

**AN IMPACT ASSESSMENT  
OF THE RESEARCH FUNDED BY WRC  
ON WETLAND MANAGEMENT IN SOUTH AFRICA**

Report to the  
**Water Research Commission**

by

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# EXECUTIVE SUMMARY

Wetlands are valuable but threatened ecosystems that play an important role in the water cycle (Millennium Ecosystem Assessment, 2005). In 2009, in order to promote continual improvement and guide future activities, the South African Water Research Commission (WRC) commissioned an impact assessment of the wetland research supported by WRC. The desk top study employed a combination of quantitative and qualitative measures, including stakeholder perception, to obtain a holistic picture of the economic, social, institutional and environmental impact of wetland research supported by the WRC.

The study has shown that the WRC has invested nearly R50 million in 67 research studies with a wetland objective. The majority (99%) of this investment was made in the last 8 years (2002-2010), and an estimated 10% of this investment was co-funded by other donors. This confirms stakeholder perception that the WRC plays a critical role in funding and guiding wetland research. The investment also has an indirect economic impact in that it is directed toward resources (biodiversity, water) and infrastructure (wetlands) of public benefit. Conservatively, 25% of the wetland research was geared to support sustainable development and 18% sustainable practice. Over half (57%) of these projects were commissioned in the last five years, and stakeholders indicate a continued need for resource economic studies on the value of wetlands.

The WRC supported wetland research made a valuable social and institutional contribution. An estimated 74% (R37 million) of the investment was used to procure the services of nearly 70 research organizations and nearly 180 researchers. Approximately 70% of the projects supported career development and employment, through education and training of post-graduate students and emerging researchers. It was suggested that bursaries for undergraduate studies and possibly for school-university bridging studies, may make it possible for more students to enter this field, particularly historically disadvantaged individuals. Stakeholders reported that the tacit knowledge and expertise gained by researchers is invaluable in a number of respects, including determining the value of wetlands. Research also contributed to gender equality and diversity. Nearly 80% of projects engaged female researchers and 55% historically disadvantaged researchers. There was no reported evidence of local labour hired at research sites, but two rehabilitation research projects actively supported the Working for Wetlands and Working for Water Expanded Public Works Programmes, which employ and train local contractors and labour. In 2009 alone, Working for Wetlands rehabilitated 95 wetlands, created employment for 1500 people and supported 250 small businesses. An estimated 26% of the projects produced knowledge and tools to support sustainable wetland use and livelihood development. Stakeholders indicated a need for more studies on wetland sustainable use and livelihood development.

WRC's strategic networking initiatives, multi-stakeholder project steering committees, multi-disciplinary research consortia and the participatory approach adopted by many researchers, have helped strengthen the institutional arrangements underlying wetland management, protection, rehabilitation and sustainable-use. A community of practice has developed around wetland research, with on average 12 (n=29; sd=7) organizations per project acknowledged for their engagement in the research process. Over 600 acknowledged broader stakeholder groups were identified, including local authorities, community organizations and individuals. Research has raised public awareness of wetlands and undoubtedly built

stakeholder capacity, although the degree of learning is difficult to quantify. There is evidence to indicate that short courses are being developed and delivered to build the capacity of managers, practitioners, consultants and students to apply the knowledge and tools that have been produced. Stakeholders stressed the need to close the gap between research and implementation through such training courses. It is suggested that consideration be given to the need to standardize such training and to create a central database to monitor what training is being delivered and where the gaps are. An action research approach, allowing for longer term mentoring and capacity building in the work place, was raised as an alternative way to close the gap between research and implementation, but it may not be appropriate approach for all research. An action research approach was used to develop a series of wetland rehabilitation and management tools in conjunction with Working for Wetlands, and stakeholders confirm these tools are being utilized. An estimated 32% of research projects produced knowledge and tools to support the community of practice with natural resource management, 2% specifically support integrated management (e.g. integration of wetlands into catchment management), 3% wetland-related policy development (e.g. agriculture, freshwater biodiversity), 15% policy implementation (e.g. reserve determination, wetland inventory), 2% governance models (e.g. cooperative governance in communal areas), 3% management of water supply and other resources (materials), 15% wastewater management, 10% conservation and development planning, and nearly 20% support informed decision-making that helps balance the needs of society, conservation and development. Stakeholders raised the need for improved understanding of the institutional arrangements governing wetlands, especially factors leading to successful cooperative governance and the role of political influence on wetland management and decision-making.

Depending on the way research is carried out, there may be a negative impact on local culture and the environment. Inference was made to cultural and environmental matters in one or two projects but sensitivity measures were generally not reported on. It is recommended that they are reported on in future, as they are indicative of product responsibility and impact.

In general, direct environmental impacts were more difficult to ascertain than socio-economic impacts. One project employed an action research approach, directly assisting Working for Wetland managers, practitioners and local contractors rehabilitating wetlands. Of the 21 projects with regional/local research sites, 11 were in or adjacent formally protected areas, Biosphere Reserves, Conservancies, Ramsar or Ramsar designated sites. An estimated 23% of projects produced knowledge and tools to support mitigation of impacts (e.g. development, agriculture, mining), assessment and/or maintenance of wetland condition. Nearly 50% produced knowledge and tools to support overall environmental protection (including management), 44% contributed new data related to wetlands, nearly 10% were related to wetland rehabilitation, 16% to sustainable-use including understanding and valuing ecosystem services, 3% to the supply and use of water / materials linked to wetlands, and 14% to wastewater management. Of 28 projects contributing new data related to wetlands, half (50%) were commissioned in the last five years (2005-2010). This aligns with stakeholder emphasis on the need for more baseline data (plants, animals, diatoms, microbes) on which to base management tools and conservation planning. Stakeholders identified a number of other research needs, including but not limited to improved understanding of ecosystem processes (soil, water, nutrients), testing of the ecosystem services wetlands are assumed to provide (e.g. flood attenuation), deeper understanding of wetlands as socio-ecological systems at a landscape or catchment level, and the

role of wetlands in climate change adaptation. They stressed the need for rehabilitation and assessment tools to be tested by different stakeholders, in different regions for a variety of wetland types, and for these tools to be continually improved and refined as more data becomes available. Incidental reports by practitioners indicate that wetland rehabilitation is resulting in improved environmental flows, retention of water in the landscape for longer periods and return of biodiversity (wetland plants and birds). A national wetland monitoring system is needed to systematically ascertain the longer-term impact of wetland interventions. In this regard stakeholders raised the possibility of collaboration with the South African Earth Observation Network (SAEON) and the potential for sourcing funding for research and monitoring by focusing on climate change adaptation. From a practical perspective this could support long-term ecological research and monitoring at a number of strategically and systematically chosen reference sites, exposed to varying levels of disturbance. A number of stakeholders supported this approach. Underlying all of this is the urgent need for the refined national wetland inventory currently being developed through the South African National Biodiversity Institute (SANBI).

On the whole, WRC's systems and requirements result in an effective research management system, with 41 research projects (encompassing some 87 studies) being satisfactorily completed and reports published. There have been over 4000 requests for these reports and cumulative feedback from 23 respondents indicated that all but 4 of 82 reports/lessons/games are used for variety of activities ranging from general knowledge, education and training to assessments of various kinds, which inform decision-making around water-use licenses and development applications. While the reports were being used by most respondents, one or two did not know about WRC. This highlights the need identified by stakeholders, for WRC to advertise itself and its research more broadly, perhaps targeting local stakeholders to retain their interest once research has been completed. WRC is held in high regard by stakeholders and has a reputation for publishing dependable research. Several stakeholders suggested that budgeting for time to dedicate to compiling final reports after research has been completed, would allow for timely product delivery, which is important given that most research addressed immediate needs. Similarly, stakeholders suggested budgeting for time to prepare submission ready scientific papers, which would pass through an external review process, thereby ensuring that science was both robust and relevant to society.

Results indicate that while there are some areas that need attention, within its sphere of influence as a knowledge organization, WRC is generally having a significant economic, social, institutional and environmental impact and is playing its role in realizing the value of the R50 million investment into wetland research. While progress has been made toward achieving the overarching objectives related to wetland research, without previously defined indicators and benchmarks it was difficult to ascertain whether expectations have been met. It is hoped that this study contributes to the development of a generic assessment framework and standard indicators for natural resource management research programmes, allowing for comparison between programmes and organizations. Further, it is hoped that this study will help in establishing benchmarks as a guide to assess future impacts.

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# 1 INTRODUCTION

Wetlands are recognized as important water linked ecosystems with high socio-economic value (Millennium Ecosystem Assessment, 2005). They provide water, food and raw materials, and services such as flood attenuation and water purification. They also have aesthetic, recreational and cultural value. However, wetlands were not always viewed as important but more as boggy pieces of ground that served as a breeding ground for disease hosts (David Lindley - Manager Mondi Working for Wetlands Programme, pers com., 2010). In the late 1970s and early 1980s, evidence indicated that South African wetlands had been neglected in terms of conservation and management, and showed widespread evidence of loss and degradation (WRC, 2002). It is thought that nearly 50% of South Africa's wetlands have been lost (Vlok et al., 2006), a situation reflected in other countries (Cowardin et al., 1979; Millennium Ecosystem Assessment, 2005). The Ramsar Convention (Iran, 1971) illustrates increased international recognition of the importance of wetlands. In recognition of the state of the country's wetlands and their importance in an arid climate, South Africa became a signatory to the Ramsar Convention. Twenty wetlands have been designated as Ramsar sites (wetlands of international importance), and several have achieved World Heritage Status (Isimangaliso, Lake Sibaya, Kosi Bay, Turtle Beaches and Coral Reefs of Tongaland, and the uKhahlamba-Drakensberg Park). Wetlands have also been cited as an ecosystem type requiring special attention within the principles of the National Environmental Management Act of 1998, and in Environmental Impact Assessment regulations under the Environment Conservation Act of 1989.

On the research front, through the International Biological Programme (IBP), South Africa launched an initiative known as the Cooperative Scientific Programmes (CSP) from within the CSIR. This effort led to the development of a national programme known as the "Inland Water Ecosystems Programme" (IWEP) which allowed for the development of expertise and knowledge on South Africa's aquatic ecosystems, including a specific wetland research programme. A change in policy led to the disbandment of the CSPs and as a result, coordination and support of national research into wetlands during the 1990s was minimal, and tended to focus on single and isolated projects. Despite the lack of research coordination, progress was made in implementation of national wetland management programmes, largely as a result of civil society and government departments required to do so through international obligations, policy and legislation. Of note are the Mondi Wetland Project implemented by World Wildlife Fund-SA (WWF) and the Wildlife Environment Society of South Africa (WESSA), and the national "Working for Wetlands" Programme which emerged in 2000 under the banner of the "Working for Water" programme. Working for Wetlands, is implemented by the South African National Biodiversity Institute (SANBI) and recognizes the importance of conserving biodiversity by rehabilitating and protecting ecosystems. By its second year Working for Wetlands had a budget of more than R30 million (WRC, 2002). By 2009 Working for Wetlands was rehabilitating 95 wetlands, creating jobs for 1500 people and supporting 250 small businesses annually.

Given this level of investment and the need for information and tools to support rehabilitation and management of wetlands, a need was identified for a coordinated, cooperative national research programme. In 2002 an inter-agency, collaborative National Wetlands Research Programme (NWRP) was developed. The objectives of the NWRP are to:

- Initiate, support and manage research projects that contribute to wetland rehabilitation and management
- Ensure the effective transfer of information on wetlands to institutions and persons involved in wetland rehabilitation and management
- Expand human resource capacity for wetland management and rehabilitation
- Ensure financial sustainability of wetland research in South Africa

The plan (WRC, 2002) was to implement the NWRP in three phases including (i) wetland rehabilitation (complete), (ii) assessment of wetland health & importance (complete) and (iii) wise use (current). The agencies involved included the then Department of Environmental Affairs and Tourism (DEAT), Working for Water Programme, Mondi Wetlands Project, Department of Water Affairs and Forestry (then DAWF), National Department of Agriculture (then DoA), Department of Minerals & Energy (DME) and the Water Research Commission (WRC).

The WRC was established in 1971 after a period of severe water shortage ([www.wrc.org.za](http://www.wrc.org.za)). In line with its role as a “Knowledge-Hub” it administers the NWRP on behalf of the agencies. It also funds other wetland research projects and related activities, to promote the understanding, rehabilitation, sustainable use, protection and integrated management of wetlands. In 2009, the WRC commissioned this study to assess the impact of this contribution on sustainable management of wetlands. This included economic, social, environmental and institutional impacts, with a specific focus on capacity building, livelihoods, health, partnership building, integrated management, research programme management, and the contribution made on an international front. The purpose was to evaluate progress against programme level objectives and suggest options for improvement.

## **2 APPROACH**

The impact assessment study was conducted in four phases. In Phase 1, more than 50 stakeholders from the wetland community of practice were consulted to understand their perspective on the impact WRC is having (Phillips, 2009). In Phase 2 of the assessment, a review of relevant documentation was conducted to (i) provide a context for the wetland research and related activities supported by the WRC, (ii) provide an overview of the wetland research funded, and (iii) discuss the relevance of research projects to each area WRC aim to impact and the implications in terms of assessing impact (Phillips & Madlokazi, 2010). Phase 3 involved investigating assessment practice in relation to natural resource research programmes and integrating all the available information into a draft assessment framework (Phillips, 2010a). In Phase 4, a preliminary assessment was conducted using the proposed assessment framework. An overview of the framework and preliminary findings were presented and discussed with key stakeholders. The framework and indicators were then refined and the assessment conducted for the 67 wetland-related research projects that had been identified in Phase 2. The findings of all four phases were integrated into this assessment report.

In addition to the above, as part of the capacity building component of this study, a historically disadvantaged post-graduate student from the University of Cape Town assisted with aspects of the assessment.

Specifically, she was mentored in assisting with the stakeholder interviews, general communication, literature searches and reviews, as well as setting up and analysing databases. She was also asked to reflect on what she had learned and feedback was presented in an internal letter to WRC (Madlokazi, 2010).

### **3 ASSESSMENT FRAMEWORK**

Development of the assessment framework was a process involving stakeholder consultation, best practice research, stakeholder consultation, testing and refinement. This section describes the reasoning behind the framework, the final framework and how it works.

#### **3.1 Background**

Impact is the effect or influence of one thing on another and is normally associated with change (Creech & Ramji, 2004). Assessment means to measure, in this case the influence or change occurring in certain areas as a result of research. The word “assessment” is often used interchangeably with “evaluation”. Impact Assessment (IA) forms an integral part of Monitoring, Evaluation, Reporting & Improvement (MER or MERI), which is the mechanism that drives lesson-learning and adaptive management (CGIAR, 2000; Australian Government, 2009).

Impact assessment (IA) is a well-established, organized and broad practice, with a range of disciplinary lines and a rich body of literature (CGIAR, 2000; Malan et al., 2005; Turpie et al., 2010). This study focused not on the disciplines of environmental, economic, social or environmental health assessment, but on research impact assessment.

A list of some of the local and international organizations involved in assessing research programmes linked to natural resource management can be seen in Appendix 1. Examination of their approach indicates no one overarching standard practice, from one organization to the next. Most practices incorporate both qualitative and quantitative methods, the WRC funded assessment of the River Health Programme being a good example (Roux et al., 2008). In addition to considering ongoing monitoring of the objectives and deliverables set out by different research projects, the trend in determining how useful research has been is to incorporate bibliometric (number of publications and citations) methods, as well as peer review, self-review and participatory approaches in order to get a holistic and integrated picture of the various ecological, social and economic impacts (Van Raan, 2003; Roux et al., 2008; Taylor ed., 2009). State of the art assessments of research consider impact at programme rather than individual project level. They also assess social, environmental and economic impacts, which are recognized as the three legs of sustainability (CGIAR, 2000; [www.globalreporting.org](http://www.globalreporting.org)). Recent trends in IA are to include institutional impact assessment, as institutional issues are increasingly recognized as being of underlying importance to sustainability.

In general, IA practice appears well developed and methodologies (e.g. bibliometric analysis and mapping, van Raan, 2003) are quite advanced. However, there are challenges, the most relevant of which are discussed below.

## **3.2 Challenges**

### **3.2.1 Integration**

Integration of IA into institutions as a means of learning, adaptation and improvement remains a challenge (CGIAR, 2000). To enable integration there is a need for simple, effective, cost-efficient assessment methods (CGIAR, 2000; Australian Government, 2009; Taylor ed., 2009). Indicators need to be selected for which there is readily available, reliable and where appropriate, comparable data or evidence. For example, diatoms have proved an effective and cost-efficient measure of water quality in rivers and can be used to determine the ecological reserve (WRC Knowledge Review, 2000/10). However, identifying effective, cost-efficient metrics is a process (Day & Malan, 2010) and data on environmental or social indicators for use in assessments can be lacking (CGIAR, 2000).

To enable integration of IA and MER into the wetland research community, this study aimed to develop an assessment framework for which there is readily available evidence, and which holds meaning for, and can be applied by, research managers and researchers during the course of their work, without the need for specialist assistance.

### **3.2.2 Indicators & Benchmarks**

WRC has a culture of evaluation and adaptive management both at organizational (e.g. 2006 Institutional Review) and programme levels (e.g. River Health Programme). WRC articulates clear objectives for its key strategic research areas (KSAs) and National Wetland Research Programme (NWRP). In some cases (e.g. Cross-cutting domains or Impact Areas) it also describes expected outcomes and outputs. However, indicators were not clearly identified and no evidence of benchmarks could be found against which impact can be measured (Phillips & Madlokazi, 2010). The WRC funded River Health Programme assessment (Roux et al., 2008) refers to benchmarks but no description of the benchmarks and how they were ascertained could be found in the final report.

Looking more broadly for guidelines in this regard, it was found that South Africa's National Research Foundation (NRF) also recognizes the value of evaluating researchers and research programmes. They provide a protocol to guide the evaluation process and several examples of reviews ([www.nrf.ac.za](http://www.nrf.ac.za)). However, they also do not seem to employ a standard framework and set of indicators with established baselines and benchmarks, against which a research institute can evaluate its programmes.

There may be a number of reasons for the absence of common frameworks, indicators and benchmarks. It can take a good deal of sophisticated work for an organization to develop a comprehensive 'meta' framework, for assessing the efficacy/impact of a range of programmes and projects in different focus areas (Universalia, 2003). The inherently varied nature of research may not allow a one size fits all approach (Vlok pers com., 2010). Too rigid a framework may also constrain creative thinking, innovation and freedom to explore new ideas. However, a middle ground employing a broad set of generic indicators of global importance, works for organizations from a range of sectors and fields of discipline, when it comes to

assessing and reporting on their sustainability. The Global Reporting Initiative (GRI), together with stakeholders, has established a generic sustainability reporting framework that is employed by different organizations from across the globe, including South Africa ([www.globalreporting.org](http://www.globalreporting.org)). The common framework promotes peer review, comparison between organizations, benchmarking as well as lesson learning and improvement.

The GRI sustainability reporting framework includes a set of disclosures on the report parameters and the organization, which provides the context for assessing the organization's impact on social, environmental and economic aspects of global importance, as measured by a set of generic indicators. The GRI sustainability reporting indicators were produced on the basis of extensive multi-stakeholder consultation across the globe. They therefore represent the aspects of social, environmental, economic and underlying institutional sustainability considered globally important. The GRI framework is geared to assess an organization's impact and hold it accountable for its governance and operations. The framework is not geared for assessing the impact of an organization's programmes. However, the GRI recognizes the importance of reporting on the impact of an organization's programmes, and provides a non-profit sector supplement that includes indicators of programme management effectiveness. The GRI sustainability reporting framework and the supplement for the non-profit sector were used as a guide to develop a generic framework and indicators for assessing research programmes.

### **3.2.3 Isolating Contributions**

Developing a framework to assess the impact of research programmes presents a particularly interesting challenge. There are normally several steps, a number of role players and a long time lag between research, and the ultimate goal of improved natural resources that benefit society in a sustainable and equitable manner (CGIAR, 2000; Australian Government, 2009). For example, successful implementation of integrated conservation and development projects in communities, commonly involve upwards of 15 partners (Berks et al., 2004). Freshwater expert Dr Jackie King and her colleagues are compiling a book that recognizes and examines the challenges associated with implementation. They have identified no less than 20 steps that need to be in place before implementation can happen (Jackie King & Kate Brown pers com., 2009). This scenario makes it difficult to establish cause-effect relations and to isolate the impact of research *per se* (Roux et al., 2008). Moreover, failure of the implementation process can result in a poor assessment results that have little to do with research. There can also be a long lag between completion of research, uptake and implementation of results. Bibliometric analysis shows that uptake into the scientific community, let alone the management and practitioner community, peaks in the 3<sup>rd</sup> or 4<sup>th</sup> year after publication (van Raan, 2003), and the environment can take even longer to respond to interventions (Australian Government, 2009). This is particularly relevant to this study, as at the time of the assessment, several wetland research projects were still in process or had only just been completed and therefore had not had time to be taken up and applied. However, the way in which research is managed and carried out can have a direct and immediate impact. It can also influence the extent to which research results are taken up and applied (O'Fallon & Dearry, 2002). An assessment of the way in which research is managed and carried out is therefore indicative of both immediate and potential long-term impact, which overcomes some of the challenges mentioned above.

In this study, to isolate the contribution made by WRC and paint as fair and accurate a picture as possible, we aimed to develop a framework that focused on WRC's sphere of influence, research management effectiveness and stated objectives in relation to wetland research.

### **3.3 Framework description**

This section focuses on describing the framework that was developed and how the assessment was carried out.

The assessment framework is based on the GRI sustainability reporting framework but adapted for assessing programmes not organizations, and research programmes in particular.

The assessment framework has five key components and several sub-components including:

- Assessment parameters
- Organizational disclosures
- Programme objectives, indicators and impact:
  - ✓ Stakeholder perspectives
  - ✓ Economic indicators
  - ✓ Social indicators
  - ✓ Institutional indicators
  - ✓ Environmental indicators
- Programme management impact:
  - ✓ Management effectiveness
  - ✓ Research uptake
- Improving impact: Future needs

#### **3.3.1 Assessment Parameters**

This component defines the boundaries of the assessment with a view to isolate and measure WRC's contribution as clearly and fairly as possible. It deals with the purpose and limits of the assessment, as well as the quality of the information.

#### **3.3.2 Organizational Disclosures**

This component (i) sets the organizational context for WRC funded wetland research and activities, and (ii) identifies and describes the wetland research and related activities.

#### **ORGANIZATIONAL CONTEXT**

The WRC website ([www.wrc.org.za](http://www.wrc.org.za)) was used to access information on the Commission's vision, mission, goals, objectives, expected outcomes and outputs, as well as its core strategy in achieving those objectives. Annual WRC Knowledge Reviews for the last 8 years were examined to provide further insight into the

relationship between WRC wetland funded research and national priorities, including international obligations and research trends. In addition, the National Wetland Research Programme (NWRP) description (WRC, 2002), and the WRC Water-Linked Ecosystem Business Plan (2009/10), were examined. The Water-Linked Ecosystem is the key strategic area (KSA) responsible for administration of the NWRP.

## **WETLAND RESEARCH & RELATED ACTIVITIES**

A literature search was conducted to identify wetland related research projects, project reports, publications, articles and other activities funded all or in part by WRC. A combination of remote (Internet) and on-site (WRC) searches were utilized. The WRC on-line "Knowledge Hub" ([www.wrc.org.za](http://www.wrc.org.za)) was used as a starting point. Initially, the WRC website search engine was used to search all documents types (Reports, Water Wheel, Water SA, etc.) for a variety of key words. The preliminary results were used to narrow down the search fields and key words to those that produced the best results in terms of identifying research with specific wetland objective/s, as opposed to making incidental mention of wetlands. The key words that produced the best results were: wetland, vlei, bog, marsh, swamp, peatland and mire. Further exploration of the Knowledge Hub showed that Knowledge Reviews, produced annually from 2000/1, were excellent sources of information on both on research and other wetland related activities funded totally or partially by the WRC. Each of the 8 Knowledge Reviews was searched using the key words and examined for other relevant information. In addition to this remote search, a full list of wetland research publications was requested from WRC in order to access earlier research that may not be accessible via the website. When this list did not include all those found by remote search, an on-site search was conducted at WRC publications and library, so that any written and/or electronic catalogues of older records could be examined. Besides the internet and on-site search, copies of all relevant publications were obtained where possible, and the reference lists examined to identify other WRC funded research with a wetland focus. The Knowledge Reviews and publication reference lists also provided a valuable source of information on WRC funded research that was not focussed on wetlands *per se* (i.e. did not have a wetland objective), but provided information referred to / drawn on by wetland focussed studies.

Approaching the search from the other direction (proposal as opposed to report), a full list of commissioned wetland research, was requested from WRC. Databases listing completed / current / planned or potential K8 (R200 000 or less), K5 (>R200 000) and other (KV, TT) research commissions were provided, and searched using the key words.

In addition to the WRC related sources of information, the following websites were examined for relevant research: [www.environment.gov.za](http://www.environment.gov.za), [www.sanbi.org.za](http://www.sanbi.org.za), [www.fru.uct.ac.za](http://www.fru.uct.ac.za), [www.ramsar.wetlands.org](http://www.ramsar.wetlands.org). This proved particularly useful in terms of identifying and accessing unpublished reports emerging from current or recently completed projects. The Google Scholar search engine (<http://google.scholar.co.za>) and Science Direct ([www.sciencedirect.com](http://www.sciencedirect.com)) were also used to search for wetland research studies.

To facilitate processing, integration and analysis, information from the above-mentioned sources was cross-checked, collated and summarized in a database (Appendix 2) of wetland focussed research projects and associated reports funded totally or partially by the WRC, between 1971 and March 2010

### 3.3.3 Programme objectives, indicators and impact

This component (i) identifies overarching, programme level objectives related to wetland research projects, (ii) defines a set of indicators to measure impact, and (iii) assesses impact using a combination of qualitative (stakeholder perspective) and quantitative (indicators) measures.

#### OBJECTIVES

The above-mentioned literature was reviewed to identify which WRC key strategic areas (KSA) and cross-cutting areas each wetland research project relates to, and the associated objectives, indicators and benchmarks. The overarching objectives of the inter-agency National Wetland Research Programme (NWRP) administered by WRC were also identified.

#### INDICATORS & BENCHMARKS

Overarching objectives and in the case of the cross-cutting areas, outcomes and outputs were identified, but no related indicators or benchmarks could be found. Overarching objectives included economic, social, environmental and institutional aims, all of which are aspects of sustainability. Therefore the GRI sustainability indicators and Millennium Development Goals (MDG) were examined to identify generic aspects relevant to WRC's wetland related objectives ([www.globalreporting.org](http://www.globalreporting.org); [www.undp.org/mdg](http://www.undp.org/mdg)). These aspects, along with stakeholder input, were used to define a set of indicators to measure the social, environmental, economic and institutional impact of WRC wetland funded research and related activities. The indicators therefore include generic aspects of global importance, which will facilitate future benchmarking and comparison between research programmes and organizations.

