

FINAL EVALUATION OF THE ASSESSMENT OF THE POLLUTION STATUS AND VULNERABILITY OF THE WATER SUPPLY AQUIFERS OF AFRICAN CITIES



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Project CP/1000-02-03

November 2005

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Executive Summary

Introduction

This project, *Assessment of the Pollution Status and Vulnerability of Water Supply Aquifers of African Cities*, is a follow up to the project, *The Urban Pollution of Surficial and Groundwater Aquifers in Africa*. The focus of the two projects has been on pollution threats to groundwater arising from unplanned expansions, effluent leakages in open sewers, leaking septic tanks, latrines, domestic waste disposal, and uncontrolled industrial and commercial activities. The objective is to extend the projects' scope and coverage to other African countries in order to establish a pilot network of early warning contamination and trend detection for urban and peri-urban water supply aquifers. This has been achieved through four main clusters of activities.

Evaluation results

This report presents the results from the final evaluation of the project. The objective of the evaluation was to review and evaluate the implementation of planned project activities and outputs against actual results, establish project impacts as described in the project outline, and evaluate the project's execution performance and potential for sustainability.

The evaluation exercise produced the following key findings:

- From the evidence gathered, the assessment and technical capacity-building efforts, stakeholder involvement and collaboration have all been relevant, timely and highly effective. In this respect, the project must be judged an overwhelming success.
- The technical information reviewed in the final reports, the project presentations, and submissions to a forthcoming book on groundwater pollution in Africa, point to outputs of a satisfactory scientific quality and standard, which should serve as valuable reference points for both national and regional urban groundwater assessment activities.
- A solid network has been established for the exchange of groundwater-related information and a database set up for the active exchange of data and interaction between the countries involved.
- Practical methodologies have been developed for assessing and monitoring the current and potential contamination of groundwater aquifers. While the rationale was similar in each site, the project identified the need for, and inspired the development of, site-specific approaches and methods based upon the characteristics and requirements of each city.
- Based on evidence in the reports, feedback from the country coordinators and project consultant, and the field visits, it is clear that awareness of groundwater quality issues was enhanced at all levels, together with the institutional capacity of each country and the continent as a whole.
- In each country, the project teams have made meaningful contributions to influencing policy at local, national and regional levels. Due to time and budgetary constraints, these impacts have been more significant at the city level, although many countries show evidence that national or regional stakeholders have taken cognisance of their study results. With some additional time and effort, the evaluators are confident that the findings obtained will form the basis for formulating or improving groundwater-use policies and protection measures.
- In each of the project countries, the aquifer vulnerability has been mapped for an urban area reliant on groundwater, regular sampling of the water quality has been undertaken, the results have been processed and interpreted, and the implications have been communicated to decision-makers and the general public.
- The project has significantly impacted on the technical proficiency in each country and on the continent as a whole, and has provided a strong platform on which to link these results to other freshwater protection initiatives in Africa.

Lessons learned

1. **People only become concerned with groundwater quality when they have a large enough supply.** As important as groundwater quality issues are, both the general public and politicians who are in a position to promulgate laws are generally not concerned with quality issues until there is enough water readily available to them. In Lusaka, for example, community leaders showed that, while they have taken cognisance of groundwater quality protection issues, they are more concerned with the amount of water being supplied to them.
2. **Public education on groundwater protection should not be a one-off action but a continuous process.** The trickle-down strategy of public awareness does work but needs reinforcement at regular intervals otherwise behaviour will not change. While the project relied to some extent on a trickle-down approach, the fruits of this have only been felt in the countries where the project has been operating for longer (e.g. Ghana), due to the extended repetition of its messages.
3. **Scientific bulletins are an excellent tool for conveying technical information but not an effective public communication device.** Bulletins are good communication tools for other scientists but not for the general public, water managers or politicians. This was evident from the self-evaluation exercises and the country visits, with technical personnel such as those in the Lusaka Water Supply in Zambia and the Addis Ababa Environmental Protection Agency in Ethiopia rating the bulletins as highly effective, while the same could not be said for community leaders and elected representatives in these countries.
4. **Projects must take specific socio-economic conditions into account from the outset so that their aims can be appropriately defined.** A project on groundwater quality needs to recognise that many of its outputs will be obscure to members of the public or political decision-makers, and that expected outputs should clearly define those indicators for which success can obviously be measured. As an example, the current situation in Niger would make supply of water and basic foodstuffs to the wider population a far higher priority than groundwater quality protection. For this reason, the importance of groundwater protection should be emphasised to receiving communities from the earliest start-up phases of water supply projects, quoting tangible results from this and other similar projects.
5. **Groundwater protection projects should learn from and build upon the successes of previous similar projects.** A great deal of the success of this project lies in the fact that the project managers and many of the countries had been involved in the previous project on the *Urban Pollution of Surficial and Groundwater Aquifers in Africa*. This is evident from the timely development of national groundwater strategies in these countries, where the momentum has been sustained and there have been consistent awareness-raising activities.
6. **Tangible outputs should be devised for researchers to aim for.** The book currently being published has reinvigorated the research teams and provided them with a specific timeframe for producing outputs of a scientifically acceptable standard. Smaller projects such as conferences or symposia of international standing can serve a similar purpose.
7. **Local structures and community buy-in are critical for public sensitisation and acceptability.** Several countries, including Ghana, Zambia and Senegal, listed examples of attitudes being significantly changed once community members were made an integral part of their projects. It is recommended that all such projects encourage local buy-in from the outset in order to promote their popular acceptance and progress.

Project assessment

Clear criteria were set for the evaluation of the project by the UNEP Evaluation and Oversight Unit (UNEP/EOU) and rated on a scale of 1 to 6, with 1 being the highest rating and 6 the lowest. The following table outlines the ratings given to various aspects of the project's implementation:

Table 1: Overall Rating Table

Attainment of objectives and planned results	2
Achievement of outputs and activities	1
Cost-effectiveness	1
Impact	3
Sustainability	3
Stakeholders' participation	2
Implementation approach	2
Country ownership	3
Financial planning	2
Replicability	2
Monitoring and evaluation	3
OVERALL RATING	2

Recommendations

A. Priority actions

Project results should be repackaged to achieve maximum impact

- A significant amount of relevant, high-quality technical data has been generated by this project. To date, these data have been passed on to stakeholders mainly through local groundwater quality bulletins. Indications are that, while these bulletins have been highly effective in communicating to technical personnel, the format is less appropriate for informing the general public and political decision-makers. The findings and implications in each city should thus be packaged or disseminated differently to spread the significance of the scientific findings to the public and to local regulators. If possible, UNEP should facilitate this process as a matter of priority.

Suggestions:

- For the general public, readable and attractively packaged 'Citizens' Guides' on groundwater quality and protection issues may have a greater impact.
- For regulators, such guides could be used together with the bulletins and some concrete suggestions for policy changes or physical protection measures.
- For both regulators and the public, information generated by the project could be further disseminated through public forums or meetings, which public participation specialists could be employed to facilitate.
- A fixed template could be developed to provide a standard harmonised structure for the country reports. As well as promoting easy comparisons and information sharing, this would also simplify the presentation and comprehension of key issues in their dissemination over the Internet.

B. Medium-term actions

1. Assistance should be given to individual countries to strengthen their groundwater policies

- In order to sustain the gains of the project, it is recommended that a follow-up project be prepared to assist individual countries to influence policymakers and move from policy to implementation. It is suggested that national-level steering committees should be established or strengthened as part of this process, and that many of the stakeholders who have been involved in this project or have worked on similar projects with UNEP, UN-Habitat or UNESCO could serve on these committees with national decision-makers.
- At UNEP level, the Division of Environmental Policy Implementation (DEPI) should follow up on the assessment outcomes and should take a leading role in developing a proposal to assist participating governments to develop more comprehensive groundwater policies and strategies. This process should also involve close consultation with other potential donors, water supply authorities, and large-scale water users in each country.

2. Groundwater protection strategies should be linked to sanitation initiatives

- The project's findings have strongly identified poor sanitation and informal sewerage disposal as major contributors to groundwater quality degradation. As the project shows, groundwater quality is only prioritised when supply is sufficient and when alternatives are available. The results of this project should be used in conjunction with new sanitation and water supply initiatives in urban centres in Africa, for which collaboration with UN-Habitat would seem appropriate.

3. The project should be expanded

- The findings of this evaluation suggest that the project has been successful in terms of implementation and the production of important results. Based on these outcomes, the project should be expanded if at all possible.

Suggestions:

- i. As groundwater pollution and vulnerability issues are affecting all developing countries with increasing urbanisation, aspects of this project could be replicated in other African countries and developing nations where they are relevant and applicable.
- ii. In almost all of the countries investigated, other major urban areas exist where the same approaches can be followed. Since a core group of expertise has been established by this project, replicating the efforts in an additional area should be achievable at a much reduced cost. This would expand the capacity and project ownership in each country, as well as providing vital data to influence policies and test groundwater protection strategies.
- iii. If the project is expanded, experience suggests that some 'lag period' should be built in initially for new countries to launch activities before the new project aims are expanded to existing areas. This would allow for a more equitable evaluation and allow the project to progress at a rapid pace after the initial period.

