augmentation of the existing occupational health and safety database.

Objective
To conduct an assessment of the perceptions of *Working for Water (WfW)* workers and contractors on health and safety issues.

Scope of Work
The study should aim to complement the current occupational health and safety database available at *WfW*, and, in particular, should cover the following aspects:-

- What workers and contractors perceive as occupational health and safety hazards and risks they face?
- What workers and contractors think can be done to address these hazards and risks?
- What they think about, and whether they utilise, current methods used to address hazards and risks?
- How responses to the above differ from problem areas identified by the current occupational health and safety systems used by the *WfW* programme and
- How to identify categories of the most vulnerable and most affected group of workers and contractors?

Methodology
The study should be survey-based and involve a mix of mutually complementary qualitative and quantitative methods. It should aim to cover a range of working environments, typical of the conditions faced by *WfW* workers and contractors across a sample of regions where *WfW* operates. The proposal must specify how the sample will be drawn and the expected level of precision of survey results, and should address the following:

- Review of *WfW* occupational health and safety reports and database;
- Interviews with occupational health and safety *WfW* staff and other key informants and
- Focus group interviews with workers and contractors.

Outputs

The outputs of the study should include:

- recommendations around effective management of occupational health and safety within *WfW*, identifying specific interventions feasible.
- further research priorities.

Appendix 10 to the *Working for Water* Research Strategy

Priorities for management research as at 2004.

The goal of management (previously termed "operational") research is to develop techniques that will enable all managers throughout the *Working for Water* programme to improve the efficiency of every aspect of their work and to ensure that all of these aspects are informed by the best available knowledge.

1. Background and rationale

The activities of the *Working for Water* programme span a wide range of fields. In addition, this is a young programme with a strong development imperative, and as a result many staff lack experience. There is a need to understand the major challenges facing the programme's managers, and to respond by conducting research in priority areas. In addition there often appears to be a tension between "development" and "technical" approaches within the programme. Accordingly a subtle objective of research in this field should be to demystify these supposed boundaries and to focus instead on putting relevant information at the disposal of all managers. Finally, managers within the programme are frequently tempted to look at other management models in order to solve the management problems they encounter, but the reality is that *Working for Water* often requires unique management approaches as it spans so many different disciplines in its attempt to deliver simultaneously on each of its multiple goals.

2. Strategic approaches

The overall strategy to be followed throughout this field is one of adaptive management, *i.e.* the whole *Working for Water* programme must develop a culture of "learning by doing" in which no manager is prepared to simply accept the *status quo* but instead is constantly striving to improve the performance of every one of his tasks through the judicious use of new approaches, the testing of such approaches through controlled research and then the rapid dissemination and implementation of successful research improvements. Monitoring and evaluation of all management actions must become routine.

A key question that must be resolved at the very outset by the programme's senior management before the strategy for research in this field can be defined, is exactly whose responsibility it is to develop the required monitoring and evaluation schemes for the *Working for Water* programme, whose responsibility it is to collect and curate the relevant data, whose responsibility it is to analyse these data and whose to communicate the results of these analyses back into the management system.

3. Research priorities

Priority projects for research in this field for the period 2005 to 2007 have been identified for each of the following broad range of topics:

(a) Communications and extension.
(b) Planning.
(c) Financial management.
(d) Field operations.
(e) Beneficiation and value addition.
(f) Awareness-creation, education and training.
(g) Organisational structure and functioning.
(h) Data management.
(i) Auditing and monitoring.
(j) Human resource management.
(k) Legislation.

An expanded description of the potential projects under each of these priority topics are presented below.

4. Possible priority projects in this field

Below are listed potential research topics that were identified during a workshop with *Working for Water* managers, held in Cape Town on the 6 June 2002. The research topics are listed under broad groups of activities, but no attempt has yet been made to rank the relative importance of the activities or their component projects. Clearly, the list is too long to cover adequately, and prioritisation must take place before research can be commissioned.