The indicators are described in the assessment results, with the GRI and MDG aspects shown in italics, as per the example in Table 1.

Table 1: Example of indicators

<b>Impact</b>	<b>Economic Indicator</b>
Direct	Total <i>investment</i> in wetland research
Direct	% of total investment funded by donors other than WRC
Indirect	Investment directed toward <i>infrastructure of public benefit</i>
Indirect	% of projects providing knowledge and tools to support sustainable <i>development</i> (including balanced decision-making; <i>livelihood</i> development)
Indirect	% of projects providing knowledge and tools to support <i>sustainable practice</i> (including impact mitigation; financial sustainability)

#### ASSESSMENT

This sub-component seeks to obtain a holistic picture of the impact of wetland research and related initiatives funded by the WRC, using a combination of qualitative and quantitative measures.



### **Qualitative measures (Stakeholder perspective)**

Semi-structured interviews were conducted telephonically with 50 role players in the wetland sector (Appendix 3). Role players included researchers, consultants, practitioners (Provincial Departments, Working for Wetlands, Working for Water, Mondi Wetlands Programme), managers (Department of Water Affairs, Department Environmental Affairs, Department of Agriculture, Forestry and Fisheries), and the research manager and director of the WRC Water-Linked Ecosystem KSA, under which this study falls. Five of the 50 respondents were more focused on rivers and wetlands linked to rivers, but their wealth of experience working with WRC and slightly broader focus, helped to put wetland research in perspective. For example, wetland research is relatively new in comparison to river research and the environment that it was born into in South Africa was very different to that of river research. As a result, from the start there was a greater imperative for wetland management tools and less baseline data on which to base these tools. The opposite appears to be true for rivers.

The following questions were used to guide consultation with each role player.

- What is your involvement with WRC wetland related research and activities?
- What is your perception of the general impact?
- What is your perception of the ecological, social, public health, capacity building and institutional / governance impact?
- Are there any key strengths, challenges and opportunities that stand out?
- In terms of measuring impact what criteria would you like to see included and are you aware of any sources of information / data that can be used to measure impact?
- Is there anyone you recommend we consult?
- Is there anything you recommend we read?

The response was recorded separately for each respondent. The results were reported on in a generic manner to maintain confidentiality. It should be noted that although questions were used to guide consultation, the purpose was not to quantify responses, but to understand perceptions and suggestions.

Transcripts were analyzed and responses entered into a spreadsheet to facilitate further analysis and integration. Key impacts, improvements and drivers were then summarized and reported (Phillips, 2009).

### **Quantitative measures (Indicators)**

Evidence on each of the identified indicators was collected for each of the projects listed in Appendix 2. Evidence was obtained from proposals, reports, annual WRC Knowledge Reviews and WRC management records. The evidence was captured in a database and analysed as per the example in Table 2.

Table 2: Example of supporting evidence

			Y/N	Y/N	Y/N	Yes = 1; No = 0; Uncertain = blank
Project	Start	Budget (ZAR)	Co-funders	Sustainable practice	Sustainable Development	Description
501	1994	82850	1	0	1	Wetland Use: Decision support system
582	1994	376200	0	1	0	Wastewater management - mines - crop irrigation
...						
<b>Total</b>		<b>49040926</b>	<b>7</b>	<b>15</b>	<b>11</b>	
		<b>~R50 million</b>				
%			<b>10%</b>	<b>25</b>	<b>18</b>	
<b>Count (n)</b>				<b>61</b>	<b>61</b>	

A separate database was established for economic, social, institutional and environmental indicators. The WRC project reference number and a brief description of what the project was about were included in the databases, along with the project start date, which allowed trends to be examined. To facilitate future comparison between programmes and organizations, the majority of indicators were expressed as a % of the total number of projects commissioned. Indicators were expressed in the affirmative so supporting evidence (yes) was ascribed a value of 1, and an absence of supporting evidence (no) a value of 0. In cases where there was uncertainty this evidence was excluded from the analysis, so the sample size (count) varies, but was generally large enough to produce reliable information. This applies to current and pending projects in particular, as only the information in proposals and / or annual Knowledge Reviews were available for these projects. The total number of yes answers was expressed as a percentage of the total number (count) of projects involved in the analysis. Some indicators required actual values (e.g. Budget) or an average and standard deviation to be calculated. This evidence was either entered into the database as per the above example, or separate lists with supporting evidence were established and analysed. These included lists of regional and local research sites, research organizations and researchers contracted, and broader stakeholder organizations / groups acknowledged for their involvement in the research process.

### 3.3.4 Programme Management Impact

This component evaluates the management systems and approach that influence the uptake and impact of research.

#### MANAGEMENT EFFECTIVENESS

The GRI defines a series of indicators to assess programme management effectiveness in the non-profit sector. Generic aspects of the GRI indicators, MDG goals and the nine principles described below were used to define a set of indicators relevant to management of research programmes. The indicators are described in the assessment results, as per the example in Table 3.

Table 3: Example of research management indicators

<u>Indicator</u>	<u>Description / Measures</u>
System: Meaningful research products	WRC proposals require researchers to consider the target for the research product and the application of that product
% of projects synthesizing and applying existing information to develop new tools (applied as opposed to fundamental research)	97% of completed projects

Indicators included both descriptions of overarching systems that applied to all projects, and individual aspects that varied from project to project. Evidence on each indicator was obtained from proposals, reports, annual WRC Knowledge Reviews and WRC management records. A WRC research manager was consulted to obtain further input on policy and systems. The supporting evidence for indicators relevant to individual projects was recorded in a database and analysed in a manner similar to the example in Table 2.

## **RESEARCH UPTAKE**

The way in which research is carried out can have a direct and immediate impact, and it can influence the uptake and application of research results. O'Fallon and Dearry (2002) reviewed research uptake in the complex field of community health. They identified five key principles to apply in order to maximize the chances of uptake:

- I. Define the beneficiary community
- II. Practice cultural (and environmental) sensitivity
- III. Research should be community-driven
- IV. Practice collaboration and participation at every stage of research
- V. Disseminate results in meaningful terms and ensure information is accessible

An assessment of the impact of WRC funded research in support of the River Health Programme (Roux et al., 2008) identified two key areas influencing the uptake and application of research:

- VI. Robust science (defensible, repeatable, reliable)
- VII. Relevance to society

Furthermore, the WRC prioritize:

- VIII. Competency and capacity development (research capacity, implementation capacity)

And the GRI stresses:

- IX. Effective programme management

These nine 'principles' cover the entire research cycle and the management thereof. The extent to which they are applied is indicative of the chances of uptake and application of research results, and hence the immediate and potential long-term impact of projects.

Stakeholder input from Phase I assisted in defining two indicators for each of the 9 principles. As indicated in the example in Table 4, each indicator was ascribed a value of 0.5. All available evidence and information was used to score each project, and the average score was calculated to provide an overall rating between 0 and 1 for each principle. A score of 0-0.5 was considered below par and 0.6-1.0 above par.

Table 4: Example of research uptake indicators

Principle	Indicator (Posed as a question)	Cumulative Average Rating (0-1) (See Appendix 16)
Define community	Are the targets for research products identified in proposal...broadly (0.5)...specific end-client (0.5)	0.72 (n=34; sd=0.25)

To obtain an indication of whether research products were being used and how they were being applied, a list of completed research was circulated to a broad group of stakeholders via the national wetlands listserver and the Provincial Wetland Forums, with a request for feedback. In addition WRC provided records on the number of requests for each of the completed projects.

To obtain further insight into the value added by WRC, as part of the capacity building component of this project, a literature search was conducted to provide an overview of the general similarity and differences between WRC supported wetland research and that supported by other organizations in South Africa, Africa and Internationally. This process was also used to ascertain whether research findings were published and/or presented in a form other than a WRC report. Key word and author searches were conducted with the Google Scholar, Science-Direct, and WRC knowledge-hub search engines. Publications, including Water Wheel and Water SA and five other journals that commonly publish wetland research conducted in South Africa, were also searched. The five journals included:

- Transactions of the Royal Society of SA
- Journal of Limnological Society of SA
- Hydrobiologia
- SA journal of Marine Science
- Journal of Aquatic Science

### **3.3.5 Improving Impact – Future Needs**

Preliminary assessment results were shared with key stakeholders via email, workshop and meetings, to create an opportunity for them to reflect on the outcomes and consider future research needs. This component describes the future research and related needs that were identified.

## **4 ASSESSMENT RESULTS**

### **4.1 Assessment Parameters**

The purpose of the impact assessment was to enable continual improvement and guide future wetland research and related activities funded by the WRC.

The scope of the assessment was limited to palustrine wetlands (generally those vegetated wetlands commonly called marshes, swamps and vleis), but may include some research relevant to inland riparian wetlands linked to rivers. The assessment excludes projects making a passing reference to wetlands, focusing instead on research with a stated wetland objective, commissioned between 1971 and March 2010.

To isolate and measure the contribution made by WRC in as clear and fair a manner as possible, the scope of the assessment was limited to WRC's sphere of influence and set objectives. WRC is a water centred "Knowledge-Hub". It does not conduct research itself, but contracts service providers to carry out research and create new knowledge. Through the creation of new knowledge, WRC and its service providers influence integrated water resource management and matters of social, environmental and economic importance. As a knowledge organization, it also transfers knowledge, and builds capacity to create and apply knowledge. WRC's influence therefore includes knowledge creation, transfer and capacity building. Through its own activities as an organization, and through its research management policy and systems, it also influences the way in which research is conducted, knowledge transferred and capacity built.

The information and evidence on which the assessment is based is considered reliable in that it was provided by wetland specialists (researchers, managers, consultants, conservation practitioners) and/or obtained from published sources and management records (proposals, reports, annual WRC Knowledge Reviews). Every effort was made to identify research projects with a wetland objective and capture reported / recorded / published evidence. Nearly 70 projects with a wetland objective were identified and assessed, and while it is inevitable that some may have been missed, it is unlikely that the key findings of the impact assessment would change. Evidence was gathered for each individual project and combined to assess overall impact. The assessment was therefore carried out at programme level, and not for individual projects.

### **4.2 Organizational Disclosures**

#### **4.2.1 The Water Research Commission (WRC)**

The WRC's vision is:

*"To be a globally recognised leader in providing innovative solutions for sustainable water management to meet the changing needs of society and of the environment"*

The WRC's mission includes support for the "...creation, transfer and application of knowledge", and their mandate, as taken from the WRC website, is as follows:

- Promoting co-ordination, co-operation and communication in the area of water research and development.
- Establishing water research needs and priorities.
- Stimulating and funding water research according to priority.
- Promoting effective transfer of information and technology.
- Enhancing knowledge and capacity-building within the water sector.

In carrying out this mandate over the first 20 years (1971 – 2001) the WRC funded research in 18 key research areas (WRC Knowledge Review 2001/02), namely:

- Water policy
- Integrated water resource management
- Conservation of water ecosystems
- Catchment hydrology
- Groundwater
- Hydroclimatology
- Municipal wastewater management
- Water quality management
- Mine-water management
- Agricultural water management
- Industrial water management
- Membrane technology
- Hydraulics
- Rural water supply and sanitation
- Water services
- Integrated urban water management
- Potable water treatment
- Health-related water issues

South Africa became a democracy in 1994 and the following seven years (1994 – 2001) was a period of marked political and policy change. In response, the WRC developed a new core strategy to align with the country's new policy, transformation, social and economic priorities and objectives. The core strategy involved re-organizing the 18 research fields into 5 key strategic areas (KSA) and cross-cutting domains or impact areas, namely:

#### KSA

- Water Resource Management
- Water-Linked Ecosystems
- Water Use and Waste Management
- Water Utilisation in Agriculture
- Water-Centred Knowledge

#### Cross-cutting domains

- Water and Society
- Water and the Environment
- Water and the Economy
- Water and Health.

Each KSA is aligned with WRC's mission, guided by a business plan and headed at director level by top-level scientist / engineer who is also a successful research manager. There is no overlap between them,

each form an independent area where output and impact may be assessed. The Water-Centred Knowledge KSA was newly established in 2001 to support other KSAs and cross-cutting domains in the organization and sharing of knowledge and other activities. The cross-cutting domains address issues of national importance by supporting relevant research in each KSA and driving its own research into overarching matters that relate to all KSAs (WRC Knowledge Review, 2001/02). In addition to its core business of knowledge creation through four KSAs, the WRC also undertakes other activities related to institutional strengthening (partnership development), capacity building, knowledge transfer and dissemination. In 2003/04 12% of WRC's budget was allocated to activities other than research projects. This 12% was used mainly for consultancies (67%) as well as workshops and conferences (26%), capacity building – mobility fund (3%) and research sponsorships and other grants (4%).

The new core strategy was implemented in 2002/03 (financial year end 31 March) along with other adaptations to their approach to knowledge creation. This included introduction of 3 funding streams, namely solicited research focusing on specific objectives, unsolicited research allowing for innovation and consultancies. They also introduced a system involving comprehensive review of project proposals and a committee to steer projects. The steering committees would both raise and widen the reviewers profile and allow for extensive feedback. In addition they encouraged the building of research consortia to facilitate transfer of knowledge between organizations and individuals. A requirement was introduced for building the capacity of students through projects, with a particular focus on historically disadvantaged students.

Five years after it implemented this new core strategy, the WRC Board commissioned an independent institutional review. The review was carried out in July 2006 by a group of international and local experts. The review painted a positive picture of the WRC's relevance, effectiveness and efficacy, and indicated that WRC play an integral role in the water-centred community of practice and is held in high regard by this community. The review also highlighted certain areas that could be improved and informed the WRC's future core strategy and business plan. Two key areas for improvement included the need to create new knowledge in anticipation of future needs, and the need to build relationships and capacity to apply research findings and support policy implementation. The former implies that we are reaching the limits of the available fundamental knowledge needed to support management. Research that supports management has been a key focus of the WRC over the last decade and a half (WRC Knowledge Review: Water-Linked Ecosystems, 2008/09), but this finding suggests that a new balance needs to be found between fundamental and management-oriented research. The need to improve uptake of research findings implies the need to shift toward an approach to research that forges linkages and promotes cooperation between scientists, authorities and end-users of water-related goods and services (WRC Knowledge Review: Water-Linked Ecosystems, 2008/09).

Following the institutional review, KSA primary objectives remained the same from 2006-2009, but there were shifts in secondary objectives, research thrusts and programmes (WRC Knowledge Reviews, 2006/07-2008/09). Emphasis was placed on the need for new knowledge and improving mechanisms for dissemination and uptake of information, with a particular focus on policy development and implementation. In addition, the Water-Linked Ecosystem and Water Use & Waste Management KSA's emphasized the need for a deeper understanding of existing topics (e.g. wetland ecological reserve) (WRC Knowledge Review,

2008/09). These shifts reflected the findings of the institutional review as well as annual knowledge reviews and research needs analyses. Needs analyses are conducted in various ways, such as stakeholder workshops, analysis of strategic documents, strategic studies, focal group and individual interviews, interpretation of research outcomes and international / regional forums. In addition, WRC's role in the water community, places it in an ideal position to understand different perspectives and forge the links between agencies to address needs. WRC does not conduct research, it facilitates research. It is the "bridge-building" organization so pivotal to the success of integrated conservation and development initiatives (Berkes et al., 2004). As such WRC has forged strong relations with members of the water community, plays a role on key committees (e.g. Working for Wetlands), is involved with key international initiatives, plays a leading role in Africa and undertakes a variety of other activities facilitating knowledge creation, sharing and application (e.g. training workshops, reviews for journals and organizations, publication of papers and articles, lectures, conference key note addresses and presentations).

## 4.2.2 Wetland Research

The international Ramsar Convention (Iran, 1971) defines wetlands as:

***“ Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.”***

This definition is all-inclusive for most wetland types in South Africa (e.g. estuaries, reservoirs, farm dams, vleis, marshes, floodplains, pans, river sections and shallow lakes etc.). This assessment focused on palustrine wetlands (generally those vegetated wetlands commonly called marshes, swamps and vleis) but may also include some research on inland riparian wetlands linked to rivers. This is in line with the WRC managed, inter-agency National Wetland Research Programme (WRC, 2002). In addition, the scope of the literature search was further limited to research with a specific wetland objective, commissioned between 1971 and March 2010.

Working within this scope, every effort was made to identify all the wetland focussed research projects funded partially or totally by WRC. While we are confident that the key studies focussing on wetlands have been identified, some may have been missed, especially earlier studies (prior to 1994). This is because they may not be listed in catalogues, captured on the online Knowledge Hub, referenced by other studies and/or published yet. It was found that the WRC online "knowledge-hub", provides readily and freely available information on water-centred matters. Their staff will also readily help you track down information that you may not be able to find online, and publications are freely available (excluding international postage). However, it was found that it takes time, trial and error to work out how best to use the website search engine to find documents. The search engine could potentially be improved by facilitating searches for particular K5, K8, TT or KV report codes, as this is how WRC tends to organize information and how the research community referred to studies when consulted during Phase 1 of the impact assessment.

The results of the literature search are shown in Appendix 2. The literature search identified nearly 70 (67) WRC funded research projects with a wetland objective. Of those, 4 were never started, 1 was terminated before it ended, 41 (~60%) have been completed, 17 (~25%) are current, 3 (~5%) are pending and no report



could be found for 1 project initiated in 1992. Some of the research projects include more than one study and in some cases these studies are incorporated into 1 final report, in others they are published separately. Some 87 completed studies (double the number of projects) were identified. In addition wetland-linked lesson plans and other teaching aids for schools have been published. Since 2008 quarterly reports on the rivers and wetland network project have been submitted to the FETWater Programme (KSA10). The FETWater programme promotes further education and training in the water sector using a networking approach, the main output being an MSc in Water Resource Management. The following wetland-related modules are presented either as short courses or as part of the MSc (Vlok pers com., 2010):

- Module 1: Wetland and river functional ecology
- Module 2: Water quality
- Module 3: Monitoring of wetlands and rivers
- Module 4: Estuaries and the marine environment
- Module 5: Wetlands, rivers and the Law
- Module 6: Wetland and river management
- Module 7: Wetland and river rehabilitation methods
- Module 8: Project (Master and Honours students)

The wetland focussed studies identified, referenced at least 90 other studies funded by the WRC. These 90 studies did not have a wetland objective and therefore do not form part of this review. However, they contain supporting information (e.g. guide to freshwater invertebrates) used in conducting wetland research, thereby indirectly contributing to WRC's investment in wetlands.

A review of the literature (Phillips & Madlokazi, 2010) indicated that the knowledge and tools created through the wetland research completed to date support the wetland community of practice with:

Wetland inventories	Ecological Reserve Determination	Understanding hydrological processes
Protection & Mitigation	Rehabilitation	Balanced decision making
Integrated management	Policy development	Wastewater treatment
Water supply	Livelihood development & wise use	Resource assessment
Cooperative governance	Human induced impacts	Mitigation of extreme events

Current or planned research will support the wetland community of practice with:

Sustainable Use Indicators	Treating wastestreams	Climate change (Mfabeni Mire)
Eutrophication	Alternative training material	Wetland Vegetation
Buffer zones	Rapid Reserve determination	Sustainable use guidelines
Education & Training	Heritage protection network	Restoration livelihood value
Livelihoods	Evapotranspiration	Review of ecological sensitivity
Plant ID guide	Water Quality & Landuse	Regional processes
	Impact medicinal plant cultivation	Wise use (DST Farmer to Pharma)

Trends indicate an increase in the number of socio-economic related research projects after 2007, reflecting an imperative to increase socio-economic understanding of wetlands. Trends also indicate an increase in the

number fundamental as opposed to applied research projects from 2007, aligning with the observation that we are reaching the limits of our current knowledge of water-linked ecosystems and require new knowledge to further inform management and sustainable-use of ecosystems (WRC Water-Linked Ecosystem Business Plan, 2009/10). Natural means of addressing eutrophication, managing waste streams to mitigate the impact of harmful substances (e.g. Endocrine Disruptor Chemicals - EDCs) and the mitigation of climate change, are considered important research areas globally, and the role of wetlands in addressing these issues may well be considered in future research (WRC Knowledge Review, 2008/9). Other future research needs were identified through the assessment process and are discussed in section 4.5.

## **4.3 Programme Objectives, Indicators & Impacts**

### **4.3.1 Objectives**

Appendix 2 shows the wetland research projects identified and their link to the WRC key strategic areas (KSA) and research thrusts. Overall, 72% of the projects fall under KSA 2 (Water-Linked Ecosystems), 15% under KSA 3 (Water Use & Waste Management), 11% under KSA 1 (Water Resource Management) and 2% under KSA 4 (Water Utilisation in Agriculture). This distribution of wetland research across KSAs is probably due to the nature of wetlands. Wetlands are a water-linked ecosystem (KSA 2), they play an important role in the water cycle (KSA 1), can be used in the management of wastewater (KSA 3) and for agricultural purposes (KSA 4).

Overarching wetland research objectives are aligned with the objectives of the inter-agency National Wetlands Research Programme (NWRP) initiated in 2002, the KSAs as well as the cross-cutting domains of Water & Economy, Water & Society, Water & Environment, and Water & Health.

The NWRP is being implemented in three phases, phase 1 (wetland rehabilitation) and phase 2 (wetland health & importance) have been completed and phase 3 (wise use) is being initiated (WRC, 2002). The overarching objectives of the NWRP were to:

- Initiate, support and manage research projects that contribute to wetland rehabilitation and management.
- Ensure the effective transfer of information on wetlands to institutions and persons involved in wetland rehabilitation and management.
- Expand human resource capacity for wetland management and rehabilitation.
- Ensure financial sustainability of wetland research in South Africa.

The overarching primary and secondary objectives of the KSAs and cross-cutting domains are shown in Appendix 4 and can be summarized as follows:

- **Water resource management:** Ensure water resources are protected, utilized, developed, conserved, and managed to achieve environmental, social and economic sustainability.

- **Water-linked ecosystems:** ...enable good environmental governance to ensure the utilization and sustainable management of water ... and understand the ecological processes underlying the delivery of goods and linked ecosystems.
- **Water use & waste management:** ... ensure reliable, affordable and efficient water use and waste management services to enhance the quality of life, and contribute to economic growth and improved public health.
- **Water and Agriculture:** ...increase household food security and improve the livelihoods of people at a farming, community and regional level through efficient and sustainable utilization and development of water resources in agriculture.
- **Water & Economy:** Demonstrate the applicability of economic principles in the water field and provide convincing evidence as well as sound knowledge and support to water management institutions and implementing authorities.
- **Water & Society:** Develop a greater understanding of... social dynamics in the water sector...using water for transformation and social justice...utilising water as a shared and scarce resource in a sustainable way...providing water services which are socially acceptable, affordable and available to all...ensuring ready access to water for the poor and disadvantaged members of society.
- **Water & Environment:** Contribute to achieving ...sustainable water management... sustainable techniques in water governance and water projects that are aimed at addressing human development needs.
- **Water & Health:** Contribute to the protection of human health by investigating the sources, occurrence, persistence and control of causes leading to water related diseases and other water-related health problems.

Further analysis of Appendix 4 shows that as a knowledge organization, WRC aims to realize these objectives through the provision and transfer of knowledge, the development of tools and strategies, policy reform, and capacity building for research and management.

Appendix 4 also shows that the objectives and related research thrusts and programmes align with the:

- Department of Water Affairs (DWA) priorities of equitable and sustainable supply of water and goods and services related to water-linked ecosystems, protection policies and measures, institutional regulation and development, methods to restore degraded ecosystems, effective water service institutions, effective local-level operations and management of DWA water service schemes, efficient and sustainable delivery of water service, sound policy and practice of water services, provision of base water supply and sanitation, water conservation and demand management, social and economic growth through water.

- Convention on Biological Diversity's (1993) focus on knowledge, capacity and tools ([www.cbd.int](http://www.cbd.int)).
- Ramsar Convention's (1971) focus on wise use, information transfer, and institutional capacity.
- Millennium Development Goals (MDGs) of poverty reduction, environmental sustainability, global partnerships for development, combatting disease and primary education.
- GRI indicators of sustainability related to economic and social benefits, including community health and safety, as well as environmental indicators related to resource (water, natural materials) use, biodiversity and natural habitats, and overall environmental protection.

### 4.3.2 Indicators

Generic aspects of relevant MDG goals and GRI sustainability indicators were used to define indicators of social, environmental, economic and institutional impact, relevant to wetland research related objectives. The indicators are described below with GRI and MDG aspects shown in italics.

Table 5: Economic Indicators

<b>Impact</b>	<b>Economic Indicator</b>
Direct	Total <i>investment</i> in wetland research
Direct	% of total investment funded by donors other than WRC
Indirect	Investment directed toward <i>infrastructure of public benefit</i>
Indirect	% of projects providing knowledge and tools to support sustainable <i>development</i> (including balanced decision-making; <i>livelihood</i> development)
Indirect	% of projects providing knowledge and tools to support <i>sustainable practice</i> (including impact mitigation; financial sustainability)

Table 6: Social Indicators

Note that the WRC procures the services of external research organizations and researchers. They are therefore considered to be part of WRC's stakeholder community, and according to the GRI, community contributions fall under the bracket of social impact. However, support of research organizations and researchers also has an institutional impact.