4. Efforts to train young African water scientists to build on the project's successes should be intensified

- This project has generated core centres of expertise in each country, and the training provided by the project has been key to this achievement. Due to the nature of the project, it is understandable that most participants in the training courses were university professors or senior personnel, but future projects should emphasise, in the memoranda of agreement if necessary, that young local scientists should also be exposed to expert training. This type of training should continue and be expanded with a particular focus on young scientists.

Suggestions:

- i. In future projects, at least one training session could be dedicated to the training of young local scientists. The benefits in terms of establishing long-term networks and increasing the expertise base will ensure sustainability.
- ii. Future projects should include a training seminar in the region or country for personnel outside the project teams. This would further build local capacity and make local regulators and stakeholders aware of the expertise available in each country.

5. Greater efforts should be made to streamline funding administration

- The limitations of the funding have been alluded to and, while this cannot easily be rectified, indications are that there are some difficulties with the transfer of funds to individual countries. This aspect was discussed with the participants and the project managers, and it appears that the route followed was the lesser of two difficulties. The delays in this process, however, appear to have resulted in delays in the progress of project activities in several countries. This aspect should be carefully considered at the inception of future multinational projects.

6. A financial exit strategy should be incorporated into a future project

- Further funding opportunities seem to exist with both bilateral and multilateral agencies in all of the project countries. It is suggested that better resource mobilisation could be made one of the results of a future project. This should include the provision of a budget line for local resource mobilisation, in order to promote the long-term sustainability of project results.2.

1. Introduction

Groundwater use is widespread in many major cities in Africa. Rapid urbanisation in most of these cities has led to unprecedented population growth, resulting in the development of large areas of unplanned and sub-standard housing. The lack of services in such informal settlements poses serious threats to groundwater through sewerage and effluent leakages, the dumping of domestic waste, and uncontrolled industrial and commercial activities. As many of these settlements rely on groundwater as their main source of potable water, such pollution poses major health risks to a large proportion of their population.

The current project, *Assessment of the Pollution Status and Vulnerability of Water Supply Aquifers of African Cities*, is a follow up to the *Urban Pollution of Surficial and Groundwater Aquifers* project, which established a programme of inter-nation research into the little understood and poorly documented field of urban groundwater pollution in Africa.

1.1 Scope and objectives of evaluation

The objective of this terminal evaluation was to review and evaluate the implementation of planned project activities and outputs against actual results, establish the project's primary impacts, and evaluate its performance and potential sustainability. The evaluation was based on two questions:

- i. Whether the assessment and technical capacity-building efforts, including stakeholder involvement and collaboration, have been relevant, timely and effective;
- ii. Whether the technical information produced is of a scientific quality and standard that can serve as a reliable reference model, and contribute to national and regional urban groundwater assessment activities.

The evaluation assessed, among other things:

- I. Delivered outputs: The project's success in producing each of the programmed outputs, in terms of their quantity, quality, usefulness and timeliness (Sections 2.3, 3.1 and 3.5);
- II. Project outcomes and impact: The project's success in achieving its outcomes (Sections 3.3, 3.4, 5.1, 5.2, 5.3, 5.9 and 5.10);
- III. Project sustainability (Sections 3.6, 3.7, 5.7 and 5.10);
- IV. Execution performance: Effectiveness and efficiency of project management and supervision of project activities (Sections 2.2, 3.10, 3.11, 3.11.2, 5.4, 5.9 and 5.10).

1.2 Methodology of evaluation

The methodology followed was based as closely as possible on the guidelines provided by the terms of reference. The findings of the evaluation were based upon:

- Interviews with UNEP/DEWA and UNESCO Nairobi project staff;
- Field visits to Lusaka, Zambia, and Addis Ababa, Ethiopia, to interview staff from participating institutions, government officials and decision-makers, NGOs and members of the public;
- Interviews with representatives of the 11 national lead institutions involved in the project;
- Interviews with specialists involved in the implementation of specific project activities;
- Interviews with several groundwater scientists and other stakeholders;
- A desk review of the project document, financial and monitoring reports (including quarterly and biannual reports to UNEP, and mid-term review), technical reports, scientific bulletins, the project website, and all related documents;
- Self-evaluations of technical and project management staff, using the 'evaluation wheel' approach outlined in the IFAD M&E Guide (see Appendix D), and questionnaires provided to country representatives for feedback on specific issues.

1.2.1 Potential limitations of evaluation

Although every effort has been made to be as objective as possible in this evaluation, some minor limitations should be noted. It is not felt, however, that these limitations have had a significant influence on the evaluation. The limitations include:

- The lead evaluator was involved at mid-term with training and gave input to the project technical advisor for the mid-term review. As such, the expectations created by the mid-term meeting and the progress since may not be as objectively viewed as a completely fresh evaluator;
- The lead evaluator has been involved in reviewing several of the technical papers produced for the African groundwater pollution book, which is due to be published at the end of 2005;
- Only two countries were visited, both of which were so-called 'new countries', which may not have presented a full perspective of follow-up progress;
- The final evaluation was undertaken six months prior to the project's completion, when some activities, such as the completion of the South African case study, had yet to be carried out.



Figure 1: A pit latrine and a well being constructed in close proximity at a new housing development in Lusaka, Zambia.



Figure 2: Informal waste disposal and sanitation facilities surround a karstic aquifer, in the foreground, in Lusaka.



Figure 3: Waste discarded directly into a stream beside an aquifer in Addis Ababa, Ethiopia.



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Figure 4: One of the water supply wells in the Addis Ababa well-field, with a factory partially hidden by the vegetation in the background.

2 Project Overview

2.1 Project identifiers

Title of sub-programme: Environmental Assessment and Early Warning
Title of sub-programme element: Environmental Assessment and Reporting

2.2 Background information

Project/programme title: The Assessment of the Pollution Status and Vulnerability of the Water Supply Aquifers of African Cities (CP/1000-02-03)
Division/Unit: DEWA/Water Unit
Duration: December 2002 - June 2005

Project objectives

The overall objective of the *Assessment of the Pollution Status and Vulnerability of the Water Supply Aquifers of African Cities* is set out in the project document as "to extend the scope and coverage to other African countries in order to establish a pilot network of early warning contamination and trend detection for urban and peri-urban water supply aquifers."

The specific objectives of the project were listed as:

- Development of methodologies for cost-effective and practical monitoring of the water quality and status of aquifer exploitation;
- Assessment and mapping of groundwater vulnerability, identification of pollution 'hotspots' and major threats;
- Demonstration and dissemination of lessons learned from project implementation;
- Development of stakeholder awareness to better safeguard the aquifers of African cities, including pollution and health problem mitigation;
- Capacity building in the design and implementation of monitoring networks, assessment of vulnerability and contaminant loads, and appropriate protection.

The responsibility for the implementation and management of the project has been with the Water Assessment Unit of UNEP's Division of Early Warning and Assessment (DEWA), in collaboration with the Division of International Hydrology Programme (IHP) of the UNESCO Regional Office in Nairobi. UNEP-DEWA has been responsible for facilitating the project, while UNESCO has been the implementing agency. An advisor based in Mauritius was recruited to provide technical support but had to withdraw early on in the project due to illness. Subsequently, the UNESCO Chair on Hydrogeology based at the University of the Western Cape, South Africa, executed these functions on a voluntary basis. With respect to the appointment of the project's 11 national coordinators, a balance was sought between candidates from governmental and scientific institutions.

This report presents the final evaluation conducted in Cape Town, South Africa, in July 2005, with visits to Lusaka, Zambia, and Addis Ababa, Ethiopia. The evaluation was based upon the following anticipated project results and costs, as outlined in the original project document:

- Preparation of factual material for information in the review of legislation relevant to groundwater resources protection, National Water Acts, and approaches to integrated policy development within participating countries;
- Suggested policy options to better safeguard aquifers in African urban areas, including the mitigation of pollution and public health problems;
- Identification of sources of pollution within groundwater protection areas or wellhead protection areas for attention by the appropriate agencies;
- Improved understanding of the physical and chemical composition and inter-relationship of surface water and groundwater, especially the interaction of physical, chemical and biological processes in the unsaturated zone as controlling agents in the fate of groundwater contaminants;
- Improved public awareness of the role of the subsurface in the functioning of a city and the general

- need for long-term environmental protection of this resource;
- Reliable information to enable governments and other decision-makers to make environmentally sound decisions regarding land use and the protection of urban groundwater quality, based upon aquifer vulnerability and city water infrastructure maps;
- Technical cooperation among participating countries to promote the establishment of a regional network to monitor groundwater pollution and to stimulate higher professional competencies;
- Enhanced development of public attitudes to contribute to the reduction of adverse human impacts on groundwater in urban areas.

Project Costs	(in US \$)	% Counterpart
Contribution by the Belgian Government (Cash)	400,000	80
Cost to DEWA (in kind)	15,000	3
Cost to UNESCO/IHP (in kind)	15,000	3
Cost to 10 Countries (in kind)	70,000	14
Total	500, 000	100

2.3 Project activities

A timetable and work plan for the project were presented in the project document, comprising four 'activity clusters' (see Table 2.1). The activities in each cluster, which were further refined during a launch workshop, were designed to run in parallel throughout the project period. The work plan was designed to achieve the objectives set out in the project document and in the introduction to this report.