4.1 Communications / extension

(a) How do we improve internal and external communications?
(b) A guideline / protocol is required that can be implemented
(c) Identification of target audiences and developing of tailor-made packages for these audiences.
(d) Marketing of programme: Is there a certain protocol laid down? If not than this must be developed.
(e) What are the returns on investment – possibility for doing a resource economics based study?
(f) Failure to integrate communications into operations – why not make recommendation that managers contribute to annual report?
(g) What induction programmes is in place for new workers?
(h) Communication media needs to focus on conveying results from resource economic assessments on costs and benefits of various initiatives undertaken by the programme.
(i) Formation of communication working group with assistance from research unit.

4.2 Planning

(a) Assess level of infestation - what methods to be used and at what costs
(b) Development of a multi-criteria system that will enable one to prioritise projects on a national basis
(c) Planning at macro and micro levels - inclusivity of all concerned.

(d) Recommendation: A service provider to be approached to examine structure and function of planning within *Working for Water*.

4.3 Financial Management

(a) Response time to ordering a service or goods.
(b) Protocol and guidelines on procurement and accounting systems in the regions.
(c) Regions to come up with regional guidelines to standardise systems.
(d) What are the implications on *Working for Water* of tariffs raised through water charges.
(e) Mechanisms to address financial transfers to other Departments.

4.4 Field Operations

(a) Optimal combination of clearing methodologies, rehabilitation and herbicide application.
(b) Generic protocol that can be adapted to suit particular site conditions.
(c) 3-phase focus throughout project lifespan, *viz.* initial assessment, implementation and post-clearing assessment – formalise protocol.
(d) Responsibility of assessing long-term impacts?
(e) Research on occupational health and safety aspects.
(f) Environmental impact assessments?

4.5 Value-adding / beneficiation

(a) Decision support tools for implementation to assess potential for utilisation of biomass.
(b) Issue of whether the establishment of secondary industries will lead to dependency on invasive species – indigenous woodland establishment?
(c) Linking with Forestry SETA?

4.6 Awareness, creation, education and training

(a) Identified lack of induction training.
(b) Dept. of Labour and *Working for Water* partnership – what are the returns on investment?
(c) Impacts of education programmes.
(d) Lessons from other countries?
(e) How to best alert the public?

4.7 Organisational structure and functioning

(a) Issues surrounding regional structures and integration of emerging Department of Water Affairs and Forestry institutions including CMA's

4.8 Data management

(a) Filling the gap on social data.
(b) What is the optimal data configuration to suit the Programme's needs?
(c) Working across a range of different institutions – explore partnerships.
(d) Internet resources?

4.9 Auditing / monitoring

(a) A protocol to be established
(b) The Department of Water Affairs and Forestry's plantation guidelines?

4.10 Human Resources

(a) Conditions of service *e.g.* insurance – evaluation of the cost implications.
(b) Capacity development and transformation *e.g.* mentorship.
(c) Recreation: - Team building
    - Raise public profile
    - Optimum funding for recreational programmes
    - A strategy to be developed to be more in touch with the welfare of the workers

4.11 Legislation

Compilation of legislation: tools that can support the operations of *Working for Water*.

Appendix 11 to the New *Working for Water* Research Strategy

Priorities for biological control research as at 2004.

The goal of *Working for Water's* contribution to biocontrol research is the expansion of capacity to the levels required to carry out all the necessary identification, screening, release and monitoring of suitable and safe biological control agents (insects and pathogens) and the field evaluation of their effectiveness in the management of all the priority alien plant species invading South Africa.

1. Background and rationale

The effective control of invading alien plants depends on the application of a range of suitable techniques, in combination. These techniques include mechanical clearing (felling, uprooting and burning of stands of invasive alien plants), the use of chemicals (i.e. herbicides), and biological control. Biological control is aimed at overcoming the phenomenon of "ecological release". This is a feature of many alien plants that have been introduced into new countries in the absence of plant-feeding invertebrates and pathogens that have co-evolved with, and suppress, the particular plant species in its native environment. The practice of biological control includes the introduction of safe, host-specific agents (usually insects, mites or fungal diseases) that will reduce the invasive potential of the problematic plants in their country of introduction. The agents counteract the phenomenon of ecological release by reducing the vigour or seed output of the target plant, in some cases resulting in high levels of plant mortality (Zimmermann *et al.*, 2004).