<u>Table 6a: Labour</u>	
<b>Impact</b>	<b>Indicator</b>
Direct	% of total investment spent on <i>procuring services</i> of researchers
Direct	Total number of research <i>organizations contracted</i>
Direct	Total number of <i>researchers (authors, editors) contracted</i>
Direct	% of total investment spent at local research sites ( <i>labour</i> , other resources, services)
Direct	% of projects directly supporting public works programmes employing <i>local labour</i>
Direct	% of projects that directly contribute to improved <i>occupational health &amp; safety</i>

<u>Table 6b: Capacity building</u>	
<b>Impact</b>	<b>Indicator</b>
Direct	% of projects employing researchers who are <i>female and/or HDI</i>
Direct	% of projects <i>employing and training</i> students or emerging researchers to assist with research ( <i>training that supports employment &amp; career development</i> )
Direct	% of projects indicating research forms the subject of a student thesis or project ( <i>training that supports employment &amp; career development</i> )
Direct	% of projects building broader stakeholder <i>capacity</i> through training or action research
Direct	% of projects raising <i>public awareness</i> (Community groups, Individuals)

<u>Table 6c: Human Rights</u>	
<b>Impact</b>	<b>Indicator</b>
Direct	Number and/or % of projects describing <i>sensitivity</i> measures taken to protect the local culture and environment

<u>Table 6d: Health &amp; Safety</u>	
<b>Impact</b>	<b>Indicator</b>
Direct	% projects describing improved <i>health &amp; safety</i> as result of research / research application

<u>Table 6e: Indirect Social Impacts</u>	
<b>Impact</b>	<b>Indicator</b>
Indirect	% of projects providing knowledge and tools to support / inform use and <i>livelihood development</i>
Indirect	% of projects providing knowledge and tools to support <i>education and training</i>
Indirect	% of projects providing knowledge and tools to support <i>human rights</i> (healthy environment, sustainable & equitable water and material supply, indigenous rights)
Indirect	% of projects providing knowledge & tools to support improved human <i>health &amp; safety</i>

**Table 7: Institutional Indicators**

<b>Impact</b>	<b>Indicator</b>
Direct	% of projects with a number of collaborating organizations contracted to provide research (consortia, partnerships)
Direct	Average number per project of broader stakeholder organizations / groups acknowledged for their involvement in the research process (Community of Practice)
Indirect	% of projects producing knowledge and tools to support policy development / improvement:
Indirect	% of projects producing knowledge and tools to support policy implementation
Indirect	% of projects producing knowledge and tools to inform governance models
Indirect	% of projects producing knowledge and tools to support integrated management
Indirect	% of projects producing knowledge and tools to support natural resource management
Indirect	% of projects producing knowledge and tools to support water/material supply/use
Indirect	% of projects producing knowledge and tools to support waste management
Indirect	% of projects producing knowledge and tools to support decision-making that balances ecological and human needs / promotes sustainable development
Indirect	% of projects producing knowledge and tools to support conservation and development planning

**Table 8: Environmental Indicators**

<b>Impact</b>	<b>Indicator</b>
Direct	% of projects describing potential negative environmental impacts related to the research process and mitigation ( <i>responsibility</i> )
Direct	% of projects where the research process directly assisted <i>restoration</i>
Indirect	% of projects contributing knowledge & tools supporting <i>mitigation</i> of impacts and maintenance or assessment of environmental condition
Indirect	% of projects contributing knowledge & tools supporting environmental <i>protection</i> of wetlands (including management measures)
Indirect	% of projects contributing knowledge & tools supporting <i>restoration</i>
Indirect	% of projects contributing knowledge & tools supporting ecosystem services & <i>sustainable-use</i> ( <i>environmental sustainability</i> )
Indirect	% of projects contributing new data to understand wetland form and function
Indirect	% of projects contributing knowledge & tools supporting <i>water and material supply/use</i> management
Indirect	% of projects contributing knowledge & tools supporting <i>wastewater</i> management
Indirect	% of projects where research was conducted <i>in or adjacent protected areas</i>

### 4.3.3 Impact

#### STAKEHOLDER PERSPECTIVE

A detailed description of the outcomes of the stakeholder consultation process can be found in Phillips (2009). In general, perceptions of 50 key role players indicate WRC has had the following key impacts on the

wetland sector (i) it has supported development of a capacitated community of practice; (ii) been the primary source of funding for wetland research; (iii) supported relevant research linked to key impact areas; (iv) explored new learning promoting growth and leadership and (v) developed a relatively accessible body of knowledge. While these impacts indicate that WRC is fulfilling its mandate and mission, the perception is there are areas that can be improved. Improvements are related to three key factors (i) institutional changes and associated challenges regarding implementation, (ii) understanding of wetlands as part of a larger socio-ecological system (watershed), and (iii) the lack of students entering this field of research, particularly students from a historically disadvantaged background. These concerns and potential improvements are discussed further in section 4.5.

## ECONOMIC, SOCIAL, INSTITUTIONAL & ENVIRONMENTAL INDICATORS

The measures for each indicator are presented in table form below and the extensive supporting evidence used in the calculations is presented in the appendices.

### Economic Indicators

Measures of the direct and indirect indicators of economic impact can be seen in Table 9 and the supporting evidence used in calculations in Appendix 5 and Appendix 6 (List of Research Sites).

Table 9: Economic impact

Impact	Indicator	Measure
Direct	Total <i>investment</i> in wetland research	~R50 million
Direct	% of total investment funded by donors other than WRC	10%
Indirect	Investment directed toward <i>infrastructure of public benefit</i>	Wetlands are a natural form of infrastructure providing direct and indirect goods and services to the public (Appendix 6 lists local / regional wetland research sites)
Indirect	% of projects providing knowledge and tools to support sustainable <i>development</i> (including balanced decision-making; <i>livelihood</i> development)	25 %
Indirect	% of projects providing knowledge and tools to support <i>sustainable practice</i> (including impact mitigation; financial sustainability)	18%

Findings indicate that the WRC has invested nearly R50 million into 67 research studies with a wetland related objective. Most (99%) of this investment has been made since 2002. An estimated 10% of this investment was co-funded by other donors. This confirms stakeholder perception that the WRC plays a critical role in funding and guiding wetland research. The investment also has an indirect economic impact in that it is directed toward resources (biodiversity, water) and infrastructure (wetlands) of public benefit, with research sites including formally protected areas, Ramsar Sites, Biosphere Reserves and communal areas where livelihood dependence on wetlands is high (Appendix 6). Over 40% of the wetland research was

geared to support sustainable socio-economic development and sustainable practice. Of 26 economic-related projects, over half (54%) were commissioned in the last five years (2005-2010).

## Social Indicators

The direct and indirect indicators of social impact and measures thereof can be found in Table 10 and supporting evidence in Appendix 7, Appendix 8 (Research Organizations) and Appendix 9 (Researchers).

Table 10 (a-e): Social impact

<u>Table 10a: Indirect Social Impact</u>		
<b>Impact</b>	<b>Indicator</b>	<b>Measures</b>
Indirect	% of projects providing knowledge and tools to support / inform use and <i>livelihood development</i>	26%
Indirect	% of projects providing knowledge and tools to support <i>education and training</i>	11%
Indirect	% of projects providing knowledge and tools to support <i>human rights</i> (healthy environment, sustainable & equitable water and material supply, indigenous rights)	24%
Indirect	% of projects providing knowledge & tools to support improved human <i>health &amp; safety</i>	19%

The indirect impacts are discussed below in relation to direct labour, capacity building, human rights, and health and safety impacts.

## Labour

<u>Table 10b: Labour Impact</u>		
<b>Impact</b>	<b>Indicator</b>	<b>Measure</b>
Direct	% of total investment spent on procuring services of researchers	Average of 74% (n=37; sd=18) per project; Total of ~R37 million
Direct	Total number of research organizations contracted	68 organizations (Appendix 8) The number of organizations has increased by over 85% since 2000
Direct	Total number of key researchers (authors, editors) contracted	176 (Appendix 9) The number of researchers has increased by over 85% since 2000
Direct	% of total investment spent at local research sites (labour, other resources, services)	This was not recorded, although there is likely to have been some local expenditure. There is no indication in reports of payment for local labour
Direct	% of projects directly supporting public works programmes employing local labour	3 out of 31 projects (10%)
Direct	% of projects that directly contribute to improved occupational health & safety	1 project on EDCs resulted in Working for Wetland teams working at the research site being warned to avoiding drinking directly from streams (WfWetlands feedback on report use)



An estimated 74% (R37 million) of the R50 million investment was used to procure the services of researchers. This has helped to grow the wetland research community by over 85% in the last ten years. Conservatively, the number of research organizations involved in research increased from 10 in 2000 to 68 in 2010 (Appendix 8), while the number of researchers increased from 20 to 176 (Appendix 9). There was no evidence to suggest that local labour was hired at research sites, although this may have been the case. It is suggested that records of expenditure at local research sites are kept and reported on in future, as it is indicative of economic impact. Two research projects on wetland and riparian rehabilitation actively supported the Working for Wetlands and Working for Water expanded public works programmes (EPWP), which employ and train local contractors and labour. An estimated 26% of projects contributed knowledge and tools to support sustainable wetland use and livelihood development. Of 16 projects producing knowledge and tools supporting wetland use and livelihood development, 10 (62%) were commissioned in the last five years (2005-2010).

### Capacity Building

<u>Table 10c: Capacity Building</u>		
Impact	Indicator	Measure
Direct	% of projects employing researchers who are <i>female and/or HDI</i>	78% female 55% HDI/DI
Direct	% of projects <i>employing and training</i> students or emerging researchers to assist with research ( <i>training that supports employment &amp; career development</i> )	~70%
Direct	% of projects indicating research forms the subject of a student thesis or project ( <i>training that supports employment &amp; career development</i> )	42%
Direct	% of projects building broader stakeholder <i>capacity</i> through training or action research	30%
Direct	% of projects raising <i>public awareness</i> (Community groups, Individuals)	47%

### *Capacity Building: Wetland Research Community*

Nearly 80% of the research projects employed female researchers and 55% of the projects employed historically disadvantaged individuals (HDI) Nearly 70% of the projects employed, trained and mentored postgraduate students and emerging researchers. Students were involved as researchers or research assistants and conservatively, 42% of the projects formed the subject of Honours, Masters or Doctoral theses. This confirms stakeholder perception that WRC has played an important role in funding the training of postgraduate students and growing research capacity. There are cases to suggest that postgraduate training improves employability and career development, with students trained through projects going on to become established researchers in Universities and Consultancies. There are also cases that suggest that while some researchers do leave South Africa, they may remain engaged in the research field and return to the country with new knowledge and experience. An area of stakeholder concern was the lack of students interested in this field. It was suggested that funding undergraduate bursaries and possibly even school-university bridging studies, may make it possible (particularly for HDIs) for interested school leavers to follow studies in this field.

### *Capacity Building: Broader Stakeholder Community*

WRC policy is to establish a steering committee to guide research projects comprised of authorities, researchers, experts and other key role players. In addition, 86% of the projects adopted a participatory approach of some sort to engage stakeholders in the research process. This has helped to develop a wetland community of practice (see institutional impact).

Nearly 50% of the research projects involved local authorities, community based organizations and community members, and aided in raising public awareness of wetlands. While participation undoubtedly helps to raise awareness and build the capacity of stakeholders, the degree of learning taking place is difficult to quantify. An estimated 30% of the projects built stakeholder capacity to apply research through training courses or through action research. Several projects indicated that training courses would be developed and delivered on an as needed basis. There is evidence to suggest that this is occurring. For example Rhodes University in conjunction with Ground Truth delivered a five day course on the wetland rehabilitation tools produced through phase 1 of the NWRP. This course was attended by 24 people from SANBI (8) and Aurecon (4 interns, 12 staff) an engineering consultancy, although only 11 turned in the final assignment and received a certificate of competence as well as attendance (Aurecon - Tamara North pers com., 2010). Stakeholders emphasized the need for training to bridge the gap between research and implementation, but it was suggested that consideration be given to standardizing training, especially when it comes to the use of tools. Just over 10% of the projects supported wetland / environmental education and training at the school (school) and further education and training (FET) level, including the development and delivery of an MSc in Water Resource Management through the FETWater Programme. The FETwater programme adopts a network approach to education and training, involving a number of different service providers in development and delivery of training. From 2008-2010 a total of 153 people (38 DWA, 58 Women, 95 males, 85 disadvantaged) underwent wetland related training through the FETWater Programme, either through short courses or as part of the MSc (Vlok pers com., 2010). Training to build stakeholder capacity to apply new knowledge and tools is therefore taking place. It is suggested that a central database be established to record what courses are delivered, who delivers them and who was trained, and that this database be used to identify gaps and focus training efforts. This could possibly be done through WRC KSA 5 or the FETWater Programme wetland network. If training courses are delivered as part of research projects, it would facilitate future assessments if course and participant information were summarized in final reports, possibly as an appendix.

Lessons from the Mondi wetland research programme suggest that a mentorship approach, where stakeholders are guided and mentored in applying wetland knowledge during the course of their work, may be more effective in building capacity than stand-alone, more convenient short courses (WWF, 2009; David Lindley pers com., 2009). Opportunities for research and long-term mentoring can be created by dovetailing research with existing, well-resourced (funds, personnel) natural resource management programmes. Not all research is suited to this type of "action research" approach but in some cases it is appropriate. A good example was the WRC managed wetland rehabilitation research programme, which dovetailed with the Working for Wetlands programme, and adopted a client-centred, action research approach to the development of wetland rehabilitation tools. In this scenario it is possible to clearly define a client and

develop a detailed understanding of their needs and capacity. This assists in matching research products to needs (as far as possible). However, research and development is by nature exploratory and what emerges may not meet immediate client needs or match their capacity. Ongoing mentoring can assist clients in effectively applying emerging knowledge, while the capacity of the client (expertise, time, funds) to implement the knowledge is developed.

### Human Rights

Impact	Table 10d: Human Rights	
	Indicator	Measures
Direct	Number / % of projects describing local culture and environment at research sites and sensitivity measures	Generally not reported but are indications sensitivity measures in 2 projects (6%)

Two projects (6%) referred to cultural practice or spiritual belief. Measures to mitigate the impact of research on the local culture were generally not reported on although they may be implicit in a participatory approach. It is recommended that cultural sensitivity measures be reported in future as it relates to impact. The same applies to environmental sensitivity, in that South Africa's constitution states that people have the right to a healthy environment. An estimated 24% of projects produced knowledge and tools in support of human rights, including a healthy environment, indigenous rights, and a sustainable and equitable supply of water and materials.

### Health & Safety

Impact	Table 10e: Health & Safety	
	Indicator	Measures
Direct	% projects describing improved <i>health &amp; safety</i> as result of research / research application	As a result of 1 project Working for Wetland teams working at a site were warned not to drink from streams with high pollutant levels (WfWetlands feedback on use of reports)

Stakeholder feedback on the uptake and application of research products, indicates that one project helped to improve the occupational health and safety of a Working for Wetland team. The team was warned not to drink water from the vlei they were helping to rehabilitate. Nearly 20% of projects produced knowledge and tools supporting health and safety, with a focus on wastewater management (e.g. mine, wine, effluent), removal of pollutants (e.g. EDCs, urban stormwater) and water quality. One project reviewed the relationship between wetland rehabilitation and disease vectors that breed in wetlands (Malan et al., 2009).

### **Institutional Indicators**

The indicators of institutional impact and the measures thereof can be found in Table 11 and the supporting evidence in Appendix 10 and Appendix 11 (Broader Stakeholder Organizations / Groups).

Table 11: Institutional impact

Impact	Indicator	Measure
Direct	% of projects with a number of collaborating organizations contracted to provide research (consortia, partnerships)	45%
Direct	Average number per project of broader stakeholder organizations / groups acknowledged for their involvement in the research process (Community of Practice)	Conservatively on average 12 per project (n=29; sd=7) Conservatively over 600 organizations / groups including community members, community organizations and local authorities ( <i>Appendix 11</i> ). Number of organizations / groups has increased by nearly 70% since 2000.
Indirect	% of projects producing knowledge and tools to support policy development / improvement	3%
Indirect	% of projects producing knowledge and tools to support policy implementation	15%
Indirect	% of projects producing knowledge and tools to inform governance models	2%
Indirect	% of projects producing knowledge and tools to support integrated management	2%
Indirect	% of projects producing knowledge and tools to support natural resource management	32% (2% integrated management)
Indirect	% of projects producing knowledge and tools to support water/material supply/use	3%
Indirect	% of projects producing knowledge and tools to support waste management	15%
Indirect	% of projects producing knowledge and tools to support decision-making that balances ecological and human needs / promotes sustainable development	19%
Indirect	% of projects producing knowledge and tools to support conservation and development planning	10%

An estimated 32% of research projects produced knowledge and tools to support natural resource management, 2% specifically support integrated management (e.g. integration of wetlands into catchment management), 3% wetland-related policy development (e.g. agriculture, freshwater biodiversity), 15% policy implementation (e.g. reserve determination, wetland inventory), 2% governance models (e.g. cooperative governance in communal areas), 3% management of the supply of water and other resources (materials), 15% wastewater management, 10% conservation and development planning, and nearly 20% support informed decision-making that helps balance the needs of society, conservation and.

In addition, participatory research and WRC policy (multi-stakeholder steering committees, multi-disciplinary research consortia) and strategic initiatives (International, National, Africa), have directly helped strengthen the institutional arrangements underlying wetland management, protection, rehabilitation and sustainable use. A summary of the WRC activities described in the 2008/09 Knowledge Review, which are related to wetland research in general and to specific wetland projects, is shown in Appendix 12 as an example of the

type of capacity building, transfer, dissemination and strategic activities undertaken. Forty five percent (45%) of projects were carried out by more than one research organization (consortia). On average 12 organizations per project (n=29; sd=7) were acknowledged for the role they played in the research process. Conservatively, over 600 stakeholder organizations or groups have been involved in projects completed to date (Appendix 11), including representatives from local communities. However, continued engagement is necessary to maintain local interest and momentum generated by research. WRC could potentially play an important role in maintaining contact through their water-centred knowledge support, dissemination and transfer activities. Stakeholders also suggested that interested local parties could be linked into existing wetland forums and catchment forums.

A key area of concern raised by stakeholders was linked to the marked institutional shifts since 1994. Many people previously in institutions (government, university) have moved to consultancies. As such they are required to generate their own income (some personnel in Universities are also required to do so), which limits the amount of time they have to spend on research steering committees. Correspondingly, institutions have been left with limited resources and capacity. Personnel are stretched and research has to be directly linked to their specific needs for them to be involved. Stakeholders indicated a willingness to participate on steering committees, but were concerned that unavoidable time limitations may compromise scientific rigour and defensibility.

It is essential that WRC maintain their reputation for publishing quality research via WRC Reports or papers in *Water SA*, a well-recognized journal with a growing citation record (Jenny Day pers com., 2010). Stakeholders stressed the importance of maintaining the standard of papers in *Water SA*. They also suggested that the peer review process associated with publishing scientific papers could be employed to help maintain scientific rigour. Literature searches produced little evidence to suggest that research is being published in scientific journals, although this may be due to the limitations of key word and author searches. Either way the information is not readily available to the scientific community through search engines such as Google Scholar or Science Direct. This suggests that this is an area that could improve. Alternatively, as not all research may lend itself to scientific publication and consultancies are not geared toward publishing papers, an independent, paid reviewer could be budgeted for, although issues of bias do need to be considered.

A related concern raised by stakeholders was that financial constraints left limited time for compiling final research reports and/or scientific papers. Evidence (see section 4.4.1) indicates that 86% of reports were published after the project completion date (although the research may have been completed on time). This is a concern given that the research generally addressed immediate needs and could have taken several years to complete as it was. It was suggested that an allowance be made in the research budget for time to dedicate to writing reports and papers, and avoid publishing delays.

## Environmental Indicators

Indicators of environmental impact and measures thereof can be found in Table 12 and supporting evidence in Appendix 13.

Table 12: Environmental impact

Impact	Indicator	Measure
Direct	% of projects describing potential negative environmental impacts related to the research process and mitigation ( <i>responsibility</i> )	Generally not reported on - one project stated paper and printing as considerations for dissemination methods.
Direct	% of projects where the research process directly assisted <i>environmental improvement</i>	1 project - Action research approach assisted Working for Wetlands with rehabilitation at case study sites
Indirect	% of projects contributing knowledge & tools supporting <i>mitigation</i> of impacts and maintenance or assessment of environmental condition	23%
Indirect	% of projects contributing knowledge & tools supporting environmental <i>protection</i> of wetlands (including management measures)	47%
Indirect	% of projects contributing knowledge & tools supporting <i>restoration</i>	9%
Indirect	% of projects contributing knowledge & tools supporting ecosystem services & <i>sustainable-use</i> (environmental sustainability)	16%
Indirect	% of projects contributing new data to understand wetland form and function	44%
Indirect	% of projects contributing knowledge & tools supporting <i>water and material supply/use</i> management	3%
Indirect	% of projects contributing knowledge & tools supporting <i>wastewater</i> management	14%
Indirect	% of projects where research was conducted <i>in or adjacent protected areas</i>	52% of projects with regional/local research sites were linked to formally protected areas, Biosphere Reserves, Conservancies, Ramsar or Ramsar designated sites (Appendix 6)

The way in which research is carried out may have a negative impact on the environment (e.g. sampling, transport, etc.). Measures to mitigate negative impacts were generally not reported on, although one project did consider paper and printing in terms of dissemination methods. It is suggested that such considerations are reported on in future, as it relates to impact and indicators of product responsibility.

One project employed an action research approach, directly assisting Working for Wetland managers, practitioners and local contractors in rehabilitating wetlands. Of the 21 projects with regional/local research sites, 11 (52%) were in or adjacent to formally protected areas, Biosphere Reserves, Conservancies, Ramsar or Ramsar designated sites (Appendix 6).

An estimated 23% of projects produced knowledge and tools to support mitigation of impacts (e.g. development, agriculture, and mining), assessment and/or maintenance of wetland condition. Nearly 50% produced knowledge and tools to support overall environmental protection (including management), 44% contributed new data related to wetlands, nearly 10% to wetland rehabilitation, 16% to sustainable-use including understanding and valuing ecosystem services, 3% to the supply and use of water / materials linked to wetlands, and 14% to wastewater management. Fourteen (14) of 28 (58%) research projects (completed and current) potentially producing new data on wetlands were commissioned in the last five years (2005-2010).

## 4.4 Programme management impact

### 4.4.1 Management effectiveness

Indicators related to research management effectiveness are shown in Table 13. They include descriptions of systems that apply to all projects and measures of aspects that vary from project to project. Supporting evidence for can be found in Appendix 14, 15 (peer review, dissemination) and 12 (related activities).

Table 13: Research Management Effectiveness

<b>System / Indicator</b>	<b>Description / Measures</b>
System: Meaningful research products	WRC proposals require researchers to consider the target for the research product and the application of that product
System: New knowledge, Coordination, Alignment	Coordination: WRC commissions rather than conducts research, and as such forms a key link in the wetland Community of Practice, building bridges between stakeholders. Alignment: WRC networking and strategic international, national and Africa initiatives, knowledge transfer and capacity building activities provide them with a good understanding of research needs and initiatives (Appendix 12). New knowledge: WRC conducts or commissions regular needs analyses. Most projects synthesize existing knowledge and target gaps in understanding or use what exists to develop tools. WRC commission short term consultancies, solicited research targeting certain objectives and unsolicited research promoting innovation.
% of projects synthesizing and applying existing information to develop new tools (applied as opposed to fundamental research)	97% of completed projects
% of projects adding new information (or fundamental as opposed to applied research)	50% of completed projects
% of projects adding new information and synthesizing and applying existing information (combined)	38% of completed projects
System: <i>Broader stakeholder engagement</i> in the research process	WRC establish a steering committee to guide most projects. Committees are comprised of “policy-makers”, researchers, specialists and other key stakeholders. The participatory approach adopted by many researchers engages other

<b>System / Indicator</b>	<b>Description / Measures</b>
	stakeholder groups, including local community groups, individuals and local authorities where appropriate.
% of projects where research meets a need at a local/regional research site	100%
% projects engaging in participatory research (meetings, workshops, interviews, sampling, testing, action research)	86%
% of projects engaging in action research or an approach that facilitates a high level of buy-in	23%
System: Promoting Robust Science	WRC: Peer review via specialists on steering committees. Researchers: Peer review through presentations, independent specialists, and possibly the publishing process for scientific papers or books.
% of projects where research is subject to peer review through workshop/conference presentations	50% (Appendix 15)
% of projects where research is subject to peer review through publication in a scientific journal, thesis publication, book publication	28% (Appendix 15)
System: Knowledge transfer, product promotion, availability and dissemination	Research reports can be downloaded free of charge from the WRC website or they can be ordered from WRC publications (free, except international post). WRC promotes research at Open Days, in annual Knowledge Review reports, through Water Wheel (WRC popular publication), Water SA (WRC Scientific Journal), and where appropriate via WRC policy, technical and/or news briefs. Added dissemination / transfer takes place through participation in / leadership of strategic initiatives, workshops, conferences, capacity building initiatives (Appendix 12). KSA 5 (Water-Centred Knowledge) plays a key role in driving and supporting other KSAs with research management, knowledge transfer and dissemination.
% of projects where products (tool, popular, media, paper, conference presentation, policy, technical) match target groups (generally)	Generally - 100%
% of project reports published by end date	24%
% of projects achieving objectives, producing envisaged products to a level acceptable by WRC and the steering committee	100% of completed projects One project was terminated before completion.
% of projects indicating adaptation of original brief (flexibility within reasoned boundaries)	16%
System: Stakeholder <i>feedback and response mechanism</i>	KSA 5 (Water-Centred Knowledge) assumes this responsibility
System: Capacity & Competency Development ( <i>Gender &amp; Diversity, HDI</i> )	This is a requirement of WRC. Proposals have a section that focuses on competency and capacity building. WRC support training of students and emerging researchers through projects, with a focus on HDI and females. Researchers report that their tacit knowledge and expertise is increased by participating in the creation of new knowledge and tools – which is WRC's focus.



<b>System / Indicator</b>	<b>Description / Measures</b>
System: <i>Public awareness and advocacy</i> (position statements)	KSA 5 (Water-Centred Knowledge) assumes this responsibility in support of other KSAs. A media policy exists to guide this interaction. Policy briefs are produced where appropriate. An end of project evaluation form asks reviewers for recommendations regarding policy, news or technical brief preparation.
System: <i>Procurement policy</i> - spreading financial benefits	WRC encourage research consortia, promote continuity and sustainability by supporting existing organizations, and promote growth by supporting new organizations.

This section links closely to research uptake and the results are described in following section.

## 4.4.2 Research Uptake

Indicators related to nine principles influencing uptake of research are shown in Table 14 together with a rating reflecting the degree to which the principles have been applied during the research process. Supporting evidence is provided in Appendix 16, as well as an excel spreadsheet describing the evidence, which is available on the CD accompanying this report. The following section also provides further insight into research management.

Table 14: Research Uptake Indicators

<b>Principle</b>	<b>Indicator (Posed as a question)</b>	<b>Cumulative Average Rating (0-1) (See Appendix 16)</b>
Relevance to society	Is there a need for the research project ...knowledge gap (0.5)...broad priority, local meaning (0.5)	1 (n=34; sd=0)
Define community	Are the targets for research products identified in proposal...broadly (0.5)...specific end-client (0.5)	0.72 (n=34; sd=0.25)
Community-driven	Are the products meaningful for targets...broadly (0.5) ... specifically (0.5)	0.72 (n=34; sd=0.25)
Collaboration & Participation at all stages of the research	Are targets engaged in the research process (steering, consultation, interviews, training - 0.5) ... through action research or an approach facilitating high level of buy-in (0.5)	0.66 (n=31; sd=0.24)
Sensitivity	Are local culture (0.5) and environmental sensitivity (0.5) considerations acknowledged in carrying out research	0.04 (Generally not reported on although it may be implicit in the approach)
Robust science	Is peer review employed to ensure results are reliable (steering, external comment/testing/thesis review - 0.5) ...including through scientific paper publication process (0.5)	0.63 (n=32; sd=0.28)
Dissemination in a meaningful form	Are research products transferred / disseminated to targets via accessible (reports, website, thesis) (0.5)...books, papers, conferences, briefs (popular, technical, policy) (0.5)	0.71 (n=33; sd=0.25)
Competency & Capacity Building	Is target capacity built (participation, general awareness & training, transfer end results) (0.5) ....	0.63 (n=31; sd=0.26)

Principle	Indicator (Posed as a question)	Cumulative Average Rating (0-1) (See Appendix 16)
	including training / mentoring to implement results (0.5)	
Competency & Capacity Building	Is research capacity built to produce quality research products (key researchers - 0.5)...students, emerging researchers (0.5)	0.81 (n=32; sd=0.30)
Research management	Is research management effective (objectives met, adaptation) (0.5)...published by end date (0.5) [excludes aspect covered above]	0.59 (n=29; n=23)

## RELEVANCE

This is an area of strength. WRC undertake numerous research-related activities (strategic initiatives, knowledge transfer, needs analyses) that are outlined in their published annual knowledge reviews. The resulting networks, collaboration and understanding contribute to the development of a strategic wetland research portfolio. The portfolio is designed to fill knowledge gaps in key areas linked to national wetland priorities and activities, including responsibilities associated with the Convention on Biological Diversity (1993) and Ramsar Convention (1971). The portfolio also relates to some of the Millennium Development Goals (MDGs) and to economic, social, institutional and environmental aspects of global concern, identified by multiple-stakeholders through the GRI (Appendix 4). The research supported by WRC therefore has broad relevance to society.