Table 2.1: Project Activities

1.	Assessment of groundwater vulnerability a) Establishment of country taskforces and a regional meeting involving new participants and those from the previous project (Phase I); b) Selection of survey areas that will serve as references for future monitoring studies; c) Compilation of data for the assessment of major threats; d) Connection of participating countries through the network via the Internet.
2.	Identification of 'hotspots' and major threats to aquifers in African urban areas a) Establishment of a monitoring system in each country as well as a regional database; b) Compilation and interpretation of data on variations in physical and chemical properties of groundwater (sampling and analysis of samples from boreholes, wells and springs); c) Compilation of data on changes in water quality and contaminants (physical and chemical characteristics); d) Conducting of field surveys, monitoring of wells and boreholes, springs and hydraulically-connected water bodies; e) Design and preparation of maps, identification of 'hotspots' and major threats (scanning and digitisation of cartographic and geological maps to realise vulnerability maps using existing software or GIS); f) Sampling and assessing of groundwater quality in West African countries and new countries.
3.	Actions for safeguarding groundwater aquifers in urban areas a) Implementation of a training course on the estimation of groundwater recharge (substituted with training on management of waste disposal); b) Training on the use of GIS in groundwater pollution mapping; c) Promotion of concerted action to create public awareness.
4.	Hydrogeological conceptualisation of groundwater vulnerability in African urban areas a) Testing and adaptation of existing hydrogeological models; b) Development of a clear conceptual model of the groundwater setting in each city, both in terms of the aquifer system and its exploitation status; c) Training of technical staff selected in the participating countries in the use of suitable models; d) Printing of the final maps and the final report of the project.

6 The urban areas to be studied in each country were identified and agreed as follows: Benin - Cotonou; Côte

d'Ivoire - Abidjan; Niger - Niamey; Mali - Bamako; Senegal - Dakar; Burkina Faso - Ougadougou; Zambia - Lusaka, Ethiopia - Addis Ababa; Kenya - Mombasa; and South Africa - Cape Flats, Cape Town. A timetable for the project was outlined and was used as the basis for its evaluation.

Table 2.2: Project Work Plan

Project Work Plan (Proposed) Tasks	2003												2004											
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O					
1. Site Selection & Data Collection (Literature - Field Work)																								
Digitalization of topographic maps																								
Piezometry of areas identified																								
Meteorological data																								
2. Purchase and Scanning Materials																								
Air Photos/Satellite Images																								
3. Mapping of Key Pollution sources																								
4. Analyses, Synthesis and Presentation																								
Inclusion of Geological data, structures																								
First Vulnerability maps																								
Pollution status																								
5. First REPORTING to UNEP																								
Bulletin																								
6. Dissemination Workshop - to promote awareness & influence policy formulation																								
7. Draft Thematic Maps																								
More sampling and analysis																								
8. 2nd Report to UNEP																								
Bulletin																								
9. Continuation of Work																								
10. Final Report, Evaluation and Proposal for Up-scaling																								
11. 2nd Dissemination Workshop																								

The activities outlined above were largely completed within the projected schedule. At the mid-term, a decision was made to extend the project to June 2005 to allow the completion of all tasks and to incorporate South Africa into the project. This decision was also based on the fact that more money was available due to currency fluctuations, and thus the extension could be achieved within budget.

The national project coordinators from the participating countries presented the results of their work to date in May 2004, and for the final evaluation in Cape Town in July 2005.

On-site geochemical data have been collected as well as water samples for simple geochemical and microbiological groundwater analyses. These analytical data have been incorporated into the national project databases, vulnerability maps and reports to provide the foundations of an early warning system in each country. The quality and interpretation of these results, although not yet optimised, have progressed significantly during the project period.

The vulnerability maps of each city were produced using professional expertise obtained during the GIS

training. The DRASTIC methodology was well received and adopted by the national teams, several of which have adapted the methodology to take account of their own site-specific influences, such as saltwater intrusion or multiple aquifer systems.

Each country team has documented its progress through a variety of reports, including a one-page early warning bulletin, a summary report of the country's general hydrogeological situation, and a project report presenting a more detailed description of the project area, its monitoring results and vulnerability to date (progress and final reports).

3 Evaluation Findings

The country teams have all successfully completed the tasks outlined in the project document. There was a concerted scientific effort in each country and the technical aspects outlined have been achieved to a large degree for the project as a whole.

3.1 Completion of activities

The activities planned for the project as listed in the project document are presented in Table 3.1, together with brief comments on their levels of achievement. From the six-monthly progress reports issued by UNEP, it is clear that the originally planned outputs have not been altered but that the timeframe was extended marginally to ensure the successful completion of all activities.

Table 3.1a: Completion of Activities

ACTIVITIES	Complete in budget/ time	COMMENTS
Assessment of groundwater vulnerability	Yes	All countries presented methods to assess their groundwater vulnerability. These were based on standard methods, but in several cases, such as Abidjan and Addis Ababa, site-specific matters were included. The geological data and relative permeabilities were included for all countries and identification of sources was carried out to determine specific vulnerability.
(a) Establishment of country taskforces and a regional meeting involving new participants and those from the previous project	Yes	Done in all countries. In countries where this was a continuation, the taskforces were established early in the project, while all the new countries except Kenya had them established by mid-term. Kenya had made significant progress to complete the activities by July 2005.
(b) Selection of survey areas that will serve as references for future monitoring studies by the new participants	Yes	Achieved prior to mid-term in all countries, with Mombasa area refined based on mid-term recommendations.
(c) Compilation of data for the assessment of major threats	Yes	Data collected through the fieldwork was compiled into country databases and integrated into the project database. This data was also presented graphically in the reports and bulletins.
(d) Connection of countries through the network via the Internet	Yes	Achieved, with all countries having the capacity to communicate within the project. The created database represents a major achievement for this project, although based on interviews and the self-evaluation, intercommunication was not as regular as ideally hoped.

Identification of 'hotspots' and major threats to aquifers in African urban areas	Yes	For each area, this was done by analysing water quality and hydrochemical parameters. Geophysical investigations were employed to delineate formations bearing fresh and saline water in Ghana, distinguishing between different lithologies and establishing the freshwater-saline water interface in e.g. Benin, Ghana and Senegal. Hotspots were identified and major threats then evaluated through the collection, interpretation and analysis of integrated geological, geophysical, lithological and hydrochemical data. In countries such as Ethiopia and Mali, streams were included as potential influences on groundwater quality, as was seawater intrusion in countries such as Benin. Geological and human influences were factored into the analyses, and the results compared to the vulnerability maps.
(a) Establishment of a monitoring system in each country, as well as a regional database	Yes	The created database represents a major achievement for this project. In each country a well established monitoring system now exists.
REGIONAL DATABASE	Yes	Exemplary outcome – see Figure 5.
(b) Compilation and interpretation of data on variations in physical and chemical properties of groundwater	Yes	Done in all countries. The data sets presented show time series data and comparison to rainfall, surface water flows, and water levels where applicable.
(c) Compilation of data on changes in water quality and contaminants (physical and chemical characteristics)	Yes	Done in all countries. The data sets presented show time series data and comparison to rainfall, surface water flows, and water levels where applicable.
(d) Conducting of field surveys, monitoring of wells and boreholes, springs and hydraulically-connected water bodies	Yes	This was achieved by field sampling and measurement, assisted by the equipment such as water level and pH meters purchased in the course of this project.
(e) Design and preparation of maps, and identification of 'hotspots' and major threats	Yes	Done in all countries, although no formal vulnerability map was produced by Zambia. This appears to be as a result of the GIS component not being fully implemented by the country team.
(f) Sampling and assessing of groundwater quality	Yes	Done in all countries. The results have been interpreted using various standard and more specific hydrochemical techniques.

Table 3.1b: Completion of Activities

<i>Actions for safeguarding groundwater aquifers in urban areas</i>		The project teams initiated several actions ranging from extensive media campaigns (e.g. Ethiopia), meetings with cabinet ministers and regulatory agencies (e.g. Zambia and Benin), and legislative reviews (all countries), to physical actions resulting from the dissemination of project results (e.g. the closure of polluted boreholes in John Laing, Lusaka, the introduction of zoning activities in Côte d'Ivoire and Benin, and the provision of sanitation to 6,000 housing units in Senegal). In several countries, the results were widely disseminated to various government and civil institutions, including national water and environmental affairs bodies.
(a) Implementation of a training course on the estimation of groundwater recharge (substituted with groundwater protection)	Yes	The course took place in Mombasa, Kenya, at mid-term (10-12 May 2004), attended by 10 participants from the 10 project countries, with some additional participants from Kenya. New skills were acquired in groundwater protection measures and strategies and the principles of contamination. This was initially intended to be a course on groundwater recharge but, based on feedback from the national team leaders and the technical advisor, the project managers amended the subject to groundwater protection, which was considered more applicable to the project. Various concepts and principles included in the training were reflected in the final reports.
(b) Training on the use of GIS in groundwater pollution mapping	Yes	Extremely successful and timely training was done early in the project in Cape Town, South Africa (28 July-1 August 2003). This training in ARCVIEW and Aquifer Vulnerability, particularly DRASTIC mapping, was widely utilised in facilitating the vulnerability mapping.
(c) Training on Fractured Rock Aquifers	Yes	The representatives of 11 countries (including South Africa) attended a training workshop on Fractured Rock Aquifers at the University of Western Cape from 4-6 July 2005. Participants were taught about pumping test analysis, geophysical techniques, aquifer management and contaminant issues in fractured rock. While this was too late to impact on the project results, the skills attained should stand the countries in good stead for continuation of activities as the majority of African aquifers are fractured.
(c) Promotion of concerted action to create public awareness	Yes	See Section 3.2.
(d) Training on the use of MODFLOW	Yes	The representatives of the 11 countries were trained on Groundwater Modelling at the University of the Western Cape, Cape Town, from 6-14 October 2004. The participants were taught to carry out numerical modelling using examples from their own countries, which were also used for sharing experiences of groundwater monitoring activities. The groundwater numerical modelling package was accessed from the UNEP website for use in ongoing monitoring activities.