Biological control is an essential component of the management of invasive alien plants. This is because the total eradication of invasive alien species is almost never an achievable objective. Areas cleared by mechanical or chemical means will usually be re-invaded unless these expensive controls are maintained in perpetuity (which is not an economically viable option). Biological control, on the other hand, offers a relatively inexpensive and sustainable, long-term solution to many invasive alien plant problems, and is one that can be maintained indefinitely with little intervention.

Biological control offers significant economic benefits. A recent study in South Africa showed that benefit:cost ratios (in terms of historic benefits gained compared to costs incurred in research) of existing South African biocontrol programmes ranged from 8:1 for lantana to 709:1 for jointed cactus. When future estimates of benefits are considered, benefit:cost ratios were greater, and ranged from 34:1 for lantana to 4333:1 for golden wattle. These returns on investment are phenomenal (van Wilgen *et al.*, 2004).

In some circumstances, biological control is the only practical option for achieving effective control. For example, Australian hakeas have invaded extensive tracts of remote and inaccessible mountain areas in the Western and Eastern Cape provinces, where control by mechanical or chemical means is not feasible. In these areas, biological control

is essential for achieving effective control and for minimising negative impacts on water runoff, catchment stability and biodiversity.

As indicated above, South Africa has a proud track record of successful biocontrol of invasive alien plant species (see also Section 3). Our biocontrol practitioners are acknowledged as being world leaders in this field. However, the levels of investment and capacity needed to produce optimum benefit from the potential that biocontrol offers are not nearly in place (in fact South Africa's capacity in this field has decreased slightly in recent years).

2. Strategic approaches

The following are the core elements of the strategy to be followed in this field: We need to maintain South Africa's established world-class capacity to do this research by ensuring the continued support of existing research centres. Further, we must build this capacity by training scientists and promoting transformation under guidance of the existing core group. Capacity should be doubled or trebled from current levels over the next six years by phasing in new appointments. Capacity building should be supported by directing some of the capacity beyond South Africa's borders (*e.g.* alien plant biocontrol could be a very significant contribution to our partner nations in SADC and indeed in the whole continent under the newly launched NEPAD Alien Invasive Species initiative).

3. Research priorities

Undoubtedly the top priority in biocontrol is the reversal of the recent decline in capacity in this field within South Africa. The target that has been set for *Working for Water's* contribution over the six-year period 2004-2010 is the doubling of research capacity in this field (see **Appendix 11** for a detailed strategy as to how this will be achieved).

There are a number of priority research projects in this field (many of which it is planned will be addressed as part of the capacity-building exercise mentioned above). The priority projects which have been identified through an exhaustive consultative process are:
(a) development of biocontrol agents for high priority invasive alien plant species that are already established and causing extensive damage in South Africa (listed in alphabetical order of scientific names): Australian *Acacia* species, including *A. baileyana* (Bailey's wattle), *A. cyclops* (rooikrantz), *A. dealbata* (silver wattle), *A. implexa* (hickory wattle), *A. longifolia* (long-leaved wattle), *A. mearnsii* (black wattle), *A. melanoxylon* (blackwood), *A. pycnantha* (golden wattle), *and A. saligna (Port Jackson); Chromolaena odorata* (triffid weed); *Eichhornia crassipes* (water hyacinth); *Eucalyptus* species (gums), including *E. camaldulensis* (red river gum), *E. cladocalyx* (sugar gum) *and E. lehmannii* (spider gum); *Hakea gibbosa* (rock hakea) and *H. sericea* (silky hakea); *Jacaranda mimosifolia* (jacaranda); *Lantana camara* (lantana); *Leptospermum laevigatum* (Australian myrtle); *Pereskia aculeata* (Barbados gooseberry); *Pinus pinaster* (cluster pine); invasive hybrids of *Prosopis* (mesquite).

(b) pre-emptive control through the development of biocontrol agents for emerging invasive alien plant species that are already passed the stage of being able to be eradicated within South Africa (listed in alphabetical order of scientific names): *Campuloclinium macrocephalum* (pompom weed); *Cardiospermum grandiflorum* (balloon vine); *Parthenium hysterophorus* (parthenium, feverfew); *Rubus cuneifolius* (American bramble); *Tecoma stans* (yellow bells).