The research shows that wetlands are highly, variable complex systems. They vary between the northern and southern hemisphere and stakeholders indicated that they vary from region to region in South Africa, and possibly even within a region. Research conducted on wetlands elsewhere therefore needs to be assessed in terms of applicability to the South African situation. This is the general approach taken by WRC and researchers. Over 95% of projects synthesized existing knowledge and based on this produced tools and metrics suitable for application in South Africa. During the course of this research 50% of the completed projects also collected new (fundamental research) environmental, social, economic or institutional information / data. This approach ensures that WRC supports research that produces new knowledge and tools. The overview conducted by Ms Madlokazi as part of this study's capacity building efforts, showed that wetland research supported by other organizations internationally, in Africa and South Africa, is broadly similar to that supported by the WRC. However, the above-mentioned approach helps to avoid duplication and build on what exists. Moreover, Ms Madlokazi's perspective is that WRC's focus on capacity building and research that supports collaborative management sets WRC apart.

## COMMUNITY DRIVEN

Although research may not strictly have been driven by local communities, nearly 50% of projects engaged local communities (Table 10c). This is partly because the research was not only broadly relevant to society, but meaningful at a local level. All (100%) of the completed projects with field research sites addressed regional/local needs.

## **DEFINED TARGET / MATCHING PRODUCTS**

This is an area that warrants some attention. WRC's proposal template requires researchers to consider the target for the research products as well as the application of those products. While general target groups are described (e.g. water resources managers), only in a few cases were specific end-clients identified (e.g. Working for Wetlands). While products may be broadly matched with target groups (Table 13, Appendix 14), there may be a mismatch when it comes to the details. This became evident in the Wetlands Health & Importance (WHI) programme, phase 2 of the NWRP. Prior to the initiation of this programme, research needs for assessment of wetland condition were investigated in collaboration with stakeholders. Based on this the Terms of Reference for the WHI programme were compiled. Proposed products broadly matched the needs of the general target groups. The products that were developed reflected the fact that wetlands are complex systems and require some time and level of expertise to assess them. However, as the process unfolded it became apparent that the actual need was for rapid, cost-effective assessment tools, requiring little expertise to implement. This example highlights the importance of detailed understanding of product needs and client capacity upfront. Careful consideration needs to be given to the ability to meet these needs, given the existing levels of information and expertise likely to be required to implement research results. Common expectations can then be established and a phased approach to product development adopted if necessary. An action research approach that uses product development as an opportunity to mentor a client may be appropriate in a situation where tools are needed virtually immediately, and capacity (expertise, resources) to implement is lacking. Action research essentially closes the gap between research and implementation, a need identified by several stakeholders.

## **PARTICIPATION**

This is an area needing some attention (Table 14, Appendix 16). Although there was some sort of participation in 86% of the projects, only 23% used an action research or similar approach that engages stakeholders during every stage of the research process (Table 13, Appendix 14). It is the latter that leads to a high level of buy-in and uptake of research results (O'Fallon & Dearry, 2002).

## **SENSITIVITY**

The score for this aspect of the research process was low (Table 14, Appendix 16). However, this may be because cultural and environmental sensitivity issues were considered but not reported. It is recommended that this be reported on in future in order to provide a measure of product responsibility.

## **ROBUST SCIENCE**

This is a critical area that needs attention in order to maintain WRC's reputation of producing quality research. The WRC system of having experts review proposals, sit on steering committees and evaluate end-results has helped ensure that research was reliable. In addition many researchers obtain comment / reviews from external experts and 50% of the projects presented research for peer review at workshops and conferences (Table 13, Appendix 14, Appendix 15). However, while lauding the value of steering committees

in terms of interaction and knowledge exchange, stakeholders are concerned that the institutional changes described above are compromising the system maintaining robust science. It was suggested that the peer review process associated with publishing scientific papers be used to ensure the reliability, repeatability and defensibility of research. Literature searches indicate that only 28% of projects (Table 13, Appendix 14, Appendix 15) underwent the external peer review process associated with publishing scientific papers, books or theses (although the results may be more a function of using search engines than the lack of publications). This suggests that more focus on this aspect may be warranted. Alternatively, it was suggested that external reviewers could be budgeted for, which may be more appropriate in the case of consultancies not geared for scientific publication, and research that does not lend itself to a scientific paper.

## **MEANINGFUL TRANSFER / DISSEMINATION**

This is an area of relative strength but there are improvements that can be made (Table 14, Appendix 16). The match between targets for the research and the research product was discussed above as an area that needs some attention. Research results were mainly disseminated in the form of WRC reports, with over 4000 publications being distributed to universities, technicons, institutes and private individuals / enterprises. Apart from one or two early studies, reports are readily accessible via the WRC website and/or they can be ordered from the publication department. They are distributed free of charge apart from international postage. Research results were also disseminated through popular articles in Water Wheel, coffee table books, papers in Water SA and other journals, conference and workshop presentations, as well as a technical brief for industry. WRC has a system in place for developing additional technical, policy and media briefs where appropriate, in order to transfer knowledge in a meaningful manner to selected stakeholder groups. Feedback from stakeholders on provincial wetland forums indicated that some had not heard of WRC let alone made use of the wetland research reports. They were pleased to receive the list of studies and intent on obtaining relevant reports, which ties in with a suggestion made by several stakeholders. Stakeholders felt that while WRC is well known to the wetland research community, it needs to advertise itself more broadly and draw attention to the research it commissions. WRC does hold open days, produces annual knowledge reviews and participates in an extensive number of strategic initiatives, knowledge transfer and capacity building initiatives. However, it seems that additional promotional effort is required. Advertising and public relations targeting the broader group of stakeholders involved in research, especially local authorities, land owners and users, community groups and individuals, provides a good place to start, and will help to further the momentum created by research, rather than the interest being lost once the research is finished.

## **COMPETENCY & CAPACITY BUILDING**

As discussed under education and training impact, raising awareness and training students and emerging researchers is an area of strength (Table 10). However, capacity building to improve implementation is an area that needs attention (Table 14, Appendix 16). The wetland rehabilitation research programme is a good example of what can be achieved when research is integrated with a well-resourced natural resource management programme like Working for Wetlands. Working for Wetlands provided both the context for research and the context for building stakeholder capacity to implement. All the ingredients were in place to

allow for client-centred product development and an action research approach that involved the Working for Wetlands team at each stage of the research process, and mentored them in applying a series of wetland rehabilitation tools to the work at hand.

## **RESEARCH MANAGEMENT**

This section links closely to section 4.4.1 and results are discussed in an integrated manner. WRC's systems and requirements have to a large degree resulted in effective research management (Table 13, Appendix 14). Out of 67 wetland-related research projects one was terminated before completion as a result of systems being applied effectively. On the other end of the scale, 41 projects have been completed and reports published, after being approved in the final evaluation procedure. Stakeholders indicated that WRC also accommodates the 'exploratory' nature of research and development by being flexible within certain boundaries. Indication of this flexibility was found in 16% of the projects, involving, for example, a slight adjustment to objectives based on changes that had occurred between the proposal being submitted and the project starting (Table 13, Appendix 14). Stakeholders hold WRC in high regard and report that WRC establishes a constructive working environment and maintains good working relations. This helps to create a productive, collaborative, effective work effort. One area that does need attention (Table 14) is the production of the final report and possibly scientific publication. Seventy six (76%) of reports (Table 13, Appendix 14) were published after the end date (year), largely because financial constraints require researchers to move on to other work while trying to complete reports. According to some stakeholders, this is the reason they do not manage to publish papers. It is suggested that allowance be made in project budgets for time to dedicate to the preparation and where appropriate publication of papers.

## **STAKEHOLDER FEEDBACK ON USE OF RESEARCH PRODUCTS**

An analysis of WRC requests for publications, stakeholder consultation and a survey conducted via a national wetlands listserver and provincial wetland forums provided the following evidence of research reports being used by the stakeholder community:

- Over 4000 orders of publications since 2002 (Private, Universities, Technicons, Institutes). This figure excludes the WET-Management Series (rehabilitation) and Wetland Health & Importance Series (assessment), which have only recently been published.

The most popular reports included:

- ✓ Ecological & economic valuation of wetlands in Upper Olifants Catchment
- ✓ Integration of wetlands into catchment management
- ✓ Cost : benefit analysis of urban wetland rehabilitation
- ✓ Water Resource assessment (WR2005)
- ✓ WET-Roadmap overview of wetland rehabilitation series of tools
- ✓ Cultivation of high-value plants in rehabilitated urban wetlands

- According to the report requests and feedback from 23 respondents all but 4 of 82 reports/lessons/games emerging from completed projects were used. Respondents included authorities, natural resource management programme managers and practitioners, consultants / practitioners, students and university researchers / lecturers. They are used for:

General knowledge	Informing new research	School & University Education
Public awareness raising	Rehabilitation planning	Rehabilitation management
Management planning	Assessments (Health, EIA)	Decision-making (water-use & development)
Policy	Management models	Management of wastewater treatment
Reserve determination		

- Although there is no formal national wetland monitoring programme, incidental observations by practitioners indicate that wetland rehabilitation informed by the new knowledge and tools, has in some cases resulted in improved environmental flow, retention of water in the landscape for longer and return of biodiversity (birds, frogs). There is another incidental report of a research study related to EDCs assisting in improving the occupational health & safety of a rehabilitation team working in the study area.

## **4.5 Improving Impact – Future Needs**

In reviewing WRC supported wetland research to analyze its impact, it became apparent that wetlands are socially important, economically valuable, ecologically complex and variable, and would probably be best conserved and managed at a landscape level. Stakeholders considered future needs against this scenario and the key outcomes of this assessment (Phillips, 2010b). Some of the research needs identified by stakeholders may well be addressed by current studies, but it is difficult to ascertain without the finished research products. In general, there are three areas that stand-out as needing attention going forward:

- I. We need a better understanding of wetlands, which requires...

### Ecological Research

- Baseline studies - detailed sampling of wetlands all over the country to collect data on plants, invertebrates, fish, diatoms and microbiology.
- Studies to understand ecological processes (and response to impact) – water, soil, nutrients, water quality.
- The above-mentioned information is needed at a conservation planning scale to allow for management of variability and connectivity.
- Studies to measure (quantify) the ecosystem services provided by individual wetlands such as water quality improvement, carbon storage, and flood attenuation.
- Wetlands are dynamic and often transient systems – studies are needed on the natural changes in wetlands over time.
- Studies on the role of wetlands in climate change adaptation.
- National wetland monitoring to assess the impact of wetland interventions (e.g. rehabilitation) against control sites where natural functioning is monitored.

- The lack of a refined National Wetland Inventory was identified as a serious weakness by practitioners. The South African National Biodiversity Institute is in the process of developing this inventory.
- A study to develop a spatial map and related database collating what work had been done where and what information / data existed where, would be a useful tool that could assist in developing the inventory and guiding other research and management interventions. A provincial wetland inventory map for KwaZulu-Natal was constructed in this manner.
- Short term consultancies looking at particular aspects, may help to speed up initiatives such as the national wetland inventory and wetland position papers and policy for conservation authorities.
- More wetland reserve determination studies – wetlands are lagging behind rivers.
- More studies are needed on the relationship between wetlands and groundwater, particularly recharge zones and abstraction from aquifers.
- Integration of wetlands into State of the Rivers reporting.
- A 20% conservation target has been set for rivers and wetlands. The connectivity between rivers and wetlands needs to be investigated and considered when deciding what rivers and wetlands and where.
- Studies on land-use impact on wetlands at a regional level.
- Studies to understand wetland functioning, variability and connectivity at a system or catchment level. This would help to understand which wetlands to protect and how wetlands could be grouped when conducting reserve determinations. A case study investigating the whole system in a small catchment could be useful in this regard. The case study could incorporate a combination of fundamental and applied research as well as training.
- Allied to the above, is that the need to understand wetlands as socio-ecological systems.

#### Socio-Economic Research

- Resource economic studies investigating the value of wetlands. Baseline information and quantification of ecosystem services are required for valuation studies.
- It was suggested the Working for Wetlands be coupled with research projects examining the link between rehabilitation and sustainable use of wetlands.
- Allied to the above are studies on the impact of rehabilitation on livelihoods (creation and loss) and the implications for developing wetland management plans balancing protection and activity (e.g. cultivation).
- Ecological thresholds – when does a wetland stop functioning, are we spending money on trying to rehabilitate lost causes?
- Investigations into the best management practices (BMPs) required by farmers (and in urban areas) in order to prevent/reduce pollution of wetlands and rivers. This should include ways of financing these interventions (e.g. financial tools and incentives that can be used to recompense farmers for using BMPs).
- Allied to the above, demonstration sites are needed where BMPs are applied, so that people can come and see how they work, and monitoring can be done to see how effective they are.

- Investigations into potential sustainable livelihood (and other) uses of wetland buffer zones in poor urban communities (low cost housing settlements), where buffer zones tend to get ignored.
- More research on control of vectors of disease (e.g. mosquitoes, snails) by using environmental manipulation (rather than just chemical control). This is both for diseases of humans and of animals.

#### Institutional Research

- Better understanding of institutional arrangements governing wetlands, in particular the factors leading to successful cooperative governance. Research has found that there is adequate legislation to protect wetlands but it is scattered across different sectors. What is required is cooperative governance, but this does not appear to be working effectively.
- The influence of politics on wetland management and decision-making needs to be understood.

#### Approach

Stakeholders suggest that a practical way to approach future research would be to have reference site wetlands (and small catchments) where hydrological, geomorphological, ecological, social and institutional processes are well described. These sites would serve as very valuable points of reference against which the many different tools that have been developed can be validated and against which better management of wetlands can be promoted more widely. The sites could be selected according to priority catchments and include undisturbed (control) as well as disturbed wetlands. They could also be aligned with / integrated into natural resource management programmes. They should be systematically selected to examine different regions of the country, different wetland types and so forth. In this way a database could be established to extrapolate to other, unmeasured wetlands. It was suggested that an alliance between the South African Earth Observation Network (SAEON) and WRC may help to leverage funding streams for long-term ecological research and monitoring, with a focus on climate change adaptation.

Further information on future research needs can be found in the individual research reports and publications. In addition to research, the following needs were also identified.

- II. We need to continually improve tools (rehabilitation, assessment) and develop associated databases, by testing assumptions and applying the tools to a variety of wetlands, in different locations, using different stakeholders.
- III. We need to provide stakeholder training that results in evidence of learning, develop standardized national training programmes to apply tools and improve capacity to implement.

A number of stakeholders stressed the importance of closing the gap between research and implementation, and concern about the lack of implementation capacity, especially at provincial and local level. An action research approach closes the gap between research and implementation, the work at hand providing a context for research and for learning through mentored application of emerging research results. This



suggests integrating natural resource research with natural resource management programmes such as Working for Wetlands. However, this approach may not be appropriate for all types of research. This suggests that training courses designed to standardize implementation should be developed and delivered to build stakeholder capacity for implementation. Whether these training courses should be delivered as part of the research process or in addition to it, is a matter of debate. Education, training and development (ETD) is a specialized field, requiring different skills to those required for research. If training is to be conducted as part of the research process, ETD specialists should become a part of the research team. Alternatively ETD specialists could offer an independent supporting service, working with researchers and implementers to develop suitable training courses supporting implementation of research products. In essence they would be providing a service similar to that of popular science writers but in the field of ETD. The WESSA education alliance and FETwater initiative were put forward as examples of potential ETD service providers.

## **5 CONCLUSION**

WRC has undoubtedly made progress against the NWRP objectives and wetland research has contributed to the overarching economic, social, environmental and institutional objectives of the KSAs and cross-cutting domains. However, without benchmarks it is difficult to assess whether expectations have been met. On the whole, wetland research supported by the WRC seems to have had a significant socio-economic impact that has helped develop a wetland community of practice. It has also provided the community of practice with new knowledge and tools that are (in the main) being used (at least by respondents) to improve wetland rehabilitation, protection, education, sustainable use and management. A national wetland monitoring system is required to establish the longer-term impact of interventions on wetlands, surrounding communities and underlying institutional arrangements. Examination of research management effectiveness and research uptake indicates that while there are areas that can be improved, within their sphere of influence as a knowledge organization, the WRC is playing its role to realize the value of the R50 million investment into wetland research.

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**Phillips T, 2010a.** An impact assessment of the research funded by the WRC on wetland management in South Africa. Report 3: Proposed assessment framework report. Unpublished report submitted to the Water Research Commission, K8/914.

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**WRC 2009/10.** Water-Linked Ecosystem Business Plan (KSA2)

# 7 APPENDICES

## ***Appendix 1: Organizations Assessing Research Programmes***

The following are the names of some of the international and local organizations involved in assessing research/research programmes related to natural resources, their website addresses, and titles of relevant articles/documents.

- NRF (Natural Research Foundation):  
[www.nrf.ac.za](http://www.nrf.ac.za)
  - NRF Programme Evaluation
- Natural Resources Institute:  
[www.nri.org](http://www.nri.org)
  - Socio-economic Methodologies for Natural Resources Research: Best Practice Guidelines
- Australian Government: Natural Resource Management:  
[www.nrm.gov.au](http://www.nrm.gov.au)
  - NRM MERI Framework
- IUCN (International Union for Conservation of Nature):  
[www.iucn.org](http://www.iucn.org)
  - IUCN: Meta-Evaluation
- International Institute for Sustainable Development:  
[www.iisd.org](http://www.iisd.org)
  - Measuring while you manage: Planning, monitoring and evaluating knowledge networks
  - Knowledge Networks: Guidelines for Assessment
- Department of Environment and Climate Change:  
[www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)
  - DECC Evaluation Framework for CMA
  - Evaluation Framework
- ICARDA:  
[www.icarda.org](http://www.icarda.org)
  - *Ex Post* Methods to Measure Natural Resource Management Research Impacts
- Consultation Group on International Agricultural Research:  
[www.icarda.cgiar.org](http://www.icarda.cgiar.org)
  - Impact assessment
- European Union  
[www.britannica.com](http://www.britannica.com)
  - Ex-ante impact assessment of research programmes: the experience of the European Union's 7th Framework Programme
- Centre for Science and Technology Studies - University of Leiden:  
[www.cwts.nl/ranking/LeidenRankingWebSite.html](http://www.cwts.nl/ranking/LeidenRankingWebSite.html)
  - The use of bibliometric analysis in research performance assessment and monitoring of interdisciplinary scientific developments
- CSIR (Council for Scientific and Industrial Research):  
[www.csir.co.za](http://www.csir.co.za)
  - Water Resource Governance Research Framework
- Global Reporting Initiative (GRI)  
[www.globalreporting.org](http://www.globalreporting.org)
  - Generic Reporting Framework and Indicators
  - NGO Sector Supplement

## **Appendix 2: Complete, current & planned WRC supported projects with a wetland objective & associated reports**

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
1979	K5/18	Research on the role of aquatic macrophytes in Swartvlei, Wilderness, in maintaining trophic conditions	Howard-Williams, C. and B. R. Allanson	The ecology of Swartvlei: research for planning and future management	Not available	1979	Ecosystems	Processes
1985			Boon, A. G.	Report of a visit by members and staff of WRC to Germany (FRG) to investigate the root zone method for treatment of wastewaters	WRC Report 376 S, Stevenage, August 1985 (revised in February 1986)	1985	Water Use & Waste Management	Water treatment
1990			WRC	European Design and Operational Guidelines for Recycled Treatment Systems. pp 37, prepared for the European Community/ European Water Pollution Control Association Emergent Hydrophyte Treatment system Expert Contact Group.	WRC Report UI 17, December, 1990	1990	Water Use & Waste Management	Water treatment
1992	K8/90	A preliminary model for and mapping of parts of the Western shores of Lake St Lucia		Not available			Ecosystems	Management
1993	K5/232	Research on the preparation of engineering design guidelines for artificial wetlands for wastewater treatment	Wood, A. and Pybus, P.	Artificial wetland use for wastewater treatment theory, practice and economic review.	232/1/93	1993	Water use & Waste Management	Water treatment
1993	K5/416	The application and performance of full-scale constructed wetlands for wastewater treatment in South Africa	Wood, A.	Investigation into the application and performance of constructed wetlands for wastewater treatment in South Africa	416/1/99	1999	Water use & Waste Management	Water treatment
1994	K5/501	A project to improve the management of wetlands in the KwaZulu-Natal Midlands (Continuing research into the wetlands of KwaZulu-Natal)					Ecosystems	Management
			Kotze, D.C., Breen, C.M. and Klug, J.R.	A project to improve the management of wetlands in the KwaZulu-Natal Midlands: an overview.	501/1/94 (Executive Summary)	1994		

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
			Kotze DC, Hughes JC, Breen CM & Klug JR	WETLAND-USE: a wetland management decision support system for the KwaZulu-Natal Midlands.	501/2/94	1994		
			Kotze DC & Breen CM	Agricultural land-use impacts on wetland functional values.	501/3/94	1994		
			Kotze DC, Hughes JC, Breen CM & Klug JR	The Development of A Wetland Soils Classification System for KwaZulu-Natal.	501/4/94	1994		
			Oelermann, R.G., Darroch, M.A.G., Klug, J.R., and Kotze, D.C.	Wetland preservation valuation and management practices applied to wetlands and management plans: South Africa case studies	501/5/94	1994		
			Kotze DC, Breen CM & Klug JR	A management plan for Wakkerstroom Vlei.	In 501/5/94	1994		
			Kotze DC, Breen CM & Klug JR	A management plan for Ntabamhlope Vlei.	In 501/5/94	1994		
			Kotze DC, Breen CM & Klug JR	A management plan for Mgeni Vlei.	In 501/5/94	1994		
			Kotze, D.C.	A management plan for Blood River Vlei.	In 501/5/94	1994		
			Kotze, D.C.	A management plan for Boschoffsvlei	In 501/5/94	1994		
1994	K5/582	The screening of crop, pasture and wetland species for tolerance of polluted water originating in coal mines	Barnard, R.O., Reifman, N.F.G., Amundale, J.G., Mentz, W.H. and Jovanovic, N.Z.	The screening of crop, pasture and wetland species for tolerance of polluted water originating in coal mines	582/1/98	1998	Water Use & Waste Management	Industrial water treatment
1994	K5/598	Research on the appropriate management of urban runoff in South Africa	Batchelor, A.L. and Loots, P.A.	Some Observations On The Ability Of A Created Wetland To Remove Contaminants When Subjected To Simulated Floods.	598/4/01, Emanates from project K5/598	2001	Water Use & Waste Management	Urban storm water treatment
1999	K5/1054	Cultivation of high value aquatic plants in restored urban wetlands for income generation in local communities.	Abbot Grobicki (lead)	Cultivation of high-value aquatic plants in restored urban wetlands for income generation in local communities	1054/1/02	2002	Ecosystem	Rehabilitation

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
1999	K5/1061	A field study of two and three dimensional processes in hillslope hydrology for better management of wetlands and riparian zones	Lorentz, S., Thornton-Dibb, S., Pretorius, C. and Goba, P.	Hydrological systems modelling research programme: Hydrological Processes - Phase II Quantification of Hillslope, wetland and riparian processes	1061 & 1086/1/04	2004	Water resource management	Hydrological process
1999	K5/1064	Decision-support system for rehabilitation and management of riparian systems	Quinn, N.W.	A decision-support system for rehabilitation and management of riparian systems	1064/1/03	2003	Ecosystems	Rehabilitation
2000	K5/1162	Ecological and economic evaluation in the Upper Olifants River Catchment, with reference to their functions in the catchment and their management.	Palmer, R.W., Turpie, J., Marnewick, G.C. and Batchelor, A. (Eds)	Ecological and Economic Evaluation of Wetlands in the Upper Olifants River Catchment, South Africa	1162/1/02	2002	Ecosystems	Management
			Marnewick, G.C. and Batchelor, A.L	Chapter 5. Wetland Classification, mapping and inventory, pp.55-67.	In 1162/1/02	2002		
			Grundling, L., Marnewick, G. and Muller, J.	Chapter 6. Influence of Geology, Soils and Physioregion, pp.69-82.	In 1162/1/02	2002		
			Batchelor, A. L., Matthews, G. and Coleman, T.	Chapter 7. Ecosystem services of the UORC wetlands, pp.83-113.	In 1162/1/02	2002		
			Marnewick, G.C., Palmer, R.W., Engelbrecht, J., Jacobsen, N.H. and Turpie, J.	Chapter 8. Biodiversity of the UORC wetlands, pp115-129.	In 1162/1/02	2002		
			Muller, J., Vink, D. and Palmer, R.	Chapter 9: Land Use, wetland users & threats to wetlands, pp 131-133.	In 1162/1/02	2002		
			Turpie, J. and Van Zyl, H.	Chapter 10: Direct use values of wetlands, pp 137-145.	In 1162/1/02	2002a		
			Turpie, J.	Chapter 11: Indirect use values of the UORC wetlands, pp 147-150.	In 1162/1/02	2002		
			Turpie, J. and Van Zyl, H.	Chapter 12. Synthesis, pp 151-160.	In 1162/1/02	2002b		
			Grundling, L.P.L. and Grundling, A.L.	Chapter 13. Capacity Building, pp. 163-166.	In 1162/1/02	2002		