Hydrogeological conceptualisation of groundwater vulnerability in urban areas in Africa		This was widely achieved and supported by the range of training provided in the ambit of the project. In the newer countries, this understandably took longer to achieve and can still be improved upon in some areas, e.g. Lusaka. However, all countries showed that an integration of hydrochemical and hydrogeological data had been achieved by the establishment of conceptual hydrogeological models. In several countries, e.g. Senegal, Ethiopia, Kenya and Mali, these were formalised after training in mass transport models using VISUAL MODFLOW.
(a) Testing and adapting of existing conceptual hydrogeological models	Yes	Very clearly elucidated in most areas, either through conceptual hydrogeological/pollution model construction and/or formalisation through numerical models via VISUAL MODFLOW.
(b) Development of a clear conceptual model of the groundwater setting in each city, both in terms of the aquifer system and its exploitation status		
<i>Vulnerability</i>	Yes	Widely achieved with all countries achieving a degree of vulnerability assessment, and all study areas except Lusaka producing sets of vulnerability maps.
<i>Resource</i>	Yes	Adequately achieved, although the strategic importance of groundwater resources for sustainable development could have been more explicitly advocated in certain cities.
(c) Training of selected technical staff in the use of suitable tools	Yes	See Section 3.1.1 on training courses for details.
(d) Printing of the final maps and the final project report	Yes	All the reports have been completed, with different sets of maps, according to country-specific conditions.

3.2 Attainment of outputs

The major outputs of the project can be summarised as follows:

1. A launch workshop, held in Nairobi, Kenya, from 11-13 March 2003. Representatives from nine of the participating countries attended, together with the consultant, the UNESCO groundwater advisor, and project managers from UNEP and UNESCO. Discussions were held on the implementation process and a work plan developed for project activities and budgetary items in each country.
2. A compilation and update of existing hydrogeological information in the participating countries, with each selecting an area with large-scale groundwater dependency. The selected aquifers varied from primary aquifers in Ghana, South Africa and Kenya, to fractured rock aquifers in igneous and sedimentary formations in Ethiopia, Senegal and Benin, to karstic aquifers in dolomite and marble formations, such as that in Zambia.
3. Generation of data on aquifer pollution. The sources of pollution identified were most often associated with ineffective on-site sanitation or sewerage disposal, which were pervasive in all of the study areas. Other significant problems were associated with surface-water pollution impacting on groundwater quality (e.g. in Ethiopia and Niger) and saltwater intrusion (e.g. in Benin and Ghana).
4. The generation of accurate vulnerability maps for each area studied. Maps were prepared utilising the DRASTIC approach in most areas, but due to complicating influences such as saltwater intrusion and the widely accepted limitations of DRASTIC, several variations were also employed in different areas. The application of special purposes or specific vulnerability approaches added tremendous understanding to the issues in each area. The GIS training provided early in the project was highly applicable and contributed to the successful generation of these maps in all but one of the countries.
5. Regular and periodic monitoring of groundwater quality and the factors influencing its degradation in both the established and new countries.

6. A regional groundwater quality database, maintained by the project coordinator in Abidjan, which will help to ensure the long-term sustainability of project outputs and provides a significant resource for all future initiatives concerned with freshwater quality in Africa. The data appears to be logically stored and should serve as a practical reference source for researchers, decision-makers and funding agencies for a variety of purposes (Figure 5).
7. The complete country reports, which provide a summary of the project in each country. They contain all of the data from the project and its analyses of aquifer vulnerability, pollution distribution, and the measures that should be taken to prevent further groundwater pollution in each of the target cities. The reports and bulletins give the national teams an opportunity to present their findings and to send out a forceful message of the dire social and economic consequences of ignoring aquifer pollution.
8. The country report summaries, which provide a synopsis of each country's geology, hydrogeology and climate, and a description of the setting in each project area.
9. The early warning bulletins, which provide a one-page summary of the pollution situation in the project area in each country. The bulletins have been produced to a reasonably uniform format, and typically contain information on the geology and hydrogeology of the project area, an assessment of the aquifer's vulnerability (with maps), sources of groundwater degradation, results of water sampling/monitoring and their implications, discussion points, conclusions and recommendations.
10. The project website, which is a successful collation and dissemination tool for a project of this nature, with the inclusion of many of the technical outputs described above.

The technical reports and scientific papers submitted to the project were generally of an acceptable standard. Papers arising from the project were all peer-reviewed by an international panel, which provided feedback to each country team on improving their scientific content. The reports were also reviewed by the UNESCO hydrologist prior to the release of additional funds, and the project advisor rigorously followed up on the hydrogeological data collection and interpretation. A large number of the technical country-specific recommendations from the mid-term review were included to improve the content before the completion of the project.

The scientific papers and their collation represent a major effort towards synthesising an overall view of the quality of Africa's urban aquifers, which has never been undertaken before. This was not in the original project plan or document but was proposed at the mid-term after the quality of the outputs was ascertained. This is a highly significant output that should add to the impact and credibility of the teams of scientists involved, as well as the integrity of their investigations and interpretations.

According to the self-evaluations, the technical outputs from the project were judged to be of a generally high standard. As the coordinators included several senior researchers and practitioners, who provided constructive criticism of the outputs at various stages, the impression gained was that the project had excelled technically in terms of the standard and achievement of its results.

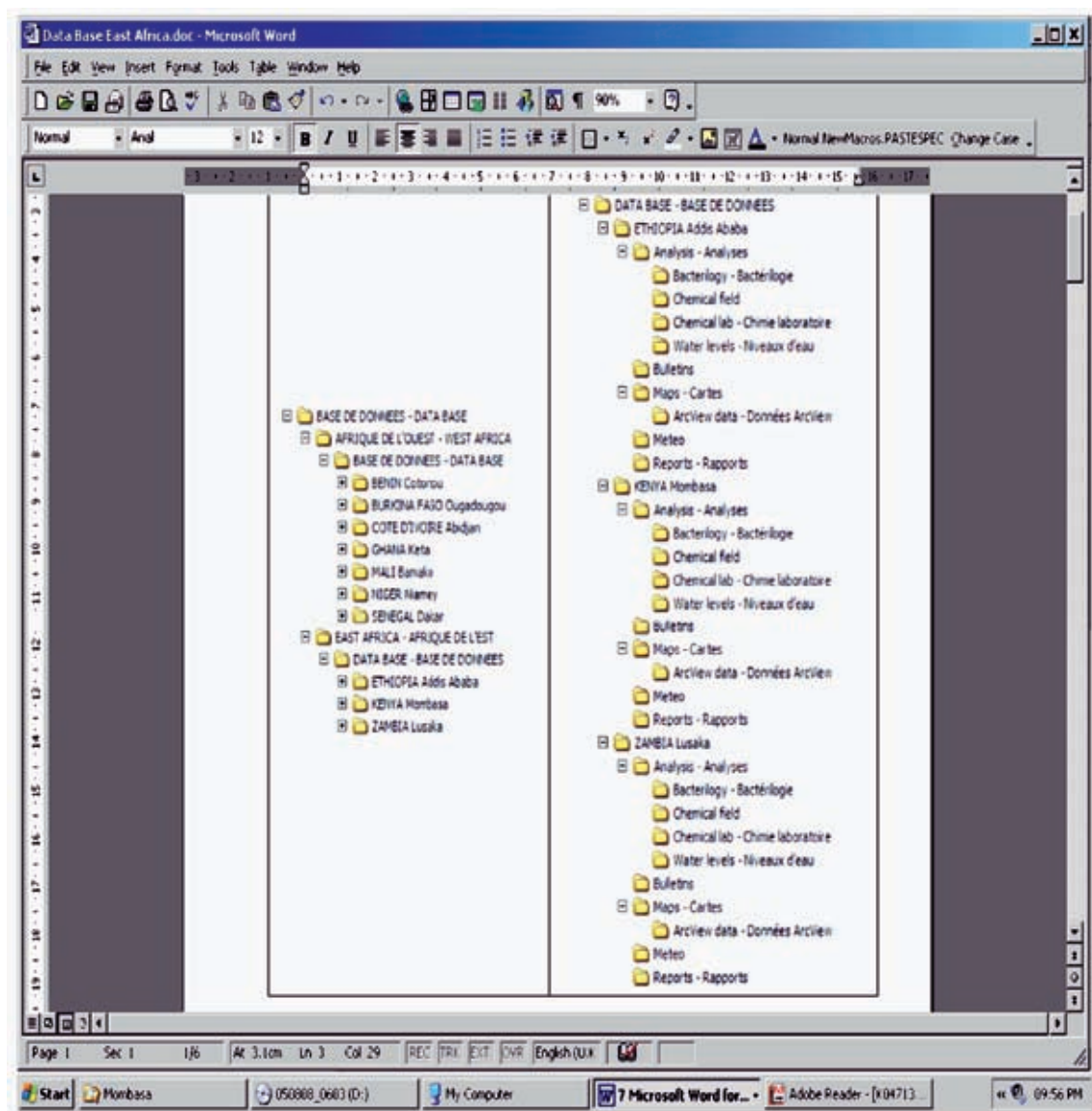


Figure 5: Outline of Project Database

3.3 Capacity building

The activities of this project have significantly improved the technical proficiencies of the participating country teams. This has filtered through to the country level in several cases (Benin, Côte d'Ivoire, Mali, Ghana and Zambia) and to the city level in most of the other countries. In Zambia, for example, a national network of experts has been established through this project and their skills are now also being used for other groundwater initiatives in the Zambian Copper Belt.