The detailed terms of reference for the above projects are presented below.

4. Terms of reference for the priority projects.

4.1 Lantana (*Lantana camara*), triffid weed (*Chromolaena odorata*), and *Pereskia aculeata* (Barbados gooseberry);

Tenders are invited from suitably qualified teams to undertake research into the biological control of the above species. The tenders should indicate clearly what strategy will be followed when approaching the biocontrol of the target weeds. In the case of lantana the research should focus on:

- The completion of research into the screening and host specificity testing of the selected biocontrol agents (*Aerenicopsis championi*, *Aerenica multipunctata*, *Anthonomus* sp., *Geraeus* sp., *Barela parvisaccata* and *Leptostales ignifera*), and the preparation of documentation needed to support an application for the release of each of these agents, if appropriate;

- The preparation of a status report detailing the locations of sites where each of the various species of biocontrol agents has been released, to date, against lantana in South Africa, and the relative effectiveness of each agent in each province where lantana occurs;

- The establishment of monitoring sites to determine trends in the effectiveness and spread of the released agents;

- On the basis of the above investigations, the preparation of a report providing recommendations on future priorities for research into the biological control of lantana, including an assessment of whether research should continue to focus on lantana, or whether resources should be channelled into alternative invasive alien species where greater returns on investment in research would be gained; and

- The publication of research results in appropriate journals, books, or other outlets.

In the case of triffid weed and Barbados gooseberry, the research should focus on the development of a comprehensive programme addressing the following aspects:

- The identification of suitable potential biocontrol agents;

- The importation, screening, and host specificity testing of potential biocontrol agents;
- The preparation of documentation needed to support an application for the release of each of these agents, if appropriate;
- The release of agents at suitable nursery sites within the range of the target weed species;
- The monitoring of establishment and initial effects of the biocontrol agents on the target weed species;
- The preparation of guidelines (dossiers) that will assist managers in the collection and redistribution of the agents;
- The evaluation of long-term impacts of biological control on the population dynamics of the target weed species; and
- The publication of research results in appropriate journals, books, or other outlets.

4.2 Australian *Acacia* species, cluster pine (*Pinus pinaster*), *Hakea* species, and Australian myrtle (*Leptospermum laevigatum*).

Tenders are invited from suitably qualified teams to undertake research into the biological control of invasive Australian *Acacia* species (including *A. mearnsii, A. melanoxylon, A. cyclops, A. saligna, A. baileyana, A. implexa, A. longifolia, A. pycnantha, and A. dealbata);* cluster pine *(Pinus pinaster);* hakea species *(Hakea sericea* and *H. gibbosa)* and Australian myrtle (*Leptospermum laevigatum).* The tenders should indicate clearly what strategy will be followed when approaching the biocontrol of the target weeds.

In the case of cluster pine, the research should focus on the further screening of the potential agent *Pissoides validirostris* only, with a view to establishing the host specificity of various biotypes of this promising agent. If appropriate, documentation needed to support an application for the release of the agent should be prepared. What about mites?

In the case of the Australian acacias, hakeas and myrtle, a comprehensive research programme addressing the points listed below, is required. However, the research programme should take account of potential conflicts of interest in the case of certain of the Australian acacias that have, or may have, commercial value. In these cases, research should focus on seed, bud and flower-destroying organisms only. With this caveat, research should address:

- The identification of suitable potential biocontrol agents;
- The importation, screening, and host specificity testing of potential biocontrol agents;
- The preparation of documentation needed to support an application for the release of each of these agents, if appropriate;
- The release of agents at suitable nursery sites within the range of the target weed species;

- The monitoring of establishment and initial effects of the biocontrol agents on the target weed species;
- The preparation of guidelines (dossiers) that will assist managers in the collection and redistribution of the agents;
- The evaluation of long-term impacts of biological control on the population dynamics of the target weed species (in the case of Australian Acacias, service providers will be required to consult with service providers appointed to investigate seed longevity of invasive Australian Acacias, to prevent duplication of work); and
- The publication of research results in appropriate journals, books, or other outlets.