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2000	K5/1197	Managing rivers in rural regions through community involvement and community awareness programmes. Phase One: Determining the influences and interactions of the factors affecting biotic integrity through an investigation on habitat requirements (Includes wetlands)	Fouche, P.S.O., Foord, S.H., Potgieter, N., Wentzel, vd Waal, B.C. and van Ree, T.	Towards an understanding of factors affecting the biotic integrity of rivers in the Limpopo province: Niche partitioning, habitat preference and microbiological status in rheophilic biotopes of the Luvuvhu and Mutale rivers	1197/1/05	2005	Ecosystems / Water & Society	Processes / Water as shared resource
2001	K5/1238	Hydrogeology of fractured aquifers and related ecosystems within dolerite ring- and sill- systems of the Eastern Cape (Includes wetland ecosystems)	Chevallier, L., Gibson, L.A., Nhleko, L.O., Woodford, A.C., Nomqophu, W. and Kippie, I.	Hydrogeology of fractured-rock aquifers and related ecosystems within the Qoqodala dolerite ring and sill complex, Great Kei catchment, Eastern Cape	1238/1/04	2004	Water resource management	Water resource assessment
2001	K5/1258	A biophysical framework for the sustainable management of wetlands in the Northern (Limpopo) Province with Nyisviei as a reference model	Vlok, W., Cook, C.L., Greenfield, R., Hoare, D., Greenfield, R. and Hoare, D.	A biophysical framework for the sustainable management of wetlands in the Northern Province with Nyisviei as a reference model	1258/1/06	2006	Ecosystem	Management
2001	K5/1293	The establishment of a water purification demonstration plant for the Star Galaxy Technology Showcase (Includes wetland option)		Internal report - not published		Internal - not published	Water Use & Waste Management	Water supply & treatment
2002	K5/1311	Refinement of aspects of reserve determination methodology for water quality, including the assessment of potential impacts to aquatic biota (Includes reserve determination for wetlands)	Malan HL & Day JA	Wetland water quality and the Ecological Reserve: Volume 1	1311/1/05	2005	Ecosystems	processes
2002	K5/1327	Ecological and environmental impacts of large-scale groundwater development in TMG aquifer systems (Includes impacts on wetlands)	Colvin, C., Riemann, K., Brown, C., Milisa, A., Blake, D., Aston, T., Mahery, A., Engelbrecht, J., Pemberton, C., Magoba, R. and Soltau, A.	Ecological and environmental impacts of large-scale groundwater development in the Table Mountain Group (TMG) aquifer system	1327/1/08	2008	Water Resource Management / Water & Environment	Water resource assessment / Functioning within Hydrological Cycle



~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2002	K5/1343	A Guide to Conduct Eutrophication Assessments for Rivers, Lakes and Wetlands	Rossouw, J.N., Harding, W.R. and Fatoki, O.S.	A guide to catchment-scale eutrophication assessments for rivers, reservoirs and lacustrine wetlands	TT 352/08, emanates from K5/1343	2008	Water resource management	Water resource assessment
2002		Wetland Research Programme Description	WRC	Wetland Research: a description of an interagency collaborative research programme		2002	Ecosystems	Management
2003	K5/1408	Wetlands Research Programme: Wetland Rehabilitation					Ecosystems	Rehabilitation
			Dada, R., Kotze, D., Ellery, W. and Uys, M.	WET-RoadMap: A guide to the wetland management series	TT321/07	2007		
			Ellery, W.N., Kotze, D.C., McCarthy, T.S., Tooth, S., Grenfell, M., Beckedahl, H., Quinn, N. and Ramsay, L.	WET-Origins: Controls on distribution and dynamics of wetlands in South Africa.	TT 334/09	2010		
			Kotze, D.C. Breen, C.M., Nxele I., and Kareko, J.	WET-ManagementReview: The impact of natural resource management programmes on wetlands in South Africa.	TT 335/09	2010		
			Kotze, D.C., Ellery, W.N., Rountree, M., Grenfell, M.C., Marenebeck, G.C., Nxele, I.Z., Breen, D.C., Dini, J., and Batchelor, A.L.	WETRehabPlan: Guidelines for planning wetland rehabilitation in South Africa.	TT 336/08	2010		
			Unknown	WET-Prioritise-Guidelines for prioritising wetlands at National, Regional and Local Scales	TT 337/08	2010		
			Armstrong, A.	WET-Legal: Wetland rehabilitation and law in South Africa	TT 338/09	2010		
			Kotze, D.C., Marenebeck, G.C., Batchelor, A.L., Lindley, D.S. and Collins, N.B.	WETEcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands.	TT339/08	2010		
			Macfarlane, D.M., Kotze, D., Ellery, W., Walters, D., Koopman, V., Goodman, P. and Goge, C.	WET-Health: a technique for rapidly assessing wetland health. Version 1.	TT340/08	2010		

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
			Cowden, C., and Kotze, D. C.	WET-RehabEvaluate: Guidelines for monitoring and evaluating Wetland rehabilitation projects	TT342/09	2010		
			Russell, W.B., Kotze, D.C., Ellery, W.N. and Brummer, V.	WET-RehabMethods: National guidelines and methods for wetland rehabilitation.	TT341/08	2010		
			Kotze, D.C., and Ellery, W.N.	WET-OutcomeEvaluate: An evaluation of the rehabilitation outcomes at six wetland sites in South Africa	TT343/09	2010		
2003	K5/1410	Guidelines for integrating the protection, conservation and management of wetlands into catchment management planning.	Dickens, C., Kotze, D., Mashigo, S., MacKay, H. and Graham, M.	Guidelines for integrating the protection, conservation and management of wetlands into catchment management planning	TT 220/03	2003	Ecosystems	Management
2003	K8/564	Cost and benefits of urban river and wetland rehabilitation	Van Zyl, H., Leman, A. and Jansen, A.	The Costs and Benefits of Urban River and Wetland Rehabilitation Projects with Specific Reference to Their Implications for Municipal Finance: Case Studies in Cape Town	KV 159/04	2004	Ecosystems	Rehabilitation
2004	K5/1491	Water resources of South Africa, 2005 Study (WR2005) (includes wetlands)	Middleton B.J. and Bailey, A.K.	Water resources of South Africa, 2005 STUDY (WR2005)	TT381-08	2008	Water resource management	Assessment & planning
2004	K5/1505	Application of chemical and biological assays and sentinel species for measuring EDC activity and the potential health risk	Bormann, R.M.S., van Vuren, J.H.J., Bouwman, H.H., de Jager, T.C., Genithe, B.B. and Barnhoorn, E.J.	Endocrine disruptive activity and the potential health risk in the Rietvlei nature reserve	1505/107	2007	Water resource management / Water and Health	Human induced impacts / Chemical water quality and associated diseases

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2004	K5/1544	Integrated Research to Characterize Indigenous Flora and Microflora for Use in Constructed Wetlands for Agro-Industry Effluent Treatment, Especially Winery Wastewater	Burton, S., Sheridan, C., Law-Brown, J., Le Roes, M., Cowan, D., Rohr, L. and Mashaphu, N.	Integrated research for use in constructed wetlands for treatment of winery wastewater	1544/1/07	2007	Water Use & Waste Management	Water supply & treatment
2004	K8/590	Strategic overview of wetland research needs regarding wetland health and integrity	WRC Malan, H.L. and Day, J.A.	Constructed wetlands for treatment of winery effluent Strategic overview of the research needs regarding wetland health and integrity	Technical Brief 2008/04/01 KV 171/05, emanates from K8/590	2008 2005	Ecosystems	Processes
2005	K5/1584	National wetland research programme: Phase 2: Wetland health and integrity	Malan, H. L., Day, J.A. and Marr, S. M. Day, E. and Malan, H.	Assessment of wetland ecological condition and socio-economic importance: An annotated bibliography Tools and metrics for assessment of wetland environmental condition and socio-economic importance: Handbook to the WHI research programme by E. Day and H. Malan. 2010. (This includes "A critique of currently-available SA wetland assessment tools and recommendations for their future development" by H. Malan as an appendix to the document).	KV 172/05, emanates from K8/590 Emanates from K5/1584	2005 2010	Ecosystems / Water and Environment	Processes and Management / Environmental functioning within the hydrological cycle
			Bird, M.	Aquatic Invertebrates as indicators of human impacts in South African wetlands	Emanates from K5/1584	2010		
			Corry, F.	Development of a macrophyte index	Emanates from K5/1584	2010		
			Kotze, D., Malan, H., Ellery, W., Samuels, I. and Saul, L.	Assessment of the environmental condition, ecosystem service provision and sustainability of use of two wetlands in the Kamiesberg uplands	Emanates from K5/1584	2010		
			Kotze, D.C., Saul, L. and Samuels, I.	Assessment of the sustainability of use. In Malan H, Kotze D C, Ellery W N, Saul L, and Samuels I, 2009. Assessment of the socio-ecological resilience of two wetlands in the Kamiesberg uplands.	In above study	2010		
			Day, J.A., Day, E., Ross-Gillespie, V. and Ketley, A.	The assessment of temporary wetlands during dry conditions	Emanates from K5/1584	2010		

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
			Ellery, W.N., Grenfell, S.E., Grenfell, M.C., Jagannath, C., Malan, H.L. and Kotze, D.C.	A method for assessing cumulative impacts on wetland functions at the catchment or landscape scale	Emanates from K5/1584	2010		
			Turpie, J.K., Lamas, K., Scovronick, N. and Louw, A.	Development of a protocol for the valuation of wetlands in South Africa. Vol I. Wetland ecosystem services and their valuation: a review of current understanding and practice. Wetland Health and Integrity Programme, Water Research Commission. 109 pp.	Emanates from K5/1584	2010		
			Turpie (ed)	Development of a protocol for the valuation of wetlands in South Africa. Vol II. The valuation of provisioning, regulating and cultural services provided by wetlands: case studies from South Africa and Lesotho. Wetland Health and Integrity Programme, Water Research Commission. 94 pp.	Emanates from K5/1584	2010		
			Kleynhans, M.T., Turpie, J.K., Rusinga, F. and Gørgens, A.H.M.	Quantification of the flow regulation services provided by Nylsvlei wetland, South Africa, using hydrological and hydraulic modeling. In Turpie, J.K. (ed), <i>Development of a protocol for the valuation of wetlands in South Africa. Vol II. The valuation of provisioning, regulating and cultural services provided by wetlands: case studies from South Africa and Lesotho.</i> Wetland Health and Integrity Programme, Water Research Commission. 94 pp.	In Turpie (ed), Emanates from K5/1584	2010		
			Scovronick, N. and Turpie, J.K.	The tourism value of Nylsvlei floodplain. In: Turpie (ed) 2009. <i>Development of a protocol for the valuation of wetlands in South Africa. Vol II. The valuation of provisioning, regulating and cultural services provided by wetlands: case studies from South Africa and Lesotho.</i> Wetland Health and Integrity Programme, Water Research Commission. 94 pp	In Turpie (ed), emanates from K5/1584	2010		

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
			Turpie, J.K. and Day, E.	Estimation of the water treatment function and value of wetlands: a case study of the Western Cape, South Africa. In: Turpie, J.K. (ed) 2009. <i>Development of a protocol for the valuation of wetlands in South Africa. Vol II. The valuation of provisioning, regulating and cultural services provided by wetlands: case studies from South Africa and Lesotho.</i> Wetland Health and Integrity Programme. Water Research Commission. 94 pp.	In Turpie (ed.), emanates from K5/1584	2010		
			Turpie, J.	Development of a protocol for the valuation of wetlands in South Africa. Vol III. The Wetland Livelihood Value Index: A tool for the assessment of the livelihood value of wetlands. Wetland Health and Integrity Programme. Water Research Commission. 42 pp.	Emanates from K5/1584	2010		
			Turpie, J. and Kleynhans, M.	Development of a protocol for the valuation of wetlands in South Africa. Vol IV. A protocol for the quantification and valuation of wetland ecosystem services	Emanates from K5/1584	2010		
			Kotze, D.	WET-Sustainable Use: A system for assessing the sustainability of wetland use	Emanates from K5/1584	2010		
			Malan, H.L., Appleton, C.C., Day, J.A. and Dini, J.	REVIEW - Wetlands and invertebrate disease hosts: Are we asking for trouble?	Water SA 35: (5) 2009 pp 753-768.	2009		
2005	K5/1591	Biogeochemical controls on the plant biodiversity within a saltmarsh ecosystem in the West Coast National Park: Impact of saltwater-groundwater interaction of pore water chemistry and vegetation		Project terminated before completion			Ecosystem	Processes

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2005	K8/614	Towards community-based governance of wetland resources: A review of cases of community (local)-based governance of freshwater resources in Southern Africa to inform potential governance arrangements of communal wetlands	Pollard, S. and Cousins, T.	Towards integrating community-based governance of water resources with the statutory frameworks for Integrated Water Resources Management: A review of community-based governance of freshwater resources in four southern African countries to inform governance arrangements of communal wetlands	TT 328/08	2008	Ecosystems	Management
2005	K8/617	WRC task for Ramsar convention scientific and technical review panel: Acceptance of contract; Appointment of sub-contractor	Marneweck, G.	WRC was Vice-chair of the Scientific and Technical Review Panel of the Ramsar Convention on Wetlands, 2002-2005. Sub-contractor appointed to assist.	n/a		Ecosystems	Management
2005	K8/642	A Model for Developing Cross-Sector Policy, Using Freshwater Biodiversity as a Case Study	Roux, D., Nel, J.L., MacKay, H.M. and Ashton, P.J.	Discussion paper on cross-sector policy objectives for conserving South Africa's inland water biodiversity	TT 276/06, emanates from K8/642	2006	Ecosystems	Management
2005	K8/652	National wetland inventory: Development of a wetland classification system for South Africa	Ewart-Smith, J.L., Ollis, D.J., Day, J.A. and Malan, H.L.	National wetland inventory: Development of a wetland classification system for South Africa	KV 174/06, emanating from K8/652	2006	Ecosystems	Management
2006	K5/1691	The History of Cape Town's River Systems: using Hindsight to guide the Management of Urban River Systems in South Africa	Brown, C. and Magoba, R. (Eds)	Rivers and wetlands of Cape Town	TT 376/08	Printed Feb 2009	Water resource management	Protection - Urban & Rural Resource Management
2006	K8/699	Development of lesson plans to support water education in South African schools, working within the revised national curriculum statement	Peddi, C. and Taylor, J. (Share-Net)	Gr R - Grade 7 lesson plans: only wetland linked lessons shown below:	Lesson Plan	2008	Ecosystems	Capacity building
				Grade 4: Activity 1 - There's a creepy crawly in this stream!!	Lesson Plan	2008		
				Grade 7: Activity 1 - Wetlands are wonderful	Lesson Plan	2008		
				Grade 7: Activity 2 - Dirty water, clean water: let's design and build a water filter	Lesson Plan	2008		
				Grade 7: Activity 4 - Walking in a wetland with David	Lesson Plan	2008		
Grade 7: Activity 5 - 'Save our wetlands' poster	Lesson Plan	2008						

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2006	K8/700	Demonstration plan for market mechanisms for water biodiversity - identification of demonstration sites within grasslands biome to pilot wetland mitigation banking and/or a water trading system	Cox, D. and Kotze, D.	Assessing the appropriateness of wetland mitigation banking as a mechanism for securing aquatic biodiversity in the grassland biome of South Africa.	KV200/08, emanates from K8/700	2008	Ecosystems	Management
2006	K8/710	Development of Policy in Wetland Management in Agriculture	Swanepoel, C.M. and Barnard, R.O.	Discussion paper: Wetlands in Agriculture	KV193/07	2007	Ecosystems	Management
2006	K8/718	Western Cape Wetlands Soil Project	Job, N.	Application of the Department of Water Affairs and Forestry (DWAF) Wetland Delineation Method to wetland soils of the Western Cape.	KV 218/08, emanates from K8/718	Printed Mar 2009	Ecosystems	Processes
2007	K5/1704	Mfabeni Mire response to climatic and land-use stresses and its role in sustaining discharge to downstream and adjacent ecosystems		Current			Ecosystem / Water and Environment	Processes / Integrative knowledge for ecosystem-based water resource management
	K5/1857	Mfabeni Mire response to climatic and land-use stresses and its role in sustaining discharge to downstream and adjacent ecosystems (year 2 & 3)						
2007	K5/1709	The development and testing of a coherent, integrated and practicable set of indicators for the sustainable use and management of communal wetlands and their catchments, with a strong focus on rehabilitation	Pollard, S., Cousins, T., du Toit, D., Dlamini, V. and Kotze, D.C.	Sustainability indicators in communal wetlands and their catchments.	Pending	2010	Ecosystems / Water and Environment	Management / Governance
2007	K5/1725	"Health for Purpose" in wetlands treating waste streams		Current			Water use and waste management / Water & Environment	Wastewater & effluent treatment and reuse technology / Environmental degradation and mitigation
2007	K8/734	Development of a diatom index for wetland health		Current (Project extended - final report not yet submitted)			Ecosystems	Processes

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2007	K8/781	Development and production of alternative training material for wetland		Project identified but not started			Ecosystems	Capacity
2007	K8/789	Compiling vegetation data in wetlands in Kwazulu-Natal, Free State and Mpumalanga (subject to budget)	E.J.J Sieben	Current (Report number pending)			Ecosystems	Processes
2007	K8/790	Guidelines for the sustainable use of wetlands		Project identified but not started			Ecosystems	Management
2008	K5/1788	Development of reserve determination methods for wetland systems: Phase 1: Rapid Reserve		Current			Ecosystems	Management - Ecological Reserve
2008	K5/1789	Guidelines for the determination and management of wetlands buffer zones		Current			Ecosystems/ Water and Environment	Rehabilitation / Integrative knowledge for ecosystem-based water resource management
2008	K5/1794	Rivers and Wetlands Network	Dr W Vlok-a	Quarterly Reports to FETWATER. Main outcome a MSc training in Wetland Management at University of Johannesburg & training collaboration with UCT			FETWater (EU Funded, KSA10)	Capacity
2008	K5/1801	Identifying and enabling protection of national freshwater heritage ecosystems for South Africa		Current			Ecosystems	Management - Governance



~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2008	K5/1803	The impact of re-establishing indigenous plants and restoring the natural landscape on sustainable rural employment and land productivity through payment for environmental services ( <i>includes wetlands</i> )		Current			Agriculture / Water and Society	Water use for fuelwood and timber production / Poverty alleviation
2008	K5/1863	FETWater Rivers and Wetlands Network	Dr W Vlok-b	Quarterly reports to FETWATER	n/a		FETWater	Capacity
2008	K5/1866	Targeted solicited project for DWAF wetland habitat index development project Phase II: Development of a habitat integrity assessment index for unchannelled valley bottom, seeps and pan wetland types		Project identified but non-starter			Ecosystems	Processes
2008	K5/1867	Review of the 1999 ecological importance-sensitivity and the present ecological state of the South African rivers including expansion to riverine wetlands according to quaternary catchments		Project identified but non-starter (pending DWA)			Ecosystems	Management
2008	K8/792	Window on our world-WETLANDS	Ms Charmaine Ashenden, Appledore & Mrs Pat Hoffman WWF SA	TEACHING AIDS - "Wetlands Game Pack"	n/a		Ecosystems	Capacity
2008	K8/826	Quantification of Evapotranspiration from a South African Rehabilitated Headwater Wetland		Current			Ecosystems	Processes
2008	K8/847	Wetland Plant Identification Guide		Current			Ecosystems	Processes
2009	K5/1921	Establishing Ranges of Water Quality Variables in wetlands and their relationship to landuse & ecosystem response: Towards refining the Ecological Reserve		Current			Ecosystems	Management
2009	K5/1923	Regional wetland processes of the Mputaland Coastal Aquifer on the Zululand Coastal Plain		Current			Ecosystems	Processes
2009	K5/1926	Evapotranspiration from the Nkazana Swamp forest and the Mfabeni Mire		Current			Ecosystems	Processes

~ Start	Ref. No.	Project Title	Authors	Report Title	Report No.	Print Date	KSA	Thrust
2009	K5/1936	"Health for Purpose" in wetlands treating waste streams		Current?			Water Use & Waste Management	Treatment
2009	K5/1946	Wetlands and Rivers Network (KSA10 - FETWATER PROGRAMME)	Dr W Vlok-c	Current - Quarterly reports to FETWater			FETWATER	Capacity
2009	K8/905	The impact of madumbe ( <i>Colocasia esculenta</i> ) cultivation on the evaporation of a <i>Cyperus latifolius</i> marsh in KwaZulu Natal.		Current			Ecosystems	Processes
2009	K8/914	An impact assessment of the research funded by WRC on wetlands management in South Africa		Current			Ecosystems	Management
2010	K5/1980	Expanding on a National Wetland Vegetation Database for the purpose of conservation planning, monitoring and wetland rehabilitation		Pending			Ecosystems	Processes
2010	K5/1986	Wetlands & Livelihoods: Restoration of wetlands ecological process, form and function to provide the ecosystem goods and services necessary to support livelihoods - solicited		Pending			Ecosystems	Rehabilitation
2010	Pending	Probabilistic modelling of wetland condition		Pending			Ecosystems	Processes/Management

### **Appendix 3: List of stakeholders interviewed**

Allan Batchelor	Consultant
Barbara Weston	Manager
Bonani Madikizela	Manager (WRC)
Cate Brown	Consultant
Charles Breen	Researcher
Chris Dickens	Researcher
Christo Marais	Practitioner
Colleen Todd	Consultant
Corrie Swanepoel	Manager
Damian Walters	Practitioner
Dave Cox	Researcher
David Kleyn	Manager
David Lindley	Practitioner
Delana Louw	Manager
Denise Schael	Researcher
Donovan Kotze	Researcher
Douglas McFarlane	Researcher
Erben Sieben	Researcher
Fred Elery	Researcher
Heather Malan	Researcher
Helen Dallas	Researcher
Jackie Crafford	Consultant
Jackie Jay	Manager
Jackie King	Researcher
Jane Turpie	Consultant
Japie Buckle	Practitioner
Jean Nel	Researcher
Jenny Day	Researcher
John Dini	Manager
L. Sanham	Consultant
Liel Haigh	Researcher
Liz Day	Consultant
Marcel Collins	Practitioner
Mark Graham	Consultant
Mark Rountree	Consultant
Nancy Job	Consultant
Naomi Fourie	Manager
Nick Rivers-Moore	Consultant
Peter Goodman	Researcher
Piet-Louis Grundling	Consultant
Rembu Magoba	Consultant
Retha Stassen	Consultant
Sekw ele Ramogale	Manager
Sharon Pollard	Consultant
Stanley Liphadzi	Director (WRC)
Steve Mitchell	Consultant
Tally Palmer	Researcher
Wilma Lutsch	Manager
Stanley (DEA)	Manager
Wynand Vlok	Consultant



KSA 2	Objectives	Thrust	Programme	DWA Priority & GRI Priority
Water-Linked Ecosystems (WLE)	<p><b>Primary:</b> Provision of knowledge to enable good environmental governance so as to ensure the utilization and sustainable management of water; and to develop an understanding of the ecological processes underlying the delivery of goods and linked ecosystems in a water-scarce country during a time of demographic and climate change.</p> <p><b>Secondary:</b></p> <ul style="list-style-type: none"> <li>- Develop the knowledge to sustainably manage, protect and utilise aquatic ecosystems;</li> <li>- Transfer the knowledge to the appropriate end-users, with special emphasis on decision makers and the community;</li> <li>- Build capacity in both research and management to sustainably manage aquatic ecosystems</li> </ul>	Ecosystem processes	<ul style="list-style-type: none"> <li>• Estuarine processes</li> <li>• Riverine processes</li> <li>• Wetland processes</li> <li>• Groundwater-dependent ecosystems</li> <li>• Impoundments</li> </ul>	<p>Develops new knowledge to support effective management and rehabilitation</p> <p><b>GRI: Environment – Biodiversity &amp; habitat</b></p>
<p><b>MDG: Environmental sustainability, global partnerships for development, poverty reduction, combat disease</b></p> <p><b>GRI: Environment – Biodiversity &amp; Habitat</b></p> <p><b>GRI: Environment – Emissions, Effluence &amp; Waste protection</b></p> <p><b>GRI: Environment – Materials / Resource Use</b></p> <p><b>GRI: Economic – Indirect</b></p> <p><b>GRI: Society – Community</b></p>	<p><b>Convention for biodiversity: Knowledge, Capacity, Tools</b></p> <p><b>Ramsar Convention: Wise Use, Information Transfer, Institutional Capacity</b></p>	Ecosystem management and utilisation	<ul style="list-style-type: none"> <li>• Ecological Reserve</li> <li>• Estuary management</li> <li>• Ecosystem health</li> <li>• Environmental water quality</li> <li>• Endocrine-disrupting compounds in water sources</li> <li>• Socio-economic considerations</li> </ul>	<p>Most of the research in this thrust is relevant in terms of protection measures, institutional regulation and development, as well as equitable and sustainable supply of goods and services through healthy ecosystems</p> <p><b>GRI: Environment – Emissions, Effluence &amp; Waste</b></p> <p><b>GRI: Environment – overall protection</b></p> <p><b>GRI: Environment – Materials / Resource Use</b></p> <p><b>GRI: Economic – Indirect</b></p> <p><b>GRI: Society - Community</b></p>
		Ecosystem rehabilitation	<ul style="list-style-type: none"> <li>• Ecosystem governance</li> <li>• Wetland rehabilitation</li> <li>• River rehabilitation</li> <li>• Influence of instream-constructed barriers</li> </ul>	<p>Developing methods to restore ecosystems degraded by human activities, facilitating equitable and sustainable supply of goods and services</p> <p><b>GRI: Environment – Biodiversity &amp; habitat</b></p> <p><b>GRI: Economic - indirect</b></p> <p><b>GRI: Society - Community</b></p>

KSA 3	Objectives	Thrust	Programme	DWA Priority
<p>Water Use and Waste Management (WUWM)</p> <p><b>MDG: Environmental sustainability, combat disease</b></p> <p><b>GRI: Environment – Overall protection</b></p> <p><b>GRI: Environment – Emissions, Effluence &amp; Waste</b></p> <p><b>GRI: Society – Community health and safety</b></p>	<p><b>Primary</b> : provide knowledge that ensures reliable, affordable and efficient water use and waste management services to enhance the quality of life, and contribute to economic growth and improved public health.</p> <p><b>Secondary</b> - To inform:</p> <ul style="list-style-type: none"> <li>- Management of water services</li> <li>- Technologies for improving the quality and quantity of our water supplies</li> <li>- Hygiene and sanitation practices</li> <li>- Solutions to water and waste management in the industrial and mining sectors</li> <li>- Treatment of wastewater and effluent and enabling increased reuse thereof</li> <li>- Improve health, economic and environmental conditions, development of socially-focused management practices related to water and effluent management</li> </ul>	<p>Water Services – Institutional and Management Issues</p> <p><b>GRI: Environment – Overall</b></p>	<p>Cost-recovery in water services</p> <p>Institutional and management issues - water services</p> <p>Innovative management arrangements – Rural water supply</p> <p>Regulation of water services</p> <p>Impact of water and sanitation interventions</p>	<p>Ensure effective water services institutions</p> <p>Ensure effective local-level operations and management of DWAF water services schemes</p> <p>Ensure effective and sustainable delivery of water services to underpin economic and social development (sound legislation, policies and strategies for the sector; sound planning culture established within sector)</p> <p>Promote and support sound policy and practice of water services to achieve millennium targets in Africa</p>
	<p>Water Supply and Treatment Technology</p> <p><b>GRI: Environment – Emissions, Effluence &amp; Waste</b></p> <p><b>GRI: Society – Community health &amp; safety</b></p>	<p>Drinking water treatment technology</p>	<p>Ensure effective water services institutions</p> <p>Ensure effective local-level operations and management of DWAF water services schemes</p>	
		<p>Water treatment for rural communities</p>	<p>Ensure provision of basic water supply and sanitation for improved quality of life and poverty alleviation</p>	
		<p>Drinking water quality</p>	<p>Ensure provision of basic water supply and sanitation for improved quality of life and poverty alleviation</p> <p>Ensure effective water services institutions</p> <p>Ensure effective local-level operations and management of DWAF water services schemes</p>	