The capacity created by this project continues to be one of its most impressive results. Not only are the project teams regarded as centres of expertise, as was confirmed in both the countries visited, but several students have also benefited directly from the project. The following table shows the number of students who have assisted or worked with the project in various capacities:

Table 3.3: Student Involvement in Project

Senegal	Mali	Niger	Burkina Faso	Ghana	Côte d'Ivoire	Benin	Kenya	Ethiopia	Zambia
1 PD, 4 UG	3 Eng, 2 Tech	2 Tech, 1 PD (1F), 1 Eng	1 M, 1 PD (1F)	3 PD, 2 Tech (1F)	3 PD, 3M (1 F)	1 PD, 2 M, 1 Eng	1PD	1M, 3 PD, 2 Tech	2 UG, 1PD

PD = Post-diploma/graduate, UG = Under-graduate, Eng = Engineering graduate, M = Masters, (F = Female)

The various country teams also undertook a host of other activities related to capacity building and knowledge dissemination, which were also highly successful. For example, in Benin 15 workshops were held, of which three were specifically on water-source protection, as part of the revision of national water laws, while in Niger bulletins were distributed and information provided to the Directorate of Water and the Directorate of the Environment.

Although there were significant capacity-building elements at all stages of project implementation, their impact was not always as great as had been envisaged in the project document or at the launch workshop. This appears to be related to the amount of time needed to effect national policy, the scientific nature of the reporting of the project results, and a lack of coherent reporting structures in many of the countries involved.

3.4 Public awareness, knowledge transfer and regulatory impact

The major part of the work plan of the present project has been the extension of the network of participating countries, the agreement of a monitoring strategy, and the obtaining of background and monitoring data on the groundwater in each country. All these aims have been successfully accomplished.

Public dissemination of information from the project is seen as a vital function in the long term. The aim is to raise awareness of issues of groundwater pollution and its impact on water resources and health. The impact of such dissemination efforts was included in the mid-term evaluation, which highlighted the success of the process in some countries and the resistance to the publication of water quality information in others. A recurrent theme from the field visits and the national coordinators is that sensitisation is more likely to bear fruit when an alternative is provided.

Improved public awareness and attitudes have always been part of this project's anticipated results. The launch workshop and the revision of the project document confirmed the need to disseminate the project results to the public. The MOUs with the original countries outlined the practical modalities for undertaking such awareness raising, while those with new countries stipulated 'public participation' as one of the project's deliverables. The activities required for this were listed as:

- Carrying out the dissemination of information on the project;
- Including in the reports the distribution list of early warning bulletins as well as their expected feedback;
- Organising at least one national seminar in order to define policy options for better safeguarding groundwater aquifers in urban areas.

It is clear from this that the project management provided a greater focus on public dissemination, with less emphasis on regulatory impact. However, the national coordinators had a fair amount of latitude to utilise local contacts and pathways of dissemination, and often did so to very impressive effect.

The country teams initiated several public awareness actions, ranging from extensive media campaigns in Ethiopia, meetings with cabinet ministers and regulatory agencies in Zambia and Benin, and legislative reviews in all countries, to physical actions resulting from the dissemination of project results (e.g. the closure of polluted boreholes in Lusaka, the introduction of zoning activities in Côte d'Ivoire and Benin, and the provision of sanitation to 6,000 housing units in Senegal). In several countries, the results were widely disseminated to various government and national-level bodies.

Many of the national coordinators were very innovative in their selection and use of available communication channels. Examples of this include numerous newspaper articles and radio interviews about the project in Ethiopia, workshops undertaken in several countries, television appearances in Côte d'Ivoire and Mali, and the production of a documentary about the project in Abidjan. Although different media options were used with excellent effect, there were a few, such as overly technical newspaper reports, that served to raise unnecessary public alarm in the absence of sufficient understanding.

Local political structures were also employed to good effect by the project in different countries. Working through grassroots political structures in Zambia appears to have paid dividends, while the inclusion of local political leaders in the project steering committee in Ghana allowed technical activities to proceed without undue resistance from the community.

In some countries, the coordinators effectively utilised high-level political routes of dissemination, such as the use of Zambia's environmental health directorate and national teaching hospital to encourage health professionals to pass messages on groundwater protection to the public. In Burkina Faso, the national laboratory and contacts with two national directors proved an equally successful means of communication, while in Benin the presence of the national water affairs director as the project coordinator provided effective high-level access and impact on national laws and strategies.

In several West African countries, workshops were held in conjunction with national-level directorates, and some of these workshops attracted high-level ministerial representatives. In Côte d'Ivoire, Benin and Burkina Faso, these workshops appear to have had some positive impact on national policymaking. However, despite some successful efforts to reach decision-makers, explicit guidelines on the revision of laws were not forthcoming from the project management, leading the project teams to concentrate largely on technical issues rather than their potential to influence legislation. In fact, it appears that the project document was overly ambitious with respect to influencing policy when taking into consideration the allocated budget and the project timeframe.

A further initiative that will assist in knowledge transfer and lend more credibility to the project is the forthcoming publication of the project results in a book format. The publication should provide a broad framework to inform a wide variety of interested parties of the technical merits and long-term objectives of groundwater protection strategies at city, national and regional levels.

The project website has also recently been redesigned to incorporate a broader range of information for a broader readership. The content and existence of the site should, however, be more widely advertised, particularly among NEPAD and AMCOW initiatives.

3.5 Relevance of the project to priorities identified in Africa by WEHAB and NEPAD, and to UNEP and UNESCO objectives

The focus and results of this project are well aligned with WEHAB, NEPAD and AMCOW objectives, and the results and methodologies should be extremely useful to furthering the stated aims and objectives of these initiatives. NEPAD's goal of establishing regional networks to strengthen African expertise and cooperation – and particularly to establish centres of excellence for water-related issues – will be well served by the results of this project and its potential for technical capacity building and skills transfer.

Although the project did have communications with several other UNEP and UNESCO projects, including the UNEP-GEMS Water Quality Programme and the UN-Habitat Programme for Cities, it appears that no formal collaborations took place – an omission that it is hoped will be rectified in the future.

The project did send five of its coordinators to the Pan-African Implementation and Partnership Conference on Water, which was held in Addis Ababa from 8-12 December 2003 under the auspices of AMCOW and the United Nations Economic Commission for Africa. The delivery of several presentations by the coordinators was credited with giving rise to a formal recommendation concerning "the establishment of networks of early warning systems to monitor groundwater pollution in urban and peri-urban areas."

In Ethiopia and Kenya, scientists from the project teams have been included in the multinational Mewari Highlands project, and expertise sharing between these projects will therefore continue. In Zambia, the project is linking well with WHO initiatives, to which it has been able to provide some practical support.

While all of these efforts are laudable, however, feedback from the self-evaluations and the country visits have shown that certain collaborative opportunities have been missed. While this should not be laid specifically at the project's door, it does point to a broader need for improving the institutional coordination of concurrent regional projects.

3.6 Sustainability

While the project has undoubtedly raised awareness among local communities and regulators, and generated considerable technical capacity in the participating countries, there are several enduring uncertainties with regard to its long-term sustainability. Although its initial results are very useful, it is clear that many of the participating countries do not have the means – financial or human – to implement the kind of protection and prevention measures that the project is advocating.

One of the chief hurdles concerns the lack of younger scientists to have attended the project training, which it is feared could hamper continuation of its work in the future. However, efforts are now being made by the technical coordinator and the UNEP/UNESCO team to prioritise the participation of younger local scientists in future training and project activities.

On issues of policy, many participants have noted that, while most countries have broad laws for safeguarding their groundwater quality, local-level regulations and directives are often insufficiently specific and inadequately enforced. While the indications from most sectors consulted in this evaluation suggest that issues of groundwater supply continue to take precedence over those of quality and protection, it is hoped that the interest and information generated by this project will continue raising awareness at the highest levels and mobilising governments to address groundwater pollution and related health issues as a matter of urgency.

3.7 Country ownership

The degree of country ownership varies considerably between countries. While early indications suggest that the project has impacted on national policy in countries such as Benin and Côte d'Ivoire, in most countries the project impacts have thus far been largely restricted to the project areas. Local regulation bodies were closely involved in the identification and implementation of project activities in some countries – for example, the Addis Ababa Water Supply Authority in Ethiopia and the Department of Water Affairs in Zambia. In many countries, the project has had a positive impact at the local level, such as in Senegal, where the findings have led to the closure of several highly impacted wells, while in many of the original West African countries the project concepts have helped to affect changes to national water laws and other regulations.