4.3 Water hyacinth (*Eichhornia crassipes*).

Tenders are invited from suitably qualified teams to undertake research into the biological control of water hyacinth (*Eichhornia crassipes)*. The tenders should indicate clearly what strategy will be followed when approaching the biocontrol of the target species. The research should focus on the development of a comprehensive programme addressing the following aspects:

- The identification of suitable potential biocontrol agents;
- The importation, screening, and host specificity testing of potential biocontrol agents;
- The preparation of documentation needed to support an application for the release of each of these agents, if appropriate;
- The release of agents at suitable nursery sites within the range of the target weed species;
- The monitoring of establishment and initial effects of the biocontrol agents on the target weed species;
- The preparation of guidelines (dossiers) that will assist managers in the collection and redistribution of the agents;
- The evaluation of long-term impacts of biological control on the population dynamics of the target weed species; and
- The publication of research results in appropriate journals, books, or other outlets.

In addition, the water-hyacinth research team should provide a comprehensive report on options for the integration of biological control with other management practices directed against water hyacinth in different ecological regions of South Africa.

4.4 Mesquite (invasive hybrids of *Prosopis*), gums (*Eucalyptus* species), and jacaranda (*Jacaranda mimosifolia*).

Tenders are invited from suitably qualified teams to undertake research into the biological control of *Eucalyptus* species (gums), including *E. cladocalyx, E. camaldulensis, and E. lehmannii,* mesquite (invasive hybrids of *Prosopis) and* jacaranda

(Jacaranda mimosifolia). The tenders should indicate clearly what strategy will be followed when approaching the biocontrol of the target weeds.

The research programme should take account of potential conflicts of interest regarding the target species and in the case of mesquite should focus on bud, seed and flower-destroying agents, and in the case of gums and jacaranda, on seed-destroying agents only. With these caveats, research should address:

- The identification of suitable potential biocontrol agents;
- The importation, screening, and host specificity testing of potential biocontrol agents;
- The preparation of documentation needed to support an application for the release of each of these agents, if appropriate;
- The release of agents at suitable nursery sites within the range of the target weed species;
- The monitoring of establishment and initial effects of the biocontrol agents on the target weed species;
- The preparation of guidelines (dossiers) that will assist managers in the collection and redistribution of the agents;
- The evaluation of long-term impacts of biological control on the population dynamics of the target weed species; and
- The publication of research results in appropriate journals, books, or other outlets.

4.5 Emerging weeds

Tenders are invited from suitably qualified teams to undertake research into the biological control of *Campuloclinium macrocephalum* (pompom weed), *Rubus cuneifolius* (American bramble), *Cardiospermum grandiflorum* (balloon vine), *Parthenium hysterophorus* (parthenium, feverfew), and *Tecoma stans* (yellow bells). The tenders should indicate clearly what strategy will be followed when approaching the biocontrol of the target weeds. Except for the case of American bramble, where investigations should be limited to plant-pathogenic organisms only, the research should focus on the development of a comprehensive programme addressing the following aspects:

- The identification of suitable potential biocontrol agents;
- The importation, screening, and host specificity testing of potential biocontrol agents;
- The preparation of documentation needed to support an application for the release of each of these agents, if appropriate;
- The release of agents at suitable nursery sites within the range of the target weed species;
- The monitoring of establishment and initial effects of the biocontrol agents on the target weed species;

- The preparation of guidelines (dossiers) that will assist managers in the collection and redistribution of the agents;
- The evaluation of long-term impacts of biological control on the population dynamics of the target weed species; and
- The publication of research results in appropriate journals, books, or other outlets.

Appendix 12 to the New *Working for Water* Research Strategy

Standard procedures and criteria used by the *Working for Water* programme for evaluating research proposals.

How are terms of reference set?
Terms of reference for proposed research projects must be drawn up by the relevant members of the Research and Development Unit (RDU) in cooperation with the relevant research review panel chair[1]. These draft terms of reference must then be circulated for comment to members of the relevant research review panel before being finalised by the RDU in the light of any feedback received from panel members and then being put out on tender.

How is the scope of a project defined?
The terms of reference for all projects must include an inception phase where the terms of reference, deliverables and budget would be reviewed by the RDU, supported by panel members and/or other advisors where necessary.