KSA 3	Objectives	Thrust	Programme	DWA Priority
			Water distribution and distribution systems	<ul style="list-style-type: none"> <li>- Ensure effective water services institutions</li> <li>- Ensure effective local-level operations and management of DWAF water services schemes</li> </ul>
		Sustainable Municipal Wastewater and Sanitation <b>GRI: Environment – Emissions, Effluence &amp; Waste</b> <b>GRI: Society – Community health &amp; safety</b>	Emerging treatment technologies - preparing for the future Application of appropriate technologies and tools Stormwater and sewage systems Wastewater sludge and fecal sludge treatment	<ul style="list-style-type: none"> <li>- Ensure the protection of water resources</li> <li>- Ensure effective water services institutions</li> <li>- Ensure effective local-level operations and management of DWAF water services schemes</li> <li>- Ensure the protection of water resources</li> <li>- Ensure provision of basic water supply and sanitation for improved quality of life and poverty alleviation</li> </ul>
		Industrial and Mine-Water Management <b>GRI: Environment – Emissions, Effluence &amp; Waste</b> <b>GRI: Society – Community health &amp; safety</b>	Quantification of water use and waste production Regulations to improve industrial and mine water management	<ul style="list-style-type: none"> <li>- Ensure the protection of water resources</li> <li>- Ensure effective and sustainable delivery of water services to underpin economic and social development (sound legislation, policies and strategies for the sector; sound planning culture established within sector)</li> <li>- Promote and support sound policy and practice of water services to achieve millennium targets in Africa</li> </ul>
			Minimizing the impact of waste on the water environment Minimizing waste production	<ul style="list-style-type: none"> <li>- Ensure the protection of water resources</li> <li>- Ensure the protection of water resources</li> </ul>

KSA 3	Objectives	Thrust	Programme	DWA Priority
			Improved ability to predict and quantify effects	- Ensure effective and sustainable delivery of water services to underpin economic and social development (sound legislation, policies and strategies for the sector; sound planning culture established within sector) Promote and support sound policy and practice of water services to achieve millennium targets in Africa
			Beneficiation and treatment of industrial and mining effluents	- Ensure provision of basic water supply and sanitation for improved quality of life and poverty alleviation
		Sanitation, Health and Hygiene Education <b>GRI: Society – Community health &amp; safety</b>	Advocacy, health and hygiene education	- Ensure effective and sustainable delivery of water services to underpin economic and social development (sound legislation, policies and strategies for the sector; sound planning culture established within sector) Promote and support sound policy and practice of water services to achieve millennium targets in Africa
			Peri-urban sanitation research	- Ensure effective water services institutions Ensure effective local-level operations and management of DWAF water services schemes
			Institutional and management aspects of service delivery	- Ensure effective water services institutions Ensure effective local-level operations and management of DWAF water services schemes



KSA 3	Objectives	Thrust	Programme	DWA Priority
			Technical sustainability of sanitation services	- Ensure provision of basic water supply and sanitation for improved quality of life and poverty alleviation

<b>KSA 4</b>	<b>Objectives</b>	<b>Thrust</b>	<b>Programme</b>	<b>DWA Priority</b>
Water Utilisation in Agriculture (WUA)	<p><b>Primary:</b> To increase household food security and to improve the livelihoods of people at a farming, community and regional level through efficient and sustainable utilization and development of water resources in agriculture.</p> <p><b>Secondary:</b></p> <ul style="list-style-type: none"> <li>- Increase efficiency of water use</li> <li>- Reduce poverty through water-based agricultural activities</li> <li>- Increase profitability of water-based farming systems</li> <li>- Ensure sustainable water resource use through protection and reclamation practices</li> </ul>	<p>Water utilisation for food and fibre production</p> <p><b>GRI: Environment – Material Use</b>  <b>GRI: Economic – Indirect</b>  <b>GRI: Society - Community</b></p>	<p>Water-efficient production methods in relation to soils, crops and technology in rain-fed and irrigated agriculture</p> <p>Fitness-for-use of water for crop production, livestock watering and aquaculture</p>	<p>Water conservation and water demand management</p>
<p><b>GRI: Environment – Material use</b></p> <p><b>GRI: Economic – Indirect</b></p> <p><b>GRI: Society – Community</b></p> <p><b>GRI: Water source &amp; use</b></p> <p><b>GRI: Environment – Overall protection</b></p>	<p>Water use for fuel-wood and timber production</p> <p><b>GRI: Environment – Material Use</b>  <b>GRI: Economic – Indirect</b>  <b>GRI: Society - Community</b></p>	<p>Water use for poverty reduction and wealth creation in agriculture</p> <p><b>GRI: Environment – Water source &amp; use</b>  <b>GRI: Economic – Indirect</b>  <b>GRI: Society - Community</b></p>	<p>Water-efficient production methods and systems in agro-forestry, woodlands and forestry plantations</p>	<p>Promote social-economic growth through development of the forestry sector</p>
			<p>Sustainable water-based agricultural activities in rural communities</p>	<p>Ensure reliable and equitable supply of water for sustainable economic and social development including the eradication of poverty</p>
		<p>Water resource protection and reclamation in agriculture</p> <p><b>GRI: Environment – Overall protection</b>  <b>GRI: Economic - Indirect</b></p>	<p>Integrated water management for profitable farming systems</p> <p>Sustainable water resource use on irrigation schemes and within river catchments</p> <p>Impact assessment and environmental management of agricultural production</p>	<p>Water conservation and water demand management</p> <p>Water conservation and water demand management</p> <p>Ensure the protection of water resources</p>

Cross-cutting Impact Areas	Objectives	Thrust	Programmes	DWA Priority
<p><b>Water and Society</b></p> <p><b>MDG: Poverty reduction, Combat disease, Primary education</b></p> <p><b>GRI: Society – Community</b>  <b>GRI: Environment – Water source &amp; use</b>  <b>GRI: Environment – Overall</b>  <b>GRI: Economic – Indirect</b></p>	<p><b>Support research which:</b></p> <ul style="list-style-type: none"> <li>- Develops a greater understanding of social dynamics in the water sector, and people's needs for and views of water; encourages people's participation in water management and decisions about water</li> <li>- Searches for ways of using water for transformation and social justice</li> <li>- Enables water users at all scales and in different localities to meet the challenges of utilising water as a shared and scarce resource in a sustainable way</li> <li>- Provides water services which are socially acceptable, affordable and available to all</li> <li>- Ensures ready access to water for the poor and disadvantaged members of society</li> </ul>	<p><b>Co-operative governance</b></p> <p>Water for transformation and equity</p> <p>Sustainable Use of water as a shared and shared resource</p> <p>Social requirements for sustainable water services</p> <p>Poverty alleviation</p>		
<p><b>Water and the Economy</b></p> <p><b>MDG: Poverty reduction, Global partnership for development</b></p> <p><b>GRI: Economic – Indirect</b>  <b>GRI: Society - Community</b>  <b>GRI: Environment - Overall</b></p>	<p><b>Primary:</b> Demonstrate the applicability of economic principles in the water field and provide convincing evidence as well as sound knowledge and support to water management institutions and implementing authorities.</p> <p><b>Secondary:</b></p> <ul style="list-style-type: none"> <li>- Assess the role of water in economic development</li> <li>- Use economic instruments for improved management of water</li> <li>- Deal with complex water-economy systems</li> </ul>	<p>Role of water in economic development</p> <p>Using economic instruments in the management of water</p> <p>Dealing with complex water-economy systems</p>		<p>The Impact Areas generally support DWA by promoting good governance and environmentally sustainable, social and economic development of water-related goods and services, as embodied in the DWAF initiative to promote the use of Water for Growth and Development. It also underpins citizens' constitutional right to health and a healthy environment.</p>
<p><b>Water and the Environment</b></p> <p><b>MDG: Environmental sustainability</b>  <b>GRI: Environment – Water source and use</b>  <b>GRI: Environment – Biodiversity &amp; Habitat</b>  <b>GRI: Environment – Material / Resource Use</b>  <b>GRI: Environment – Overall protection</b></p> <p><b>Water and Health</b></p> <p><b>MDG: Combat disease</b></p>	<ul style="list-style-type: none"> <li>- Contribute to achieving a situation where our governance systems and our understanding of environmental processes and the functioning within the hydrological cycle are aligned to support sustainable water management.</li> <li>- Contribute to the selection and application of sustainable techniques in water governance and water projects that are aimed at addressing human development needs.</li> </ul>	<p>Environmental functioning within the hydrological cycle</p> <p>Environmental governance systems</p> <p>Integrative knowledge for ecosystem-based water resource management</p> <p>Environmental degradation and mitigation</p> <p>Resource Protection</p>		
			Detection, prevention and management of water related microbial agents	

Cross-cutting Impact Areas	Objectives	Thrust	Programmes	DWA Priority
<p><b>GRI: Environment – Emissions, Effluence, Waste</b></p> <p><b>GRI: Society – Community health &amp; safety</b></p>	<p><b>Primary:</b> Contribute to the protection of human health by investigating the sources, occurrence, persistence and control of causes leading to water related diseases and other water-related health problems.</p> <p><b>Secondary:</b></p> <ul style="list-style-type: none"> <li>- Develop appropriate techniques, technologies and systems for monitoring of potentially harmful pollutants in water</li> <li>- Obtain adequate understanding of the origin, survival and persistence of, and inter-relationships between, microbial, chemical and other biological and toxic pollutants in water</li> <li>- Assess the impacts (actual and potential) of pollutants on human and animal health and on the environment by performing epidemiological investigations and developing health-risk assessment tools</li> <li>- Investigate the effects of environmental change on health(e.g. the impact of global warming on the spread of malaria; the link between climate variability and epidemics caused by water-borne diseases)</li> <li>- Develop scientifically-sound educational material on health, hygiene, the effects of pollution and the prevention of pollution, and the relationships between these</li> <li>- Provide guidance for appropriate communication, awareness-building and management strategies</li> </ul>	<p>Drinking water</p> <p>Public Health and Hygiene Issues</p> <p>Sanitation and Waste Management</p> <p>Health implications of water use other than domestic use</p> <p>Governance systems for safeguarding human health</p>	<p>Detection, prevention and management of water related microbial agents chemicals and radioactive contaminants in water resources</p> <p>Management of eutrophication and algal toxins</p> <p>Management of impacts of land-use activities on surface water and groundwater at a catchment level</p> <p>Drinking water quality management</p> <p>Water treatment technologies and reticulation systems</p> <p>Public health and hygiene awareness and educational materials</p> <p>Capacity building and training programmes for public health professionals and practitioners</p> <p>HIV/AIDS linkage with water quality and quantity and access to adequate sanitation services</p> <p>Impact of water quantity and service levels on human health</p> <p>On-site sanitation treatment technologies</p> <p>Use of waste as a resource</p> <p>Management of waterborne sewerage and stormwater systems</p> <p>Impacts of quality of irrigation water on human health</p> <p>Ensuring safe water for recreation</p> <p>Management of health impacts associated with occupational exposure to water of poor quality</p> <p>Governance system for the protection of public health from water-related impacts on human health</p> <p>Regulatory framework for an integrated water quality management approach</p>	



**Appendix 5: Supporting evidence used to calculate economic impact**

Project	Start	Total R	Y/N	Cofunders	Y/N	Sustainable practice	Y/N	Sustainable Development	Description
	1985								Wastewater management methods
	1990								Wastewater management methods
90	1992	22000				0	0	0	Lake St Lucia shores - Mapping: Planning & Management
232	1993					1		0	Wastewater management guidelines
416	1993								Wastewater management methods - SA application
501	1994	82850		1		0	0	1	Wetland Use: Decision support system
582	1994	376200		0		1		0	Wastewater management - mines - crop irrigation
598	1994	630597		0		0		0	Urban wastewater management - removal contaminants from storm runoff
1054	1999	550000		0		0		1	Use of rehabilitated urban wetlands for cultivation - local livelihood development, results in improved environmental / community health
1061	1999	1809000		0		0		0	Hydrology
1064	1999	600000		0		1		0	Decision-support system for restoration riparian wetlands
1162	2000	585000		1		0		1	UORC Inventory, Processes, Biodiversity, Landuse impacts, Ecosystem Services, Value, Capacity building
1197	2000	95975		0		0		0	Biota, anthropogenic impacts
1238	2001	485000		0		0		0	Underground water - wetlands - abstraction sites (rural)
1258	2001	745000		0		0		0	Biota, anthropogenic impacts, management framework
1293	2001	98000		0		0		1	Water purification demonstration
1311	2002	300000		0		0		0	Reserve determination: water quality
1327	2002	2201327		0		0		0	Groundwater - abstraction - impacts
1343	2002	720800		0		0		0	Eutrophication assessment
	2002					0		0	Wetland research needs assessment (PM)
564	2003	96000		0		1		1	Cost:benefit rehabilitation - property value - municipal finance
1408	2003	4000000		1		1		1	Rehabilitation management series, origins, ecoservices assess, health assess
1410	2003	255256		1		0		0	Integration into catchment management
590	2004	200000		0		0		0	Health assessment research needs (PM)
1491	2004	6700000		0		0		0	SA water resources

Project	Start	Total R	Y/N	Cofunders	Y/N	Sustainable practice	Y/N	Sustainable Development	Description	Yes = 1; No = 0; Uncertain = blank
1505	2004	1917000	0	0	0	EDCs	0	0		
1544	2004	500000	0	0	1	Treatment winery waste water	0	0		
614	2005	194000	0	0	0	Governance in communal area	0	0		
617	2005	27000	0	0	0	Scientific & Technical Review for Ramsar	0	0		
642	2005	200000	0	0	0	Policy - freshwater biodiversity conservation (Convention for Biodiversity)	0	0		
652	2005	60000	1	0	0	Classification / Inventory	0	0		
1584	2005	3450000	0	0	1	Ecological condition, social importance, economic value assessment tools	1	1		
699	2006	55000	0	0	0	Capacity building	0	0		
700	2006	63295	1	1	1	Mitigation banking	0	0		
710	2006	200000	0	0	1	Policy development - Position - Wetland management in agriculture	1	1		
718	2006	100000	1	0	0	Delineation (soils) / Inventory	0	0		
1691	2006	642200	0	0	1	Hindsight to manage urban rivers and wetlands	1	0		
734	2007	200000	0	0	0	Diatom index - reserve - condition	0	0		
781	2007	200000	0	0	0	Capacity building	0	0		
789	2007	57500	0	0	0	Vegetation	0	0		
790	2007	200000	0	0	1	sustainable use guidelines	1	0		
1704	2007	1099063	0	0	0	Climate change and landuse impact on discharge	0	0		
1709	2007	236100	0	0	1	Sustainable use indicators	1	0		
1725	2007	1465000	0	0	0	Microbial treatment of wastewater	0	0		
1857	2007	859750			0	Climate change and landuse impact on discharge	0	0		
792	2008	111754	0	0	0	Capacity building	0	0		
826	2008	200000	0	0	0	Evapotranspiration	0	0		
847	2008	200000	0	0	0	Plant identification guide	0	0		
1788	2008	1402911	0	0	1	Rapid reserve	1	0		
1789	2008	2500000	0	0	0	Buffer zones	0	1		
1794	2008	625000	0	0	0	Capacity building	0	0		
1801	2008	930000	0	0	0	National network protected freshwater systems	0	0		
1803	2008	3000000	0	0	0	Payment for environmental services - restoration/productivity/cultivation - livelihoods	0	1		
1863	2008	860000	0	0	0	Capacity building	0	0		
905	2009	199920	0	0	1	Evapotranspiration	1	0		

Project	Start	Total R	Y/N	Cofunders	Y/N	Sustainable practice	Y/N	Sustainable Development	Description	Yes = 1; No = 0; Uncertain = blank
914	2009	195000		0		1		0	Wetland research impact assessment	
1921	2009	1070064		0		0		0	Water quality in relation to landuse & environmental response - reserve determination	
1923	2009	893364		0		0		0	Regional processes	
1926	2009	908000		0		0		0	Evapotranspiration	
1946	2009	915000		0		0		0	Capacity building	
1980	2010	1951000		0		0		0	National vegetation database - conservation planning	
1986	2010	800000		0		0		1	Restoration - services - livelihoods	
	2010					0		0	Modelling condition	
18						0		0	Swartvlei ecology (macrophytes)	
<b>Total</b>		<b>49040926</b>		<b>7</b>		<b>15</b>		<b>11</b>		
		<b>~R50 million</b>								
<b>%</b>			<b>10%</b>			<b>25</b>		<b>18</b>		
<b>Count (n)</b>						<b>61</b>		<b>61</b>		



## Appendix 6: Regional or local research sites

Project	Research Area	Wetland/Catchment	Information
1584	Agulhas plain, Western Cape	Modderivlei	Wetland Health and Importance Assessment
1584	Agulhas Plain, Western Cape	Ratelsvlei	Wetland Health and Importance Assessment
598	Alexandra, Gauteng	Jukskei R	Wetland Health and Importance Assessment
1584	Betty's Bay, Western Cape	Dawidskraal (Bass Lake)	Wetland Health and Importance Assessment
1584	Cape Town, Western Cape	Cape Flats	Wetland Health and Importance Assessment
1408	Cape Town, Western Cape	Edith Stephens	Wetland rehabilitation
1054	Cape Town, Western Cape	Khayelitsha	Cultivation in rehabilitation wetlands
1584	Cape Town, Western Cape	Kuils River (Mfuleni)	Wetland Health and Importance Assessment
1584	Cape Town, Western Cape	Mfuleni	Wetland Health and Importance Assessment
1691	Cape Town, Western Cape	Rivers and wetlands of Cape Town	Using hind sight to improve urban management
1584	Cape Town, Western Cape	Soetvlei	Wetland Health and Importance Assessment
18	Cape Town, Western Cape	Swartvlei	Ecology
1327	Cape Town surroundings, Western Cape	Kogelberg Biosphere Reserve	Groundwater hydrology
1327	Cape Town surroundings, Western Cape	Theewaterskloof Conservancy	Groundwater hydrology
564	Cape Town, Western Cape	Westlake, Lower Silvermine, Kuils River	Cost:benefit of wetland rehabilitation
1584	Cape Town, Western Cape	Zeekoivlei/Rondevlei	Wetland Health and Importance Assessment
1491	Country-wide	South Africa, Swaziland, Lesotho	WP2005 - water resource model simulations
1408	Craigieburn, Mpumalanga	Manalana wetland	Wetland rehabilitation
1584	Eastern Cape	Franklinvlei	Wetland Health and Importance Assessment
1584	Eastern Cape	Goukou river	Wetland Health and Importance Assessment
1408	Eastern Cape	Kromme River	Wetland rehabilitation
1061	Empangeni, Northern KZN	Ngoye Hills catchment	Hillslope hydrology
1584	Free State	Bloemfontein	Wetland Health and Importance Assessment
1408	Free State	Memelivlei	Wetland rehabilitation
1408	Free State	Upper Meurivier catchment, Free State	Wetland rehabilitation
1408	Gauteng	Kaalspruit & Hennops catchments	Wetland rehabilitation
1238	Grahamstown-Lady Frere, Eastern Cape	Qoqodala Ring, Great Kei Catchment	Groundwater hydrology
1584	Kamiesberg, Northern Cape	Langvlei and Ramkamp wetlands	Wetland Health and Importance Assessment
1197	Kruger National Park (adjacent), Mpumalanga	Luvuvhu River, Mutale River	Anthropogenic impact on biota
1584	Kusunu, Malawi	Dwanwa catchment	Wetland Health and Importance Assessment
1408	KwaZulu-Natal	Dartmoor Vlei	Wetland rehabilitation
1064	KwaZulu-Natal	Drakensburg	Riparian system (incl. wetland) rehabilitation
1408	KwaZulu-Natal	Faber's Hill	Wetland rehabilitation
1408	KwaZulu-Natal	Hlatikulu	Wetland rehabilitation
1408	KwaZulu-Natal	Kruisfontein	Wetland rehabilitation
1064	KwaZulu-Natal	KZN Midlands	Riparian system (incl. wetland) rehabilitation

<b>Project</b>	<b>Research Area</b>	<b>Wetland/Catchment</b>	<b>Information</b>
1064	KwaZulu-Natal	Maputoland	Riparian system (incl. wetland) rehabilitation
614	KwaZulu-Natal	Mbolongwane	Governance in communal area
1408	KwaZulu-Natal	Mbongolwane	Wetland rehabilitation
1064	KwaZulu-Natal	Mhlatuze Catchment	Riparian system (incl. wetland) rehabilitation
501	KwaZulu-Natal	Midlands	Wetland Management: Decision support system
1408	KwaZulu-Natal	Nyamvubu, KZN	Wetland rehabilitation
1584	Lesotho	Letseng-la-Letsie	Wetland Health and Importance Assessment
1584	Lesotho	Letseng-la-Letsie	Wetland Health and Importance Assessment
1408	Limpopo	Lake Fundudzi	Wetland rehabilitation
1408	Limpopo	Mohlapetsi	Wetland rehabilitation
1408	Limpopo	Moro	Wetland rehabilitation
1584	Limpopo	Mutale river catchment (Sambandou and Nyahalwe)	Wetland Health and Importance Assessment
1061	Mondi Forest Estate, Seven Oaks, Pietermaritzburg	Two Streams catchment	Hillslope hydrology
1408	Mpumalanga	Draaikraal	Wetland rehabilitation
1408	Mpumalanga	Kadishe	Wetland rehabilitation
1584	Mpumalanga	Nylsvlei	Wetland Health and Importance Assessment
1584	Mpumalanga	Nylsvlei	Wetland Health and Importance Assessment
1408	Mpumalanga	Upper Olifants River Catchment	Wetland rehabilitation
1162	Mpumalanga	Upper Olifants River Catchment	Economic evaluation
1408	Mpumalanga	Wakkerstroom	Wetland rehabilitation
1408	North West	Bodibe	Wetland rehabilitation
1408	North West	Molopo	Wetland rehabilitation
90	Northern KwaZulu-Natal (KZN)	Lake St Lucia	Mapping
1408	Northern KZN	Mfolozi floodplain	Wetland rehabilitation
1408	Northern KZN	Mkuze	Wetland rehabilitation
1544	Stellenbosch, Cape Town	Wetland in winery and constructed research station	Wine wastewater treatment
1505	Tshwane, Pretoria	Rietvlei Nature Reserve	EDCs
1408	Tshwane, Gauteng	Rietvlei	Wetland rehabilitation
1408	Tshwane, Gauteng	Soshanguve	Wetland rehabilitation
1408	Umzimkulu, Eastern Cape	Ntsikeni (Killarney)	Wetland rehabilitation
1061	Umzimvubu Basin, Eastern Cape	Weatherly Catchment	Hillslope hydrology
1408	Underberg, KZN	Private farm wetlands	Wetland rehabilitation
1258	Waterberg, Limpopo Province	Nylsvlei	Anthropogenic impact on biota - Management
1311	Waterberg, Limpopo Province	Nylsvlei	Reserve determination: water quality
1408	Waterberg, Limpopo Province	Nylsvlei	Wetland rehabilitation
1311	West Coast, Western Cape	Rocher Pan	Reserve determination: water quality
1311	West Coast, Western Cape	Verlorenvlei	Reserve determination: water quality
1584	Western Cape	Agulhas plain	Wetland Health and Importance Assessment

Project	Research Area	Wetland/Catchment	Information
718	Western Cape	Agulhas plain, Coastal Overstrand, Cape Flats and Somerset West, Cape Peninsula, Stellenbosch area, Swartland and Saldanha Peninsula, West Coast, Cape Fold Mountains, Upper Breede Valley, Southern Cape regions	Soil delineation method
1584	Western Cape	South-western Cape	Wetland Health and Importance Assessment
1584	Western Cape	West Coast	Wetland Health and Importance Assessment
582	Witbank, Mpumalanga	Kromdraai open case mine	Treating mine wastewater
1408		Nsonge River floodplain	Wetland rehabilitation
614		Sand Catchment	Governance in communal area
1408		Stillerust Vlei	Wetland rehabilitation



Project	Start	%	Y/N	Local labour	Y/N	Public Works	Y/N	Female	Y/N	HDI/DI	Y/N	Students	Y/N	Thesis	Y/N	Capacity	Y/N	Local community awareness	Y/N	Sensitivity	Y/N	Livelihoods /Use	Y/N	Education	Y/N	Human rights	Y/N	Health	Y/N	
1311	2002	77	Not reported	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	Not reported	0	0	0	0	0	0	0	1	0	
1327	2002	64	Not reported	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	Not reported	0	0	0	0	0	1	0	0	0	
1343	2002	94	Not reported	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	Not reported	0	0	0	0	0	1	0	0	0	
	2002																													
564	2003	100	Not reported	0	1	0	1	0	0	0	0	1	0	0	0	0	0	1	1	Not reported	0	1	0	0	0	0	0	0	0	0
1408	2003	65	Not reported	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Pre-evaluation approached sensitively	0	0	0	0	0	1	0	0	0	
1410	2003	100	Not reported	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	Not reported	0	0	0	0	0	0	0	0	0	0
590	2004	65	Not reported	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Not reported	0	0	0	0	0	0	0	0	0	0
1491	2004	93	Not reported		1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	Not reported	0	0	0	0	0	1	0	0	0	
1505	2004	50	Not reported	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	Not reported	0	0	0	0	0	0	0	1	0	0
1544	2004	62	Not reported		1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	Not reported	0	0	0	0	0	0	0	1	0	0
614	2005	78	Not reported	0	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	Awareness of community culture indicated	0	0	0	0	0	0	0	0	0	0
617	2005		Not reported	0	1	0														Not reported	0	0	0	0	0	0	0	0	0	0
642	2005		Not reported	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Not reported	0	0	0	0	0	0	0	0	0	0
652	2005	83	Not reported	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	Not reported	0	0	0	0	0	0	0	0	0	0
1584	2005	54	Not reported	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	Not reported	0	1	0	0	0	1	0	0	0	0

Project	Start	%	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N
		Investment	Local labour	Public Works	Female	HDI/DI	Students	Thesis	Capacity	Local community awareness	Sensitivity	Livelihoods /Use	Education	Human rights	Health			
699	2006		Not reported		1						Not reported	0	1	0	0			
700	2006	94	Not reported	0	0	0	0	0	0	0	Not reported	1	0	1	0			
710	2006	84	Not reported	0	1	0	0	0	0	0	Not reported	0	0	0	0			
718	2006	56	Not reported	0	1	0	0	0	0	0	Not reported	0	0	0	0			
1691	2006	84	Not reported	0	1	1	1	0	0	1	Not reported	0	0	0	0			
734	2007	89	Not reported		0	0						0	0	0	0			
781	2007											0	1	0	0			
789	2007											0	0	0	0			
790	2007											1	0	0	0			
1704	2007											1	0	0	0			
1709	2007											1	0	0	0			
1725	2007											0	0	0	0			1
1857	2007											1	0	0	0			
792	2008		Not reported	0	1						Not reported	0	1	0	0			
826	2008	76			0	1	1					0	0	0	0			
847	2008	84			1	0						0	0	0	0			
1788	2008	47	Not reported		1	0	0					0	0	0	0			
1789	2008	91	Not reported		1	1	1					1	0	1	0			
1794	2008											0	1	0	0			
1801	2008	80	Not reported		1	1	0					0	0	1	0			
1803	2008											1	0	0	0			
1863	2008						1					0	1	0	0			
905	2009	90			0	1	1					0	0	0	0			