3.8 Replicability

The project holds great promise for replication, due to its relevance to cities across Africa and to any rapidly urbanising populations where settlement rates outstrip the rate at which authorities can provide services. In Zambia, the national director of the Department of Water Affairs has indicated that the project results and expertise are already being utilised to plan initiatives in several parts of the country's Copper Belt. The newer Anglophone countries involved in the project have all expressed confidence that, due to the ease of replicating the project's standardised approach and methodology, they will reach parity with the countries involved in the earlier phases.

3.9 Impact

Evidence presented by the national coordinators indicates a definite impact within each country. While the impact is still largely of local significance, there are indications of broader national-level impacts resulting from the dissemination of project results, such as the introduction of zoning activities in Côte d'Ivoire and Benin and the provision of sanitation to 6,000 housing units in Senegal. It is notable that it is particularly in the countries involved in the previous project that national impacts are now being seen. The capacity building in each project team, combined with further publicity and scientific/technical knowledge transfer, is resulting in a more lasting and strategic impact. Current efforts to publish a peer-reviewed book on the project are also providing the teams with additional recognition for their work, as well as an incentive to ensure their outputs stand up to scientific scrutiny. The book also has the potential to play an important role in obtaining further funding for research activities on African aquifers.

3.10 Project management

3.10.1 Implementation approach

The implementation approach of the project appeared to be clearly structured and logically defined, and the project document incorporated strong continuity with the activities and outcomes of the previous project. The project management and technical support from UNEP and UNESCO appears to have been focused and coped well with the challenges of multi-nation project implementation. The project managers were also flexible in allowing the participants to prioritise the training they required and the formats and outcomes of the early warning bulletins, which appear to have been widely and successfully distributed.

Although the technical advisor withdrew from the project in the early stages due to illness, the project as a whole adapted admirably to this unfortunate setback. To compensate, the UNESCO chair took over the role of technical advisor, shouldering a considerable additional load on an entirely voluntary basis. The lack of remuneration did, however, pose some challenges, as more could have been achieved if the advisor had had the resources to visit more project countries and provide greater guidance on the ground.

With the project consultant's functions taken over by the UNESCO chair, the need for a case study in which the application of an existing groundwater protection legal framework could be tested led to the inclusion of South Africa in the project in September 2004. The objectives of the South African team are markedly different to those of the other project countries, with a timeframe stretching to the end of 2005. As such, South Africa has not been evaluated in the same manner as the other countries. Although the South African project appears to be on track to deliver its expected outcomes, it is unfortunate that the timing of this project does not coincide with the other countries, as there are undoubtedly lessons from South Africa that could have been valuable to the other teams. However, the training provided in South Africa in pollution mapping and groundwater modelling has certainly been a significant boon to the project. A final workshop held in South Africa in November 2005 brought together several of the countries' scientists, regulators and politicians to discuss key issues and lessons arising from their respective projects.

3.10.2 Financial planning and cost-effectiveness

The project has largely been delivered on time and within budget. Ten of the countries delivered their final reports by June 2005, although some run-over activities were not fully completed by this time due to initial funding issues and currency fluctuations. Considering the scale and objectives of the project, the budgets allocated to each country were limited, with most countries receiving US\$ 20,000 or less to undertake their work. It is to the credit of the project managers from UNEP and UNESCO and to the country teams that the project achieved as much as it did within these budgets. However, from the interviews and self-evaluations conducted for this evaluation, it is also clear that the limited funds could not support all of the activities proposed for the project, which may have some negative implications for long-term sustainability. An overall assessment of the budget also shows that the project managers hold the training and skills transfer in high regard, and a review of the training materials and their perceived impact indicate that this was money well spent. However, as has already been noted, the evaluators feel that specific funding could usefully have been allocated to more detailed outcomes within the public awareness and regulatory components of the project.

For now, the main issue that requires attention to allow for smooth progress of multi-nation projects concerns the administrative problems associated with international bank transfers. Interviews with the project coordinators indicate that, in countries where the bank used for transfers has a local branch, this process proceeded smoothly, but in others the routing of transfers via New York caused substantial delays in the receipt of funds. Although this process was chosen to minimise commission and bank costs, the delays that resulted posed significant problems to project progress and the acquisition of vital equipment.

3.11 Project design

The simplified hierarchy of the following framework in the project document creates room for confusion in the definitions of, and relationships between, the project activities, outputs and results. For example, Output 5 concerning the signing of an MOU by the project countries is almost identical to Activity 2 in the groundwater vulnerability assessment cluster. Overall it is not clear how the activities and outputs should feed into the identified results, particularly with regard to the results concerning policy development, public awareness and attitudes (Results 2, 4 and 6). The only activity mentioned to achieve greater public awareness of the roles and protection of groundwater, for example, is “Promotion of concerted action to create public awareness” – although exactly how this should be undertaken remains unspecified. The reason for this is probably that the project was conceptualised largely by technical experts, leading to a strongly scientific focus and exemplary scientific results at the expense of specific activities and actions to safeguard groundwater quality.

3.12 Monitoring and evaluation

Although the project document does not provide any instructions regarding monitoring and evaluation requirements, a budget was provided for a mid-term and a final evaluation. From the interviews carried out, it is understood that monitoring took place through the regular review of project outputs and contact with the project coordinators; despite this, however, actual progress reports were not produced. The UNESCO approach of providing funds based upon produced outputs within specific timeframes appears to have been very successful and was well received by all the participating countries.

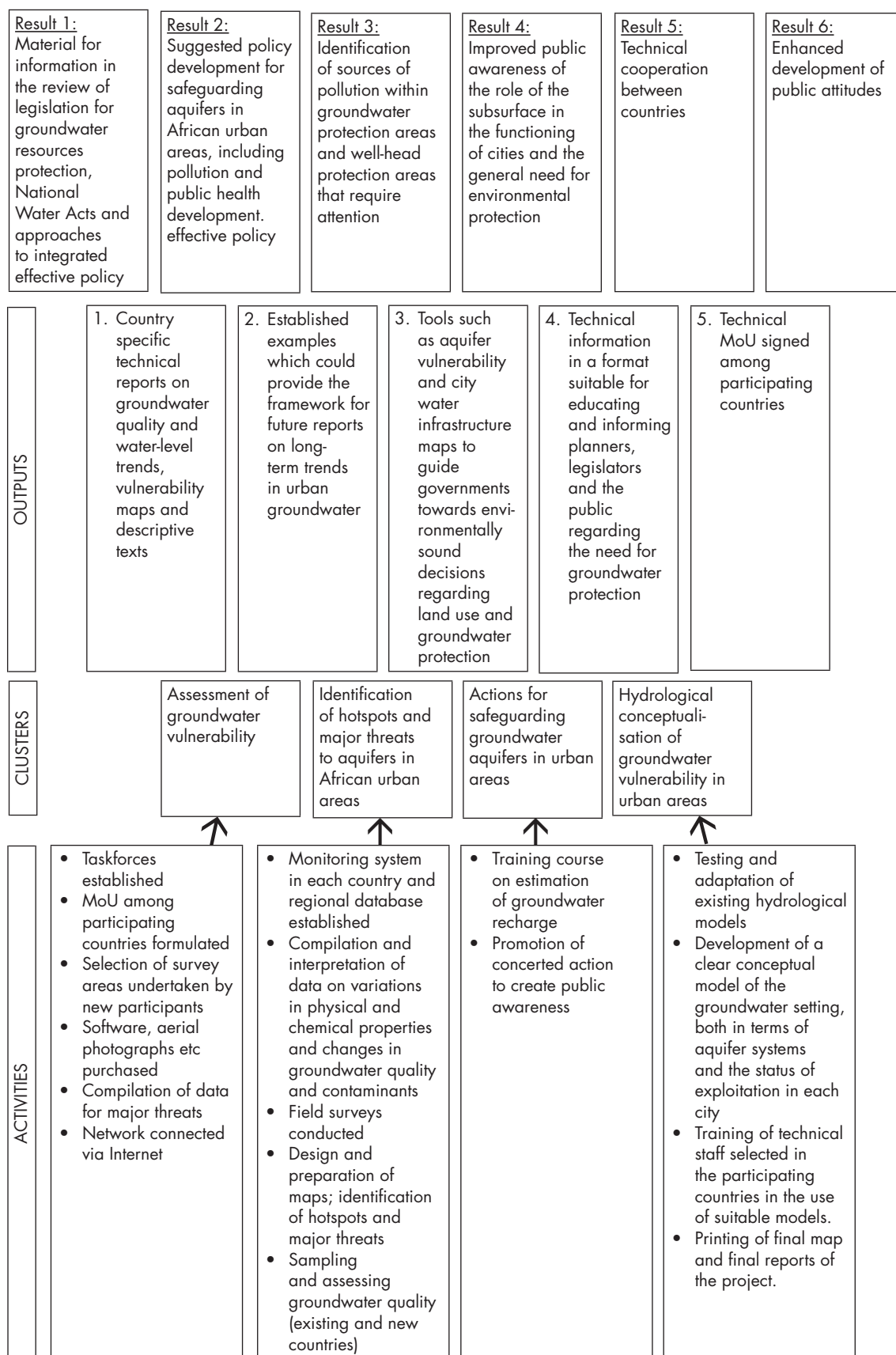
With regard to evaluation, a technical review was conducted in May 2004 in conjunction with the training workshop on groundwater protection held in Mombasa. This review led to the extension of the project until December 2005 in order to compensate for the delays experienced in the project start-up due to fund transfers and equipment acquisition. The mid-term evaluators, UNEP, UNESCO and the project coordinator were in full agreement of this short extension to ensure that the project outputs were attained.