How are proposals evaluated and service providers selected?
The proposals are evaluated by the relevant staff in the RDU in terms of the criteria laid out in the table on the next page. The service providers will be selected in the light of the evaluation their proposals receive and the financial aspects of their quotations.

[1] In this Appendix mentions of the "Research Review Panels" will need to be replaced by the "Research Advisory Panel" if this recommended simplification of *WfW's* external advisory mechanism is accepted. Mentions of "the relevant research review panel chair" would then become "the relevant RAP member" as it is intended that the RAP would have at least one member expert in each of the fields previously represented by a research review panel.

EVALUATION CRITERIA	WEIGHTING
Overall Competency and Track Record	**6**
• Appropriateness of Consulting Portfolio	2
• Reputation with Clients	2
• Alliance and Backup	2
Specific Project-applicable Expertise	**9**
• Key Expertise	5.4
• Past Project Experience	3.6
Approach and Methodology	**20**
• Understanding of TOR	8
• Problem Conceptualization	8
• Innovation in Approach	4
Project Management	**10**
• Workplan	5
• Organisational Skills	2.5
• Management Skills	2.5
Qualifications of Key Personnel	**15**
• Appropriate Fields of Specialization	9.9
• Relevant Experience	5.1
Employment Equity	**20**
• Previously Marginalised Principals	8
• Woman Principles	2
• Affirmative Career Development	6
• Social Responsibility	4
Sub-total	80
Price	20
TOTAL	**100**

Appendix 13 to the New *Working for Water* Research Strategy

Standard reporting procedures for service providers.

This appendix provides the formats for **progress reports** that must be submitted twice per year for assessment by review panels. All service providers will be asked to submit their reports in a standard format to facilitate comparison and evaluation during review panle meetings. At the conclusion of a research project, service providers will be asked to submit a final report, giving full details of all of their findings necessary to meet the terms of reference in their contracts. At that time, service providers will also be asked to complete an **abbreviated report** that should accompany the final report. The format of the abbreviated report is also provided here.

Progress reports.

Service providers are required, in terms of their contracts, to report on progress twice a year. The following format should be used:

1. **Terms of reference.**

Outline the terms of reference for the project as listed in the contract (including key questions that research will address).

2. **Duration of project.**

Provide the start and end dates for the project, as set out in the contract. **State clearly which time period this report covers**.

3. **Original project plan.**

Provide an outline of the original project plan, and mention any deviation and reasons behind these.

4. **Project budget.**

Indicate the amounts allocated to this project for each financial year, and for the period under review.

5. **Results.**

Provide an account of the achievements **during the period under review**. When doing this, explain the extent to which key questions have been answered (with reference to point 1 above), summarise your results, highlight results relevant to the Working for Water Programme, and identify any notable achievements.

6. **Problems and constraints.**

Provide an account of any problems encountered in the execution of the research **during the period under review**, or of any constraints that impact on the ability of the researchers to conduct the work.

7. Additional research needs.

Provide an account of additional research needs that may have come to light in pursuing the current research objectives.

8. Financial report.

Provide a breakdown of the budget used in conducting the work. Indicate amounts spent **in the period under review**, for human resource time, subsistence and travel costs, and equipment or materials purchased. Indicate if any additional funds are required to complete the work, or whether any savings are projected for the project budget.

9. Publications.

List all publications that have arisen as a result of the project. Provide copies or reprints of papers that appeared in press during the period under review.

10. General.

Report on any other aspects of the project that you would like to bring to the attention of the review panel.

Abbreviated report to accompany final report.

Service providers are required, in terms of their contracts, to provide a final report at the end of each contract. This abbreviated report form should accompany all final reports.

1. Terms of reference.

Outline the terms of reference for the project as listed in the contract (including key questions that research will address).

2. Duration of project.

Provide the start and end dates for the project, as set out in the contract.

3. Financial report.

Provide a breakdown of the budget used in conducting the work. State the full amount allocated to the contract for its entire duration.

4. Publications.

List all publications that have arisen as a result of the project. Provide copies or reprints of papers that appeared in press during the period under review.

5. General.

Report on any other aspects of the project that you would like to bring to the attention of the review panel.