Project	Start	%	Investment	Y/N	Local labour	Y/N	Public Works	Y/N	Female	Y/N	HDI/DI	Y/N	Students	Y/N	Thesis	Y/N	Capacity	Y/N	Local community awareness	Y/N	Sensitivity	Y/N	Livelihoods /Use	Y/N	Education	Y/N	Human rights	Y/N	Health	Y/N
914	2009		82						1		1		1										0		0		0		0	
1921	2009		49		Not reported				1		1		1										1		0		0		1	
1923	2009		52		Not reported				1		1		1										0		0		0		0	
1926	2009		83		Not reported				0		1		1										0		0		0		0	
1946	2009																						0		1		0		0	
1980	2010																						0		0		0		0	
1986	2010		77		Not reported				1		1		1										1		0		1		0	
	2010																						0		0		0		0	
	<b>Total</b>		<b>74</b>						<b>36</b>		<b>24</b>		<b>29</b>		<b>13</b>		<b>9</b>		<b>14</b>		<b>2</b>		<b>16</b>		<b>7</b>		<b>15</b>		<b>12</b>	
	<b>Count (n)</b>		<b>37</b>					<b>31</b>	<b>46</b>		<b>44</b>		<b>42</b>		<b>31</b>		<b>30</b>		<b>30</b>		<b>34</b>		<b>62</b>		<b>62</b>		<b>62</b>		<b>62</b>	
	<b>Ave</b>		<b>74</b>		<b>sd=18</b>																									
	<b>%</b>								<b>78</b>		<b>55</b>		<b>69</b>		<b>42</b>		<b>30</b>		<b>47</b>		<b>6</b>		<b>26</b>		<b>11</b>		<b>24</b>		<b>19</b>	

## Appendix 8: Research Organizations Contracted

Organization	Earliest Date	# Projects	Organization	Earliest Date	# Projects
Abbott Grobicki (Pty) Ltd	1999	1	Southern Waters	2002	2
AfriDev Consultants	2000	1	SRK	2004	1
Anchor Consulting	2005	1	SSI Engineers and Environmental Consultants (Pty) Ltd	2004	1
Appledore Advertizing	2008	1	Steffen, Robertson and Kirsten CE (PTY) LTD	1993	1
ARC - Institute for Soil, Climate and Water	2006	3	Stewart Scott Inc.	1993	1
Arcus Gibb	2004	1	Stordov	1993	1
Asset Research	2008	1	Umtulawempilo Consulting	2004	1
Association for Water and Rural Development (AWARD)	2005	2	Umgeni Water	2003	1
Aurecon	2005	1	Umvoto	2002	1
BioAssets	2008	3	University of Cape Town	2002	10
Cape Peninsula University of Technology	2009	1	University of Eduardo Mondlane, Mozambique	2005	1
Council for Geoscience	2001	1	University of Exeter	2005	1
Crispis Environment	2008	1	University of Johannesburg 7 14	2001	2
CSIR	1993	12	University of KwaZulu-Natal (previously Natal)	1994	12
De Waal and Ass	1993	1	University of Limpopo	2001	1
DH Environmental Consulting	2002	2	University of Newcastle on Tyne, UK	2005	1
Eagle Environmental Consulting	2003	1	University of North	2001	1
Fluvius Environmental Consultants	2008	1	University of Pretoria 34 62	1994	2
Freshwater Consulting Group	2005	1	University of Stellenbosch 18 51	2003	2
Golder Associates Africa	2001	2	University of the Free State 19 36	2007	2
Ihaphosi Enviro Services	2000	1	University of the North-West 4 8	2004	3
Independent Economic Researchers cc	2000	2	University of the Western Cape 21 24	2004	1
Innovative Water Solutions (Pty) Ltd	2001	1	University of the Witwatersrand 7 18	1994	2
Institute for Natural Resources	2006	1	University of Venda	2000	2
IWS	2001	1	University of Zimbabwe: Rural & Urban Planning	2005	1
Knight Piesold	2004	1	University of Zululand	1992	1
Laughing Waters	2003	1	Water for Africa 3 5	2008	1
Mpumalanga Parks Board	2000	1	Water Systems Research Group	1994	1
Ninham Shand Consulting Service	2002	2	Wates Meiring & Barnard	2000	1
NLO Environmental	2001	1	WESSA	2006	1
NRF	2004	1	Wetland Consulting Services	2000	4



Organization	Earliest Date	# Projects	Organization	Earliest Date	# Projects
PD Naidoo & Associates	2004	1	Wits Technikon	2001	1
Percy Fitzpatrick Institute	2005	1			
Rand Afrikaans University	2001	1	<b>Count = 68</b>		
Rhodes University	2003	3	<b>Increased from 11 in 1999 to 68 in 2009</b>		
SANBI	2001	2	<b>84% increase # organizations since 2000</b>		

## Appendix 9: List of researchers

Author	Earliest Date	Author	Earliest Date
Allanson	1979	Koopman	2003
Annandale	1994	Kotze	1994
Appleton	2005	Lamberth	2006
Armstrong	2003	Lane	2002
Ashenden	2008	Lannas	2005
Ashton	2005	Law Brown	2004
Aston	2002	Le Maitre	2002
Bailey	2004	Le Roes	2004
Barnard	1994	Leman	2003
Barnhoorn	2004	Lindley	2003
Batchelor	1994	Loots	1994
Beckendahl	2003	Lorentz	1999
Beuster	2006	Louw	2005
Bird	2005	Luger	2006
Blake	2002	MacFarlane	2003
Boon	1985	MacKay	2003
Bornman	2004	Magoba	2002
Boucher	2006	Maherry	2002
Bouwman	2004	Malan	2004
Breen	1994	Marneweck	2000
Brouwer	2005	Marr	2004
Brown	2002	Mashigo	2003
Brummer	2003	Matthews	2000
Burger	2006	McCarthy	2003
Burton	2004	Mentz	1994
Chevallier	2001	Middleton	2004
Chikozho	2005	Mlisa	2002
Chileshe	2005	Moshaphu	2004
Chirwa	2000	Muller	2000
Chunda	2000	Munzhedzi	2000
Coleman	2000	Murray	2006
Collins	2003	Nanngambi	2000
Colvin	2002	Ndiitwani-Nyamnade	2006
Corry	2005	Nel	2005
Cousins	2005	Nhleko	2001
Cowan	2004	Nieuwmeijer	2001
Cowden	2003	Noffke	2006
Cox	2006	Nomquphu	2001
Dada	2003	Nxele	2003
Davey	2006	Ollis	2005
Day E	2005	Palmer	1999
Day J	2004	Peddi	2006
Dickens	2003	Pemberton	2002
Dini	2003	Petersen	2006
Dlamini	2007	Pollard	2005
Dollar	2006	Potgieter	2000
du Toit	2007	Pretorius	1999
du Toit, D.	2005	Prinsloo	2002
Ellery	2003	Pybus	1993
Engelbrecht	2000	Quinn	1999

Author	Earliest Date	Author	Earliest Date
Ewart-Smith	2005	Quinn	2003
Fairburn	2006	Ramsay	2003
Fatoki	2002	Rasinga	2005
Foord	2000	Ratcliffe	2006
Fouche	2000	Rethman	1994
Genthe	2004	Riemann	2002
Gibson	2001	Roberts	2002
Goba	1999	Rohr	2004
Goge	2003	Ross Gillepsie	2005
Goodman	2003	Rossouw	2002
Gorgens	2005	Roux	2005
Graham	2003	Russell	2003
Grenfell	2003	Samuels	2005
Grenfell SE	2005	Saul	2005
Griffin	2002	Scovronic	2005
Grobicki	2002	Shandu	2001
Grundling A	2000	Sheridan	2004
Grundling P	2000	Sieben	2007
Harding	2002	Soltau	2002
Hartnady	2006	Steytler	2001
Haskins	2006	Swanepoel	2006
Hawkins	2002	Taylor	2006
Hay R	2006	Thompson	2006
Hoffman	2008	Thornton-Dibb	1999
Howard-Williams	1979	Tooth	2003
Hughes	1994	Turpie	2000
Impson	2006	Uys	2003
Jacobsen	2000	van Niekerk	2006
Jaganath	2005	van Ree	2000
Jager	2004	van Vuren	2004
Jansen	2003	van Zyl	2000
Jardine	2002	vd Waal	2000
Job	2006	Vink	2000
Jovanovic	1994	Vlok	2008
Ketley	2005	Walters	2003
Kippie	2001	West	2002
Kleynhans	2005	Wood	1993
Klug	1994	Woodford	2001
<b>Total # Researchers: 176</b>			
<b>Increased from 22 in 1999 to 176</b>			
<b># researchers increased by 87% since 2000</b>			

**Appendix 10: Supporting evidence used to calculate institutional impact**

Project	Start	%	#	Organizations	Y/N	Policy development	Y/N	Policy Implementation	Y/N	Governance Model	Y/N	Resource Management	Y/N	Water/material supply management	Y/N	Wastewater Management	Y/N	Integrated Management	Y/N	Decisions	Y/N	Planning
18	1979						0	0		0	0	0	1			0	0					0
	1985						0	0		0	0	0	1			0	0					0
	1990						0	0		0	0	0	1			0	0					0
90	1992																					
232	1993	0	0	5		0	0	0		0	0	0	1			0	0					0
416	1993	0	0	11		0	0	0		0	0	0	1			0	0					0
501	1994	0	0	22		0	0	0		0	1	0	0			0	0					0
582	1994	0	0	18		0	0	0		0	0	0	0			0	0					0
598	1994	1	1			0	0	0		0	0	0	1			0	0					0
1054	1999	0	0	7		0	0	0		0	1	0	0			0	0					0
1061	1999	0	0	6		0	0	0		0	0	0	0			0	0					0
1064	1999	0	0			0	0	0		0	1	0	0			0	0					0
1162	2000	1	1	15		0	0	1		0	1	0	0			0	0					0
1197	2000	0	0	4		0	0	0		0	1	0	0			0	0					0
1238	2001	1	1	13		0	0	0		0	1	0	1			0	0					0
1258	2001	1	1	6		0	0	0		0	1	0	0			0	0					0
1293	2001	1	1			0	0	0		0	0	0	0			1	0					0
1311	2002	0	0	15		0	0	1		0	0	0	0			0	0					0
1327	2002	1	1	16		0	0	0		0	1	0	1			0	0					0
1343	2002	1	1	6		0	0	0		0	1	0	1			0	0					0
	2002	0	0			0	0	0		0	0	0	0			0	0					0
564	2003	1	1	14		0	0	0		0	1	0	1			0	0					0
1408	2003	1	1	20		0	0	0		0	1	0	1			0	0					1
1410	2003	1	1	9		0	0	0		0	0	0	0			0	1					0
590	2004	0	0	5		0	0	0		0	0	0	0			0	0					0
1491	2004	1	1	4		0	0	0		0	1	0	1			0	0					1
1505	2004	1	1	17		0	0	0		0	0	0	0			1	0					0
1544	2004	1	1	11		0	0	0		0	0	0	1			0	0					0
614	2005	1	1	6		0	0	0		1	0	0	0			0	0					0
617	2005					0	0	1		0	1	0	1			0	0					0
642	2005	1	1	12		1	0	0		0	0	0	0			0	0					0

Project	Start	%	#	Organizations	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	
					Policy development	Policy implementation	Governance Model	Resource Management	Water/material supply management	Wastewater Management	Integrated Management	Decisions	Planning				
652	2005		1	19													
1584	2005		1	32													
699	2006		0														
700	2006		1	14													
710	2006		0	7													
718	2006		0	10													
1691	2006		1	27													
734	2007		1														
781	2007																
789	2007		0														
790	2007		0														
1704	2007		0														
1709	2007		1														
1725	2007		0														
1857	2007		0														
792	2008		1	3													
826	2008		0														
847	2008		0														
1788	2008		1														
1789	2008		0														
1794	2008		0														
1801	2008		1														
1803	2008		1														
1863	2008		0														
905	2009		0														
914	2009		0														
1921	2009		1														
1923	2009		0														
1926	2009		0														
1946	2009		0														
1980	2010		0														
1986	2010		0														
	2010		0														

Project		%	#	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N
Start	Consortium		Organizations	Policy development	Policy implementation	Governance Model	Resource Management	Water/material supply management	Wastewater Management	Integrated Management	Decisions	Planning				
Total	26		Ave	2	9	1	20	2	9	1	12	6				
Ave			12													
%	45		sd = 7	3	15	2	32	3	15	2	19	10				
Count (n)	58		29	62	62	62	62	62	62	62	62	62				
# Orgs			>200													

## **Appendix 11: Broader stakeholder groups acknowledged for the their engagement in the research process**

<b>Earliest date</b>	<b>Organization/Initiative/Group</b>
1999	Agricultural Research Council
2004	Agriculture Research Institute
2006	Agulhas National Park
2003	Aida, Fish Hoek
2002	Albany Museum
1994	Amcoal Environmental Services
2005	Anchor Environmental Consultants
2000	Anglo Coal
2000	Anglo Coal Environmental Services
2000	Anglo Coal, Marshalltown
1994	Anglo-American Coal Corporation (AMCOAL), Kromdraai & New Denmark
2003	Antoinette properties, Kuils River
2008	Appledore Advertizing
2006	Authors
2005	Association for Water and Rural Development (AWARD)
2004	B&M Environmental Services
2004	Biocrop, Laboratories, Krugersdorp)
1999	Biotechnology Plant Producers - Inyibiba project
2005	Botanical Society – Conservation Unit
2004	Cape Metrolitan Council
2002	Cape Nature
2001	Carnarvon estate
1994	CARNIA (OMN1A)
2005	Catholic University of Leuven, Belgium
2000	Chamber of Mines
2002	City of Cape Town
1999	City of Cape Town - Inyibiba project
	Coaltech 2020
2003	Coastal Estates, Fish Hoek
2001	Coastec
2005	Community - local organization or individual
1994	Consultants
1993	Council for Scientific and Industrial Research (CSIR)
1993	Cydna Laboratories
2003	De Kock Estates, Fish Hoek
2002	Department Environmental Affairs & Development Planning, Western Cape
2003	Department of Environmental Affairs (& Tourism)
1994	Department of Agriculture
2005	Department of Agriculture and Environmental Affairs, KwaZulu-Natal
2000	Department of Minerals and Energy
1993	Department of Water Affairs (& Forestry)
2003	Donors (DGIS, Netherlands)
2005	Department Land Affairs
2005	Department of Local Government
2003	Eagle Environmental
1994	East Carolina University, Department of Biology
1993	EEC Expert Group
2004	Emanti
2003	Endangered Wildlife Trust
1994	Environmental Advisory Services

<b>Earliest date</b>	<b>Organization/Initiative/Group</b>
1994	Ezemvelo KZN Wildlife (Natal Parks Board)
1997	Farmers
2005	Ford Foundation
1994	Foundation for Research & Development
2003	Free State Nature Conservation
2002	Freshwater Consulting Group
2006	Friends of Constantia Greenbelt
2006	Friends of Die Oog
2006	Friends of Liesbeek River
2001	Friends of Nylsvley
2006	Friends of Rietvlei
2006	Friends of Zeekoevlei and Rondevlei
2003	Front Doer Properties, Kirstenhof
2002	Geoss
2005	Geoterra Image
2003	Ground Truth
2005	Harvard University, USA
2003	Hawywood & Brookes, Kirstenhof
2006	Hout Bay Museum
1993	IAWPRC Specialist Working Group on Macrophytes in Water Pollution Control
1993	IAWQ Specialist Group on Macrophytes in Water Pollution Control
	IAWQ Specialist Group on Macrophytes in Water Pollution Control
1993	Institute for Natural Resources
1994	Institute for Social and Economic Research, UDW
1999	Jacana Environmental
2002	Kogelberg Biosphere Reserve
1993	Kruger National Park
1994	KwaZulu Bureau Of Natural Resources
2003	Land Resources Instiititute
2003	Landcare, South Africa
1993	Laubscher Human & Lombard
2003	Laughing Waters
2005	Leliefontein community
1993	Lethlahile Town Council
2003	Letitia Properties
2001	Limpopo Conservation (EIA section)
1999	Lotus River Project Team
1994	Louisiana State University, Centre for Wetland Resources
2005	Makana Biodiversity Centre, Albany Museum
2005	Malawi Enterprise Zone Association
1994	ManTech Environmental Technology, Oregon
2003	Marie Smit Properties, Kuils River
2005	Marine & Coastal Management, DEAT
2000	Matla Environmental Services & Olifants River Forum
2005	Mondi Wetlands Project
2002	Mountain Rose Farm
2005	Mozambique – specialists
2000	Mpumalanga Parks Board
	Mpumalanga Tourism and Parks Agency
1993	Laubscher Human & Lombard
1993	Ninham Shand
1994	Natal Town and Regional Planning Commission
2005	NMMU
2001	Norsk Hydro (Norway)
2005	Northern Cape Department of Tourism, Environment and Conservation



<b>Earliest date</b>	<b>Organization/Initiative/Group</b>
2004	North-West University (Potchefstroom Campus)
2004	Oenozyme
2000	Onderstepoort Veterinary Institute
	Oryx Environmental
2003	Pam Golding, Fish Hoek
1994	PANNAR
2003	Pegasus Strategic Management
2006	Phragmites
1994	Potchefstroom University
2005	Programme for Land & Agrarian Studies (PLAAS), University of the Western Cape
2004	Pulles Howard & De Lange, Johannesburg
2002	Rand Afrikaans University
1994	Renfreight Wetlands Campaign
2001	Rhodes University
2006	Rondevlei Nature Reserve
2001	SAFCOL
2005	SAIAB
2005	South African National Biodiversity Institute (SANBI)
2003	SANBI, Working for Wetlands
2005	SANParks
	Sasol Mining
2001	Wetland Scientists/Technicians/Practitioners
1993	SDWA
2003	Seeff, Fish Hoek
2003	Seeff, Kirstenhof
1994	SENSAKO
2004	SHSPH, University of Pretoria
2003	Silvermine Riverine Rovers
2005	South African Institute for Aquatic Biodiversity
2006	South African Soil Surveyors Organization (SASSO)
1994	South African Timber Growers Association
2002	Southern Waters
1994	Steffen, Robertson and Kirsten Consulting Engineers
2005	Stellenbosch University
1993	Stewart Scott Inc
2005	Stockholm Environmental Institute
2002	Stroompie (farm)
2003	Table Mountain Fund
2005	The Nature Conservancy-USA
1994	The Wildlife Society of Southern Africa
2002	Theewaterskloof Conservancy
2005	Tubingen, Germany
1999	Tygerberg Administration-Inyibiba project
2005	UCD, USA
2003	University of Cape Town
1994	University of (Orange) Free State
1994	University of KwaZulu-Natal (Natal)
1993	Umgeni Water
2005	University of Debrecan, Hungary
2004	University of Johannesburg, Department of Zoology
2004	University of Johannesburg, Department of Zoology
2001	University of Limpopo
2004	University of Pretoria
2004	University of Stellenbosch
2002	University of the North

<b>Earliest date</b>	<b>Organization/Initiative/Group</b>
2005	University of Venda
2005	University of Waterloo
2006	University of Western Cape
1999	University of Zululand
2004	Urban Nature Reserve
2000	Veterinarian, Witbank
	W2 Consulting (USA)
1994	Wakkerstroom Natural Heritage Association
2005	Water Committee at Lane Fundudzi
1993	Wates Meiring & Barnard
2004	Weather Bureau
2003	Wildlife & Environment Society of Southern Africa (WESSA)
2008	WESSA Learners (2000 game packs produced)
2005	Wetland Action
2003	Wetland Consulting Services
2005	Wetlands International
2005	Witwatersrand University
2003	Working for Water
2005	World Wildlife Fund – USA
2003	World Wildlife Fund
2005	Zambia – Specialist
2006	Zandvlei Trust
2005	Zimbabwe – Specialist
	<b>662 organizations/groups</b>
	<b># increased by 69% since 2000</b>

## **Appendix 12: Example of annual WRC wetland related activities (Annual Knowledge Review, 2008/09)**

<b>Wetland Link</b>	<b>Description</b>	<b>Activity</b>
General	Knowledge Cafés were conducted in tandem to create platforms for dialogue between civil society, researchers and policy makers	Capacity
General	Workshop on the Lowest Appropriate Level for Governance was held in partnership with the University of the Western Cape	Capacity
General	Workshop on Criteria for the Success of Women in the Water Sector	Capacity
Treatment	Workshop on the EDC Bio-Assay Toolkit developed in collaboration with the GWRC, University of Pretoria	Capacity
Treatment	Workshops held at WISA 2008, Sun City, included the EDC research programme and project awareness campaign and the presentation and discussion of 'Development of a Conceptual Framework for Integrated Water Quality', another WRC-funded project	Capacity
Mfabeni Mire	Inception workshop for Project No. 1843: 'An evaluation of the sensitivity of socio-economic activities to climate change in climatically divergent South African catchments' to clarify tasks, methodology and initial catchment selection	Capacity
Treatment	Workshop to discuss a WRC project dealing with water quality and quantity of the Waterberg coal reserves	Capacity
General	Internal WRC Open Day and Knowledge Review launch	Capacity
Treatment	Workshop to prepare terms of reference for a comparative study to determine the endocrine-disrupting effects of regional-specific agrochemical mixtures (pesticides, fungicides and herbicides) on aquatic wildlife (fish and amphibians) and mammals utilising affected water sources.	Capacity
Assessment, Valuation, Rehabilitation	Workshop on a Case Study of the Olifants Rivers for a Framework and Manual for the Evaluation of Aquatic Ecosystems Services for the Resource Directed Measures	Capacity
Mfabeni mire, Management	Workshop on Sustainable Peatland Management Guidelines	Capacity
Health, Rehabilitation	Workshop on the Effects of Stream Flow Regulation/ Manipulation on Invertebrate Hosts of Malaria, Bilharzia and Liver Fluke Disease	Capacity
Mfabeni Mire	Workshop on adaption to the consequences of climate change on freshwater resources (co-funded with WWF)	Capacity
General	Workshop for Sediment Quality Guidelines	Capacity
Water quality, reserve	Workshop on the Housing and Curation of the South African Diatom Collection	Capacity
Assessment	Workshop on Eco-Classification: Expected Macro-Invertebrates Frequency under Reference Conditions	Capacity
Treatment	A workshop on the Bio-assay Toolbox to discuss the assays to be included, University of Pretoria	Capacity
Management	A Sustainable Urban Drainage Workshop was held with key stakeholders (reference group members) from the various WRC projects related to stormwater and sewerage systems, Cape Town.	Capacity
Treatment	Workshop on Impact of Winery Wastewater on Soil, Crops and Wine Quality, Stellenbosch	Capacity
General	A workshop at WISA 2008 discussed the rollout of the Technical Assistance Centre	Capacity
Treatment	• Workshop on the development of the generic framework for EDC risk evaluation studies for humans, animals and the environment	Capacity
General	FMS capable of capturing student data	Capacity
General	WRC launched its Technology Transfer Office on 6 March 2009	Capacity
Capacity	Workshop: WRC, DWAF and UNESCO co-hosted the African Regional Workshop on Water Education, 24-25 February 2009	Capacity
General	WISA 2008, Sun City, 18-22 May 2008. Workshop on WISA Young Professionals: Creating a Forum for Postgraduate Students & Young Professionals.	Capacity

<b>Wetland Link</b>	<b>Description</b>	<b>Activity</b>
Study	Book launch: Rivers and Wetlands of Cape Town: Caring For Our Rich Aquatic Heritage, 10 March 2009, Cape Town.	Capacity
	<u>STAFF PRESENTATIONS, PUBLICATIONS, ETC.:</u>	
General	Zaragoza 2008 International Expo 'Water and Sustainable Development' ran from 14 June to 14 September 2008	Dissemination
General	5th World Water Forum – held in Istanbul, Turkey, in March 2009	Dissemination
General	'National Water Act review', presentation made to parliament	Dissemination
General	'Human capital development in the water sector', presentation made at the Knowledge Week organised by the DBSA	Dissemination
General	'The role of the WRC in capacity building', a presentation made at the UNESCO regional workshop	Dissemination
General	'Knowledge and Capacity Development for Growth and Development: The role of the Water Research Commission' – opening address at the EnviroWater Conference	Dissemination
Treatment, Reserve	Another presentation was made at the EnviroWater Conference in Stellenbosch on the research on water quality	Dissemination
General	'Capacity-building for IWRM in Africa' at the IWRM training course, Cape Town	Dissemination
General	'The Water Research Commission: A suitable model?' Presented at the SADC Groundwater in IWRM initiative	Dissemination
Ecosystem	'Groundwater exploration' lecture given as part of a Groundwater Division course.	Dissemination
Treatment	Keynote presentation at Pan African Environmental Mutagen Society (PAEMS) international conference in Cape Town, on the WRC research programme on toxins and EDCs	Dissemination
Treatment	A poster was presented at the International Water Association (IWA) World Water Conference, Vienna, on the EDC research outcomes and the precautionary principle	Dissemination
Mfabeni Mire	A 2-week seminar in Rome, Italy, at the International Development Law Organisation (IDLO) on climate change and law	Dissemination
General	Water SA Special Issue – Guest Editor and Guest Editor-in- Chief for a special KSA1 issue based on the IWRM conference held in March 2008	Dissemination
General	'The role of the WRC in development in South Africa', presentation made to the African Academies of Science	Dissemination
General	8th Intecol Conference, Cuiaba, Brazil	Dissemination
Reserve	Implementing Environmental Water Requirements (IEWA), Port Elizabeth, South Africa; a research manager was Conference Chair and director was International Scientific Committee Chair	Dissemination
Ecosystem	5th World Water Forum, Istanbul, Turkey; a research manager presented a paper on 'Grasslands as natural water infrastructure in South Africa'	Dissemination
Treatment	Article on EDCs 'The ABC of EDCs: Global concern spurs researchers into action' – was published in The Water Wheel	Dissemination
Treatment	Article on the EDC research programme was published in The Water Wheel: 'The ABC of EDCs: Building an armoury of knowledge'	Dissemination
Treatment	Arranged a field visit for officials and researchers to view piloting of grey-water management alternatives in the informal settlements of Western Cape	Dissemination
Treatment	Authored a scientific paper: Strong PJ and Burgess JE (2008) Fungal and enzymatic remediation of a wine lees and five wine-related distillery wastewaters. Bioresource Technology 99 (14): 6134-6142	Dissemination
Treatment, Reserve	Presented a lecture on South Africa's water quality and emerging issues to students enrolled for an M.Sc. in integrated water management at the University of Pretoria	Dissemination
General	Media support and exhibitions for international events	Dissemination
General	Logistics for international delegations visiting South Africa	Dissemination
General	Bid to host the 6th World Water Forum in 2012	Dissemination
General	Watermark Book 2nd Edition 2009	Dissemination
Reserve	SABC TV international and SABC Radio on 5 February 2009: prior to IEWA Conference	Dissemination
Reserve	SABC TV during IEWA conference	Dissemination
Treatment, Reserve	Articles on Water Quality were published in Pretoria News of 26 February 2009, News Africa of 26 February 2009, News Environment of 26 February 2009	Dissemination