The extension of the project also allowed for an important additional output: the production of a book on groundwater protection in Africa. The decision to include South Africa as a case study was a further result of the mid-term review. Finally, a number of recommendations were made to the individual project countries, most of which appear to have been followed up. There were exceptions, such as in Lusaka, where the different aquifer situation was only partially resolved despite a visit by the project coordinator. However, in general, the recommendations were well received and acted upon. In Senegal, for example, the project team gave considerable effort to using different hydrochemical techniques to present their results, leading to an improved understanding of the situation, while in Kenya, the team agreed to focus on a specific area and to employ a hydrogeologist – leading to significant progress in the final year.

Taking into consideration that no formalised system for monitoring was established, it seems that the informal monitoring worked very well and that decisions were taken appropriately according to the submissions of outputs from the project coordinators. The project was implemented within its broad outline, with the project managers adopting a flexible approach to deal with country-specific issues. This had its positive sides, with regard to activities being designed to suit specific political and social contexts. Although some countries may have benefited from more rigorous and systematic monitoring, particularly in the early stages of project implementation, the absence of such a system does not seem to have had an adverse effect on project progress. It appears that the mid-term review was particularly useful in keeping the project on track.

Table 3.11: Objectives and Planned Results

Overall Objective: To extend the scope and coverage of the project



4 Lessons Learned

The following were among the primary lessons learned by the project teams during this follow-up project:

1. **People only become concerned with groundwater quality when they have a large enough supply.** As important as groundwater quality issues are, both the general public and politicians who are in a position to promulgate laws are generally not concerned with quality issues until there is enough water readily available to them. In Lusaka, for example, community leaders showed that, while they have taken cognisance of groundwater quality protection issues, they are more concerned with the amount of water being supplied to them.
2. **Public education on groundwater protection should not be a one-off action but a continuous process.** The trickle-down strategy of public awareness does work but needs reinforcement at regular intervals otherwise behaviour will not change. While the project relied to some extent on a trickle-down approach, the fruits of this have only been felt in the countries where the project has been operating for longer (e.g. Ghana), due to the extended repetition of its messages.
3. **Scientific bulletins are an excellent tool for conveying technical information but not an effective public communication device.** Bulletins are good communication tools for other scientists but not for the general public, water managers or politicians. This was evident from the self-evaluation exercises and the country visits, with technical personnel such as those in the Lusaka Water Supply in Zambia and the Addis Ababa Environmental Protection Agency in Ethiopia rating the bulletins as highly effective, while the same could not be said for community leaders and elected representatives in these countries.
4. **Projects must take specific socio-economic conditions into account from the outset so that their aims can be appropriately defined.** A project on groundwater quality needs to recognise that many of its outputs will be obscure to members of the public or political decision-makers, and that expected outputs should clearly define those indicators for which success can obviously be measured. As an example, the current situation in Niger would make supply of water and basic foodstuffs to the wider population a far higher priority than groundwater quality protection. For this reason, the importance of groundwater protection should be emphasised to receiving communities from the earliest start-up phases of water supply projects, quoting tangible results from this and other similar projects.
5. **Groundwater protection projects should learn from and build upon the successes of previous similar projects.** A great deal of the success of this project lies in the fact that the project managers and many of the countries had been involved in the previous project on the *Urban Pollution of Surficial and Groundwater Aquifers in Africa*. This is evident from the timely development of national groundwater strategies in these countries, where the momentum has been sustained and there have been consistent awareness-raising activities.
6. **Tangible outputs should be devised for researchers to aim for.** The book currently being published has reinvigorated the research teams and provided them with a specific timeframe for producing outputs of a scientifically acceptable standard. Smaller projects such as conferences or symposia of international standing can serve a similar purpose.
7. **Local structures and community buy-in are critical for public sensitisation and acceptability.** Several countries, including Ghana, Zambia and Senegal, listed examples of attitudes being significantly changed once community members were made an integral part of their projects. It is recommended that all such projects encourage local buy-in from the outset in order to promote their popular acceptance and progress.

5 Project Ratings

The success of the project to date has been evaluated in terms of eight aspects of the project, following recommendations by UNEP/UNESCO and the previous project evaluators. The success of each aspect has been rated on a scale of 1 to 6, with 1 being the highest rating. The evaluation results are presented in the table below. The overall rating for the entire project, based on the ratings in the table, was assessed as 2.

a. Success of project implementation

The impact of the project varied considerably between countries, according to the success and timeliness of their individual activities. In many cases, the country teams went to great lengths to maximise the impact of their work. It is hoped that the recommended actions, and the publishing of the results in an edited book form, will lend further credibility to the project results.

b. Attainment of outputs

The tangible planned outputs of the project were largely attained (see Table 3.2).

c. Completion of activities

The activities defined in the project document and more closely defined at subsequent progress meetings were on the whole completed successfully and to schedule. The project managers, consultant/technical advisor, and coordinators are commended for their efforts to complete activities within budget and time.

d. Project execution within budget

The project was completed within the overall budget, and indications are that some funds remain to implement some of the priority follow-up actions. The project managers from UNESCO and UNEP played a key role in this by insisting on delivered products, closely monitoring progress and expenses, and optimising training and reporting opportunities. It should also be emphasised that funding for this project was in many cases boosted by funds available to the country teams from other projects or national/local structures to enable the objectives to be adequately attained, and the country coordinators and their teams coped admirably with the confines of a fairly limited budget.

e. Coordination with other projects

From the evaluators' point of view, there were several opportunities for sharing information and collaborating with UNEP-GEMS that were not taken up systematically during the project implementation. GEMS works through a network of national focal points which are appointed and funded by member countries and are in charge of national cooperation with GEMS/Water. It was mentioned by the UNEP team that they could have played a role in identifying focal points in countries where these do not exist. It would also seem that UNEP could have played a role in facilitating contact and ensuring a continuous flow of information between national project coordinators from the aquifer project and the GEMS focal points. UN-Habitat has also identified the potential for greater collaboration with UNEP on groundwater policy and capacity-building for policymakers in future. Indications are that, although the awareness and will for such cooperation exist, they were not always optimised by this project.

It is very encouraging, however, to see evidence that the project has contributed to the inclusion of groundwater issues on the NEPAD agenda through its active participation in water-related conferences, such as the AMCOW Pan African Implementation and Partnership Conference on Water. There are also indications that the coordinators of the project will be involved in national or regional centres of excellence on water, science and technology, which are to be set up under the auspices of NEPAD.

f. Impact created by the project

The anticipated impact on policy was perhaps optimistic within the timeframe and budget of this project, and future projects should be more explicit in the required actions or impacts to be attained within specific timeframes. However, the previous project and the efforts of this project are starting to have a measurable impact for both stakeholders and other interested parties. Although this is still largely of local significance, indications are that some impacts are being made at the national and regional levels in several countries. It is significant that it is particularly in the countries involved in the previous project that national impacts are being witnessed. The capacity building in each project team, together with further publicity and scientific/technical knowledge transfer actions, are all resulting in a more lasting and strategic impact. The book currently being produced will have a lasting scientific impact and its publication is eagerly awaited by several parties with an interest in the subject.

g. Project sustainability

Based upon feedback from the national coordinators, the increased public and official awareness of the importance of groundwater quality to the cities under study should ensure the sustainability of the project in these areas. However, it is clear that the critical role of the project in the future of these cities should be more actively publicised to key decision-makers on a national scale.

h. Capacity building

The project has already had an impact on building the scientific capacity of the participating countries, and this capacity building should continue into the future.

5.1 Overall ratings

Table 5.1: Overall Project Ratings

Aspect	Rating	Comments
Attainment of objectives and planned results	2	All the activities were undertaken, their results were in line with the original objectives, and these have largely been attained, with a policy impact appropriate for the period and scale of the project.
Achievement of outputs and activities	1	All the activities were undertaken, and the outputs were as planned.
Cost-effectiveness	1	The project's accomplishments are outstanding, considering the limited funding available to the participating countries.
Impact	3	Evidence exists that the outputs have had a scientific impact in each country, the results have been passed on to communities in various formats (as shown by the field visit to Lusaka), and policymakers have been made aware of the results.
Sustainability	3	The capacities built through the efforts of the project have permeated beyond the project teams, and the teams are considered centres of excellence, as illustrated by the experiences of e.g. Côte d'Ivoire, Zambia and Ethiopia.
Stakeholders' participation	2	The engagement of local scientists in project activities has worked very well, although in future there should be greater focus on involving more female scientists. Community involvement also seems to have been successful in several cases.
Implementation approach	2	Within the project's budgetary constraints and multinational nature, the implementation methodology has proved to be relevant and adaptable to the challenges that arose. An excellent example is the re-prioritisation of the training programme to suit the needs of the project. An area of concern for future projects should be to be more specific with the activities proposed to achieve objectives – for example, with the third cluster on 'Actions for safeguarding urban aquifers', in which the activities were mostly related to technical training. While this was required and applicable, some facilitation regarding implementation would have served the project well.
Country ownership	3	The project has created a significant core of skilled personnel and, through the efforts of this follow-up project, the team members have been used in several countries as the focus for implementation and knowledge transfer.