Wetland Link	Description	Activity
General	Open Day celebrating the theme Knowledge for Growth and Development, was held on 2 December 2008, Montana Park, Pretoria.	Dissemination
Reserve	Implementing Environmental Water Allocations (IEWA), 23-26 February 2009, Port Elizabeth	Dissemination
General	WISA Conference, 18-22 May 2008, Sun City:	Dissemination
Treatment	Public Health Association of South Africa, (PHASA)Conference, 2-4 June 2008, Cape Town	Dissemination
Treatment	Municipal Indaba, 11-12 September 2008, Gauteng.	Dissemination
Mfabeni mire	2008 Professor Humphrey Memorial Lecture & Postgraduate Colloquium, 16 September 2008 University of Pretoria: 'The impact of global warming on food security, human and environmental health and safety'	Dissemination
Treatment	3rd International Seminar on Mine Closure, Johannesburg, 13-17 October 200	Dissemination
Mfabeni mire	Climate Change Summit 2009, 3-6 March 2009, Midrand	Dissemination
General	WRC Knowledge Toolbox was developed and launched at WISA 2008: Access to WRC briefs online	Dissemination
General, Treatment, Ecosystem	Series of topic-based brochures was initiated, of which 3 have been completed: Drinking Water, Sanitation and Groundwater.	Dissemination
General	A new feature article entitled 'New from the WRC' has been included in The Water Wheel	Dissemination
General	1st phase of the new Electronic Water Knowledge Hub was started and the concept design has now been completed	Dissemination
	<u>TECHNICAL BRIEFS PRODUCED:</u>	
Ecosystem	— <i>Jatropha curcas</i> : Measuring the impact of large-scale planting on water resources	Dissemination
Treatment, Reserve	— Water quality use allocation	Dissemination
Rehabilitation	— Rehabilitating degraded catchments	Dissemination
Treatment	— Selecting suitable small water treatment systems	Dissemination
General	— Negotiated environmental agreements	Dissemination
Ecosystem	— Quantifying groundwater's contribution to baseflow	Dissemination
Ecosystem, Reserve	— Setting resource directed measures for groundwater	Dissemination
Ecosystem	— The contribution of geothermal studies to research of the TMG aquifer	Dissemination
Ecosystem	— Groundwater licensing guide	Dissemination
Ecosystem	— Groundwater supplies for municipalities	Dissemination
Treatment	— National microbial monitoring programme for groundwater	Dissemination
Ecosystem	— Estimating recharge of the Table Mountain Group aquifer system	Dissemination
Treatment	— Constructed wetlands for treatment of winery effluent	Dissemination
General	— Communities and integrated water resource management	Dissemination
General	— Developing hydraulic modelling tools for ecological studies	Dissemination
Treatment	— Biosensors for eco-toxicity testing of water sources	Dissemination
Treatment, Water quality	— Eutrophication	Dissemination
General	— A cost-benefit analysis manual	Dissemination
Treatment	— EDCs and drinking water – reducing the risk	Dissemination
Mfabeni mire	— Mfabeni Mire – a wetland case study (April 2008)	Dissemination
General	– WRC emerges as winner at WISA (May 2008)	Dissemination
General	Thumbs-up for Water SA and open-source publishing (web only) (June 2008)	Dissemination
General	— WRC leads EU-SA Summit water side event (web only) (July 2009)	Dissemination
General	— WRC represents SA at Zaragoza (web only) (August 2008)	Dissemination
Assessment, Rehabilitation, Value	— Specialists unite to save Olifants River system after massive croc kill (November 2008)	Dissemination
Treatment	— Symposium offering special training on best practice guidelines for water resource protection in mining industry (December 2008)	Dissemination
General	KSA director, in her capacity as WISA President, was interviewed several times on radio, and participated in a televised debate on SABC 1 (Asikhulume) on 8 March 2009	Dissemination
General	Handled all the media-related activities on behalf of the sector at the WISA 2008 Conference in May 2008	Dissemination

Wetland Link	Description	Activity
Mfabeni mire	SABC TV recorded interviews with WRC-funded researchers at the Mfabeni wetland in St. Lucia, KZN. The story was aired in the 7pm TV News Bulletin on SABC 3 and in Morning Live on SABC 2	Dissemination
General	WRC-funded research projects featured in the organisation's public water research and development magazine, The Water Wheel, have been well-received	Dissemination
Assessment, Rehabilitation, Value	Good press was received following the launch of CROC (Consortium for the Restoration of the Olifants Catchment), of which the WRC forms part. Articles were published in, amongst others, Beeld, Business Day, The Star, Cape Times, and The Herald, while radio stations such as RSG and 702 Talk Radio also covered the news.	Dissemination
General	A director had an interview on Metro FM on 8 December 2008 on topical water issues, including South Africa's water quality and quantity challenges	Dissemination
Reserve, health	Following IEWA conference, a research manager was interviewed by PhalaPhala Radio on environmental water and its link to food safety in November 2008.	Dissemination
Groundwater dependent ecosystem	Protocol for the Assessment of the Status of Sustainable Utilisation and Management of Groundwater Resources with Special Reference to Southern Africa (WRC Report No. TT 318/08) is now being used as a base for several SADC, African and AMCOW initiatives.	Strategic Initiative - Africa
Mfabeni Mire	UNEP Africa Water Assessment of vulnerability due to climate change	Strategic Initiative - Africa
General	NEPAD: 'Establishing a Network of Centres of Excellence in Africa'	Strategic Initiative - Africa
Health, Reserve	Project No. K5/1589 has successfully demonstrated a relationship between the ecological Reserve (environmental flows) and water-associated vectors or diseases such as malaria, liver fluke, and bilharzia.	Strategic initiative
Capacity	Demonstrated school lesson plans in Abu Dhabi -to be integrated into school system there	Strategic Initiative
Groundwater dependent ecosystem	FETWater groundwater training manual sent to Pakistan for evaluation of use at request of UNESCO & United Nations University	Strategic Initiative
MSC Wetland Management	Positive external review of FETWater	Strategic Initiative
Water treatment	Mine-water related research	Strategic Initiative
Water treatment, Rehabilitation, Assessment & Valuation	Consortium for the Remediation of the Olifants Catchment (CROC) steering committee	Strategic Initiative
Service provider	External evaluation of Centre for the Environment, Agriculture and Development (CEAD), University of KwaZulu-Natal	Strategic Initiative
Rehabilitation	Launch of the Wetlands Rehabilitation publications at the Wetlands Indaba	Strategic Initiative
Water treatment	Technical Assistance Centre (TAC) - water services	Strategic Initiative
Water treatment	Treatment of mine-water	Strategic Initiative
Water treatment	Amathole District Municipality (DM) debate on wastewater treatment	Strategic Initiative
Capacity	Providing water-related materials to school learners	Strategic Initiative
General	DWA National Water R&D Strategy	Strategic Initiative
General	WRC stakeholder map - level of interaction, relationship, the stakeholders' needs and expectations, planned communication and relationship plan	Strategic Initiative
General	Memorandum of Understanding (MoU) with the Water Institute of Southern Africa (WISA)	Strategic Initiative
General	Water Research Fund of Southern Africa (WARFSA)	Strategic Initiative - Africa
General	NEPAD Network of Centres of Excellence for Water Research in Africa. Flagship programme of the African Ministerial Council of Science and Technology (AMCOST) in association with the African Ministerial Council of Water (AMCOW)	Strategic Initiative - Africa
General	Memorandum of Understanding with Kenya Water Institute (KEWI).	Strategic Initiative - Africa

<b>Wetland Link</b>	<b>Description</b>	<b>Activity</b>
General	Technologies listed on one international IP-marketing website, The Place to go for IP. WRC IP booklet; WRC IP Technology Transfer Office website ( <a href="http://www.wrcip.org/index.php">http://www.wrcip.org/index.php</a> )	Strategic Initiative - Innovation
Mfabeni Mire	5th World Water Forum: Development of a toolbox for climate change adaptation action at local/community level	Strategic initiative - International
Groundwater dependent ecosystem	South Africa – Germany cooperation on water in the environment with specific emphasis on mining impacts on groundwater	Strategic initiative - International
Capacity	UNESCO Capacity Building Africa Regional Workshop	Strategic initiative - International
Reserve	Implementing Environmental Water Allocations (IEWA) Conference - 400 delegates, 30 countries	Strategic initiative - International
Publication	Reviewer of scientific papers for 5 Elsevier Journals (Journal of Hazardous Waste, Chemosphere Journal, Environmental Pollution Journal, Archives of Environmental Contamination and Toxicology, Science of the Total Environment Journal)	Strategic initiative - International
Mfabeni Mire	8th Intecol Conference, Cuiaba, Brazil, 20-25 July 2008: 'The status of wetlands and the predicted effect of global climate change: the situation in Africa'	Strategic initiative - International
Groundwater dependent ecosystem	5th World Water Forum, Istanbul, Turkey, 19 March 2009: "Grasslands as natural water infrastructure in South Africa"	Strategic initiative - International
Convention	RAMSAR's Science and Technical Review Panel (STRP) for 2009-2012	Strategic initiative - International
Treatment	International Network for Acid Prevention - Global Alliance	Strategic initiative - International
Treatment	Workshop to develop Global Acid Rock Drainage (GARD) Guide	Strategic initiative - International
Treatment	8th International Conference on Acid Rock Drainage (ICARD)	Strategic initiative - International
General	Global Water Research Coalition (GWRC)	Strategic initiative - International
Treatment	GWRC Workshops, San Francisco, 1-18 and 21-22 May: Trace Organics & EDC Toolbox Kit	Strategic initiative - International
Treatment	GWRC joint activities in endocrine disruptor and algal toxin research	Strategic initiative - International
General	Water Institute of Southern Africa (WISA)	Strategic Initiative - National
Groundwater dependent ecosystem	Geological Society of South Africa (GSSA)	Strategic Initiative - National
		Strategic Initiative - National
Rehabilitation	Working for Wetlands	Strategic Initiative - National
Rehabilitation	Wetland Inventory - Working for Water	Strategic Initiative - National
Water treatment	National Community Water and Sanitation Institute, University of the North	Strategic Initiative - National
Partner	ARC	Strategic Initiative - National
Service provider	Institute of Water Research, Rhodes University	Strategic Initiative - National
MSc wetland management	Framework for Education and Training in Water (FETWater)	Strategic Initiative - National
General	South African Environmental Observation Network (SAEON)	Strategic Initiative - National
General	DWA 'Adopt-a-River' programme	Strategic Initiative - National
Water treatment	DWA Sanitation Technical Advisory Group	Strategic Initiative - National
Water treatment	Development of a Framework for Integrated Water Resource Management in the Mining Industry	Strategic Initiative - National
Water treatment	Development of Best Practice Guidelines for the Mining Industry	Strategic Initiative - National
Water treatment, Assessment, Rehabilitation	DME to develop an overarching strategy for mine closure	Strategic Initiative - National
Water treatment, Assessment, Rehabilitation	Implementing a Regional Closure Strategy	Strategic Initiative - National

<b>Wetland Link</b>	<b>Description</b>	<b>Activity</b>
Water treatment, Assessment, Rehabilitation	Acid mine drainage	Strategic Initiative - National
Water treatment, Assessment, Rehabilitation	WISA's Mine Water Technical Committee	Strategic Initiative - National
Water quality / treatment	National Toxicity Monitoring Programme (NTMP)	Strategic Initiative - National
General	National Benchmarking Initiative	Strategic Initiative - National
General	DEAT National Strategy for Sustainable Development	Strategic Initiative - National
		Strategic Initiative - National
General	IWA-SA/WISA: Young Water Professionals Forum	Strategic Initiative - National
General	DWA Water Sector Leadership Group	Strategic Initiative - National
General	Water Institute of Southern Africa (WISA)	Strategic Initiative - National
General	WISA Biennial Conference held at Sun City in May 2008	Strategic Initiative - National
Groundwater dependent ecosystem	WRC's role in building capacity in the groundwater sector	Strategic Initiative - National
Ecosystems	Rivers and Wetlands of Cape Town: Caring for Our Rich Aquatic Heritage	Strategic Initiative - National
Water quality / treatment	South Africa's water quality and emerging issues	Strategic Initiative - National
Groundwater dependent ecosystem, Mfabeni Mire	Impact of climate change on groundwater	Strategic Initiative - National
General / riparian wetlands	River Health Programme (RHP) (Project No. K8/782).	Strategic Initiative - National
Ecological reserve	Environmental Water Requirements (EWR) (Project No.K8/843)	Strategic Initiative - National
Ecological reserve	Watermark booklet: Overview of Ecological Reserve	Strategic Initiative - National
Water quality / reserve	Diatom collection from the CSIR to SAIAB (South African Institute for Aquatic Biodiversity), with the collection to be housed at the North-West University	Strategic Initiative - National
General	Water Information Network (WIN-SA) - builds local government capacity	Strategic Initiative - National
General	Inter-Academy Programme (IAP) for Water. Workshop - Regional Collaboration in Hydrology and Hydropower (Pretoria, June 2008)	Strategic Initiative - National
Mfabeni mire	National Climate Change Committee	Strategic Initiative - National
Mfabeni mire	DST Global Change programme	Strategic Initiative - National
Mfabeni mire	DWA Climate Change Think Tank	Strategic Initiative - National
Mfabeni mire	High level dialogue on climate change at 5th World Water Forum	Strategic Initiative - National
Mfabeni mire	Climate Change Summit held on 3-6 March 2008 in Johannesburg	Strategic Initiative - National
Mfabeni mire	Presented at 7th edition of Water for Growth and Development Summit on 26-27 March 2009	Strategic Initiative - National
Water quality / treatment	DWA National Eutrophication Monitoring Programme	Strategic Initiative - National
Groundwater dependent ecosystem	DWA 'National Groundwater Strategy' development	Strategic Initiative - National



**Appendix 13: Supporting evidence used to calculate environmental impact**

Project	Start	Y/N	Research	Y/N	Mitigation	Y/N	Protection	Y/N	Restoration	Y/N	Sustainability	Y/N	New data	Y/N	Water/Material Supply	Y/N	Waste management	Y/N	Site-Protected
18	1979			0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
	1985			0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	1990			0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
90	1992			0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
232	1993	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
416	1993	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
501	1994	Not reported		1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
582	1994	Not reported		1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
598	1994	Not reported		1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
1054	1999	Not reported		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
1061	1999	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1064	1999	Not reported		0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
1162	2000	Not reported		1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
1197	2000	Not reported		1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
1238	2001	Not reported		0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
1258	2001	Not reported		1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
1293	2001	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
1311	2002	Not reported		1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
1327	2002	Not reported		0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
1343	2002	1		1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2002	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
564	2003	Not reported		0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0
1408	2003	Not reported		1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	1
1410	2003	Not reported		0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
590	2004	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Project	Start	Y/N	Research Mitigation	Y/N	Mitigation	Y/N	Protection	Y/N	Restoration	Y/N	Sustainability	Y/N	New data	Y/N	Water/Material Supply	Y/N	Waste management	Y/N	Site-Protected
1491	2004	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
1505	2004	Not reported		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1544	2004	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
614	2005	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
617	2005	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
642	2005	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
652	2005	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
1584	2005	Not reported		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
699	2006			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
700	2006	Not reported		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
710	2006	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
718	2006	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1691	2006	Not reported		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
734	2007			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
781	2007			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
789	2007			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
790	2007			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1704	2007			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1709	2007			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1725	2007			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1857	2007			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
792	2008	Not reported		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
826	2008			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
847	2008			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1788	2008			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1789	2008			1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
1794	2008			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1801	2008			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1803	2008			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1863	2008			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
905	2009			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Project	Start	Y/N	Research Mitigation	Y/N	Mitigation	Y/N	Protection	Y/N	Restoration	Y/N	Sustainability	Y/N	New data	Y/N	Water/Material Supply	Y/N	Waste management	Y/N	Site-Protected
	914	2009			0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1921	2009			1	1	1	0	0	0	0	0	0	0	0	0	0	0	
	1923	2009			0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1926	2009			0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1946	2009			0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1980	2010			0	0	1	0	0	0	0	0	0	0	0	0	0	0	
	1986	2010			0	0	0	0	1	0	1	0	0	0	0	0	0	0	
		2010			1	0	0	0	0	0	0	0	0	0	0	0	0	0	
	<b>Total</b>				<b>1</b>	<b>15</b>	<b>30</b>	<b>6</b>	<b>10</b>	<b>28</b>	<b>2</b>	<b>9</b>	<b>11</b>						
	<b>Percent</b>				<b>3</b>	<b>23</b>	<b>47</b>	<b>9</b>	<b>16</b>	<b>44</b>	<b>3</b>	<b>14</b>	<b>52</b>						
	<b>Count (n)</b>				33	64	64	64	64	64	64	64	64	64	64	64	64	64	21

### *Appendix 14: Supporting evidence used to assess research management effectiveness*

Project	Start	Y/N	Applied	Y/N	Fundamental	Y/N	Combined	Y/N	Local need	Y/N	Participatory	Y/N	Action research	Y/N	Peers- Conference / Workshop	Y/N	Peers- Paper / Thesis	Y/N	Match	Y/N	Objectives	Y/N	Adaptation	Y/N	Published by end date		
18	1979																										
	1985																										
	1990																										
90	1992																										
232	1993	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
416	1993	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
501	1994	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
582	1994	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
598	1994	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1054	1999	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1061	1999	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1064	1999	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1162	2000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	
1197	2000																									1	
1238	2001																									0	
1258	2001	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1293	2001	1																								0	
1311	2002	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1327	2002	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1343	2002	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2002																										
564	2003	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1408	2003	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1410	2003	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
590	2004	1																								1	
1491	2004	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1505	2004	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1544	2004	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
614	2005	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
617	2005	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
642	2005	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
652	2005	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Project	Start	Y/N	Applied	Y/N	Fundamental	Y/N	Combined	Y/N	Local need	Y/N	Participatory	Y/N	Action research	Y/N	Peers- Conference / Workshop	Y/N	Peers- Paper / Thesis	Y/N	Match	Y/N	Objectives	Y/N	Adaptation	Y/N	Published by end date
1584	2005		1		1		1		1		1		0		1		1		1		1		1		1
699	2006		1		0		0												1		1		0		
700	2006		1		0		0				1		0		0		0		1		1		0		0
710	2006		1		0		0				1		1		0		0		1		1		0		1
718	2006		1		1		1		1		1		0		0		0		1		1		0		0
1691	2006		1		0		0		1		1				1				1		1		0		0
734	2007																								
781	2007																								
789	2007																								
790	2007																								
1704	2007																								
1709	2007																								
1725	2007																								
1857	2007																								
792	2008		1		0		0												1		1		0		1
826	2008																								
847	2008																								
1788	2008																								
1789	2008																								
1794	2008																								
1801	2008																								
1803	2008																								
1863	2008																								
905	2009																								
914	2009																								
1921	2009																								
1923	2009																								
1926	2009																								
1946	2009																								
1980	2010																								
1986	2010																								
	2010																								

	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/A
Project	Start	Applied	Fundamental	Combined	Local need	Participatory	Action research	Peers- Conference / Workshop	Peers- Paper / Thesis	Match	Objectives	Adaptation	Published by end date			
Total		30	16	11	18	24	6	15	8	32	32	5	7			
Count (n)		31	32	29	18	28	26	30	29	32	32	32	29			
%		97	50	38	100	86	23	50	28	100	100	16	24			

## **Appendix 15: Wetland research related conferences, workshops, theses & papers (not listed in Appendix 2)**

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<p>Van Vuren J, Bomman M and Wepener V, 2007. Bio-indicators in the assessment of the effects of chemicals on aquatic species in an Urban Nature Reserve, South Africa. Platform presentation SETAC Europe 17* Annual meeting. 20-24 May 2007, Porto. Portugal.</p>
<p>van Wyk A. Thesis. Testicular histology. University of Pretoria.</p>
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<p>Vlok W, 2002. Biomonitoring of wetlands - Nyl Floodplain as a case study. Paper presented at S. Afr. Soc. of Aq. Sci. 37th Ann. Conf., Bloemfontein. 30 June - 8 July.</p>
<p>Watson M, 2002. The use of magnetic susceptibility measurements to delineate wetlands in KwaZulu-Natal. South Africa. Unpublished MEnvDev dissertation. Centre from Environment and Development, University of Natal, Pietermaritzburg.</p>
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## Appendix 16: Supporting evidence used to assess research uptake

### RATING SYSTEM (0-1)

- 1 Is there a need for the research project ...knowledge gap (0.5)...relevance - including local where appropriate (0.5)
- 2 Are the targets for research products identified in proposal...broadly (0.5)...specific end-client (0.5)
- 3 Are the products meaningful for targets...broadly (0.5) ... specifically (0.5)
- 4 Are targets engaged in the research process (steering, consultation, interviews, training - 0.5) --- through action research or an approach facilitating high level of buy-in (0.5)
- 5 Are local culture (0.5) and environmental sensitivity (0.5) considerations acknowledged in carrying out research
- 6 Is peer review employed to ensure results are reliable (steering, external comment/testing/thesis review - 0.5) ...including through publication process of scientific paper (0.5)
- 7 Are research products transferred / disseminated to targets via accessible (reports, website, thesis) (0.5)...books, papers, conferences, briefs (popular, technical, policy) (0.5)
- 8 Is target capacity built (participation, general awareness & training, transfer end results) (0.5) .... including training / mentoring to implement results (0.5)
- 9 Is research capacity built to produce quality research products (key researchers - 0.5)...students, emerging researchers (0.5)
- 10 Is research management effective (objectives met, adaptation) (0.5)...published by end date (0.5) [Individual project related aspects & aspects not covered above]

	Need	Target	Products	Participation	Sensitivity	Peer Review	Dissemination	Stakeholder capacity	Research Capacity	Management
18	1979	Report not available								
	1985	Report not available								
	1990	Report not available								
90	1992	Report not available								
232	1993	1	0.5	0.5	0	0	0.5	0	0.5	
416	1993	1	0.5	0.5	0	0.5	0.5	0.5	0.5	
501	1994	1	0.5	0.5	0	0.5	0.5	0.5	0.5	0.5
582	1994	1	0.5	0.5	0	0	0.5	0.5	0.5	0.5
598	1994	1	0.5	0.5	1	0	0.5	0.5	0.5	0
1054	1999	1	1	0.5	0	0.5	0.5	0.5	1	0
1061	1999	1	0.5	0.5	0	0.5	0.5	0.5	0.5	0.5
1064	1999	1	0.5	0.5	0	0.5	0.5	0.5	1	0.5

1162	2000	1	0.5	0.5	0.5	0.5	0.5	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1197	2000	1	0.5	0.5	0.5	0.5	0.5	0	0.5	0.5	0.5	0.5	1	0.5	0.5
1238	2001	1	0.5	0.5	0.5	0.5	0.5	0	0.5	0.5	0.5	0.5	1	0.5	0.5
1258	2001	1	0.5	0.5	0.5	0.5	0.5	0	0.5	0.5	1	0.5	1	0.5	0.5
1293	2001	1	1	1	1	1	0	0					1	1	1
1311	2002	1	1	1	1	1	0	0	1	0.5	0.5	1	0.5	0.5	0.5
1327	2002	1	0.5	0.5	0.5	0.5	0	0	0.5	0.5	0.5	0.5	1	0.5	0.5
1343	2002	1	0.5	0.5	0.5	0.5	1	0.5	1	1	1	1	1	0.5	0.5
	2002	1	1	1	1	1	0	0	1	1	1	1	1		
564	2003	1	1	1	1	0.5	0	0	0.5	1	0.5	1	1	0.5	0.5
1408	2003	1	1	1	1	1	0.5	0	1	1	1	1	1	0.5	0.5
1410	2003	1	1	0.5	0.5	0.5	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5
590	2004	1	1	1	1	1	0	0	1	1	1	1	1	1	1
1491	2004	1	0.5	0.5	0.5	1	0	0	0.5	0.5	0.5	1	1	0.5	0.5
1505	2004	1	0.5	0.5	0.5	0.5	0	0	1	1	1	0.5	1	0.5	0.5
1544	2004	1	0.5	0.5	0.5	0.5	0	0	0.5	0.5	1	0.5	1	0.5	0.5
614	2005	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5
617	2005	1	1	1	1	1	0	0	1	1	1				
642	2005	1	1	1	1	1	0	0	1	1	1	0.5	0	1	1
652	2005	1	1	1	1	1	0	0	0.5	0.5	0.5	0.5	1	1	1
1584	2005	1	0.5	0.5	0.5	0.5	0	0	0.5	1	1	1	1	1	1
699	2006	1	1	1	1	1	0	0							
700	2006	1	1	1	1	0.5	0	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5

710	2006	1	1	1	1	1	0	1	0.5	0.5	0.5	1
718	2006	1	1	1	1	0.5	0	0.5	1	0.5	0.5	0.5
1691	2006	1	0.5	0.5	0.5	0	0	1	1	0.5	1	0.5
734	2007	Current										
789	2007	Current										
1704	2007	Current										
1709	2007	Current										
1725	2007	Current										
1857	2007	Current										
792	2008	1	1	1	1	0			1			1
826	2008	Current										
847	2008	Current										
1788	2008	Current										
1789	2008	Current										
1794	2008	Current										
1801	2008	Current										
1803	2008	Current										
1863	2008	Current										
905	2009	Current										
914	2009	Current										
1921	2009	Current										
1923	2009	Current										
1926	2009	Current										
1946	2009	Current										
1980	2010	Current										
1986	2010	Current										

	2010	Current																
<b>Average</b>		<b>1</b>	<b>0.72</b>		<b>0.72</b>	<b>0.66</b>	<b>0.04</b>	<b>0.63</b>	<b>0.71</b>	<b>0.63</b>	<b>0.81</b>	<b>0.59</b>						
<b>Count</b>		<b>34</b>	<b>34</b>	<b>34</b>	<b>31</b>	<b>34</b>	<b>34</b>	<b>32</b>	<b>33</b>	<b>31</b>	<b>32</b>	<b>29</b>						
<b>Std Dev.</b>		<b>0</b>	<b>0.25</b>	<b>0.25</b>	<b>0.24</b>	<b>0.14</b>	<b>0.28</b>	<b>0.25</b>	<b>0.26</b>	<b>0.30</b>	<b>0.23</b>							