Financial planning	2	The project has been delivered on time and within budget and few significant problems were encountered. Although the distribution of funds for each activity was appropriate, the balance between the amount practically available to each country to undertake activities and the total budget may have been better optimised.
Replicability	2	The project structure and design have clearly demonstrated that they can easily be replicated elsewhere in Africa, and the results and lessons should form a strong foundation for other similar projects in the future.
Monitoring and evaluation	3	The distribution of funds was managed in a way that products had to be delivered before payment for the next phase of activities was made. This appears to be an excellent practice for ensuring that outputs are achieved, although it does not cover all the evaluation aspects required. The regular training and feedback sessions also acted as ongoing monitoring and evaluation exercises, and a mid-term technical review was also undertaken. This review was largely on technical aspects and perhaps certain non-technical issues could have been examined in greater detail during this evaluation to ensure that the project was on track.
OVERALL RATING	2*	On the evidence gathered, this project must be considered an overwhelming success.

The project evaluation generates a rating of 2 for 'satisfactory' and 1 for 'highly satisfactory'. In the evaluators' opinion, however, the project is above satisfactory. If the ratings had allowed for a rating of 'good', this would have been the most appropriate overall rating for this project.

5.2 Conclusions

The terms of reference highlighted two aspects primarily to be evaluated:

- i. From the evidence gathered in this full evaluation, the assessment and technical capacity-building efforts, stakeholder involvement and collaboration have all been relevant, timely and highly effective. As one of the key considerations, the project must be judged an overwhelming success.
- ii. The technical information reviewed in the form of the final reports, project presentations and submissions to the African groundwater pollution book point to the very successful attainment of outputs of satisfactory scientific quality, which will serve as strong reference points for national and regional urban groundwater assessment activities.

While these two aspects were of primary concern, the following aspects also merit highlighting:

- iii. Through the activities undertaken, the project determined the status and vulnerability of groundwater supplies in the cities of 10 participating countries.
- iv. A network for the exchange of groundwater-related information was expanded and, through the database collation efforts, active data exchange and interaction was established.
- v. The project activities enabled the participating countries to develop methodologies for assessing and monitoring current and potential contamination of their urban aquifers. While the rationale was similar in each situation, the project identified the need for, and enabled the development of, site-specific approaches and methods based on the characteristics and requirements of each city.

- vi. Based on evidence in the reports, feedback from the country coordinators and project consultant, and the field visits, it is clear that awareness of groundwater quality issues was enhanced at all levels, together with the institutional capacity of each country and the continent as a whole.
- vii. In each of the participating countries, the project teams have made meaningful contributions to influencing policy at local, national and regional levels. Due to time and budgetary constraints, these impacts have been more significant at the city level, although many countries show evidence that national or regional stakeholders have taken cognisance of their study results. In some cases, such as Benin and Côte d'Ivoire, impacts have been made at the national policy level, although in several others such efforts have not yet borne tangible fruit. With some additional time and effort, the evaluators are confident that the findings obtained will form the basis for formulating or improving groundwater-use policies and protection measures in all countries.
- viii. The cooperation between UNEP and UNESCO in this project was highly commendable and the two agencies appear to have complemented one another to achieve the outcomes of the project.
- ix. The expected project activities were all undertaken and to a large degree effectively completed.
- x. An effective network of collaborating scientific teams has been established in the 10 countries.
- xi. In each country, the aquifer vulnerability has been mapped for an urban area that relies on groundwater, regular sampling of water quality has been initiated, the results have been processed and interpreted, and the implications have been communicated to decision-makers and the public.
- xii. The project has significantly impacted upon the technical proficiency in each country, and on the African continent as a whole, and has provided a strong platform on which to link its results to other African initiatives.

6 Recommendations

The problems and successes encountered during this project have led to valuable lessons being learned, which, in turn, have allowed several recommendations to be proposed. These take the form of:

- General recommendations for consideration by UNEP and UNESCO;
- Technical suggestions for current and future work in this field in Africa.

These recommendations are briefly summarised here, in a sequence that should best serve the continuation of the project.

6.1 Priority actions

Project results should be repackaged to achieve maximum impact

- A significant amount of relevant, high-quality technical data has been generated by this project. To date, these data have been passed on to stakeholders mainly through local groundwater quality bulletins. Indications are that, while these bulletins have been highly effective in communicating to technical personnel, the format is less appropriate for informing the general public and political decision-makers. The findings and implications in each city should thus be packaged or disseminated differently to spread the significance of the scientific findings to the public and to local regulators. If possible, UNEP should facilitate this process as a matter of priority.

Suggestions:

- v. For the general public, readable and attractively packaged 'Citizens' Guides' on groundwater quality and protection issues may have a greater impact.
- vi. For regulators, such guides could be used together with the bulletins and some concrete suggestions for policy changes or physical protection measures.
- vii. For both regulators and the public, information generated by the project could be further disseminated through public forums or meetings, which public participation specialists could be employed to facilitate.
- viii. A fixed template could be developed to provide a standard harmonised structure for the country reports. As well as promoting easy comparisons and information sharing, this would also simplify the presentation and comprehension of key issues in their dissemination over the Internet.

6.2 Medium-term actions

1. Assistance should be given to individual countries to strengthen their groundwater policies

- In order to sustain the gains of the project, it is recommended that a follow-up project be prepared to assist individual countries to influence policymakers and move from policy to implementation. It is suggested that national-level steering committees should be established or strengthened as part of this process, and that many of the stakeholders who have been involved in this project or have worked on similar projects with UNEP, UN-Habitat or UNESCO could serve on these committees with national decision-makers.
- At UNEP level, the Division of Environmental Policy Implementation (DEPI) should follow up on the assessment outcomes and should take a leading role in developing a proposal to assist participating governments to develop more comprehensive groundwater policies and strategies. This process should also involve close consultation with other potential donors, water supply authorities, and large-scale water users in each country.

2. Groundwater protection strategies should be linked to sanitation initiatives

- The project's findings have strongly identified poor sanitation and informal sewerage disposal as major contributors to groundwater quality degradation. As the project shows, groundwater quality is only prioritised when supply is sufficient and when alternatives are available. The results of this project should be used in conjunction with new sanitation and water supply initiatives in urban centres in Africa, for which collaboration with UN-Habitat would seem appropriate.

3. The project should be expanded

- The findings of this evaluation suggest that the project has been successful in terms of implementation and the production of important results. Based on these outcomes, the project should be expanded if at all possible.

Suggestions:

- iv. As groundwater pollution and vulnerability issues are affecting all developing countries with increasing urbanisation, aspects of this project could be replicated in other African countries and developing nations where they are relevant and applicable.
- v. In almost all of the countries investigated, other major urban areas exist where the same approaches can be followed. Since a core group of expertise has been established by this project, replicating the efforts in an additional area should be achievable at a much reduced cost. This would expand the capacity and project ownership in each country, as well as providing vital data to influence policies and test groundwater protection strategies.
- vi. If the project is expanded, experience suggests that some 'lag period' should be built in initially for new countries to launch activities before the new project aims are expanded to existing areas. This would allow for a more equitable evaluation and allow the project to progress at a rapid pace after the initial period.

4. Efforts to train young African water scientists to build on the project's successes should be intensified

- This project has generated core centres of expertise in each country, and the training provided by the project has been key to this achievement. Due to the nature of the project, it is understandable that most participants in the training courses were university professors or senior personnel, but future projects should emphasise, in the memoranda of agreement if necessary, that young local scientists should also be exposed to expert training. This type of training should continue and be expanded with a particular focus on young scientists.

Suggestions:

- iii. In future projects, at least one training session could be dedicated to the training of young local scientists. The benefits in terms of establishing long-term networks and increasing the expertise base will ensure sustainability.
- iv. Future projects should include a training seminar in the region or country for personnel outside the project teams. This would further build local capacity and make local regulators and stakeholders aware of the expertise available in each country.

5. Greater efforts should be made to streamline funding administration

- The limitations of the funding have been alluded to and, while this cannot easily be rectified, indications are that there are some difficulties with the transfer of funds to individual countries. This aspect was discussed with the participants and the project managers, and it appears that the route followed was the lesser of two difficulties. The delays in this process, however, appear to have resulted in delays in the progress of project activities in several countries. This aspect should be carefully considered at the inception of future multinational projects.

Annex 1: Acronyms

Institutional

AMCEN	African Ministerial Conference on the Environment
AMCOW	African Ministerial Conference on Water
BGS	British Geological Survey
CIAPOL	Centre Ivoirien Anti-Pollution
DANIDA	Danish International Development Agency
DESA	Department of Economic and Social Affairs (of the United Nations)
DEWA	Division of Early Warning and Assessment, UNEP
ECA	Economic Commission for Africa (of the United Nations)
ENRICA	DANIDA Enhancement of Research Capacity
GWSC	Ghana Water and Sewage Corporation
IAEA	International Atomic Energy Agency
IDA	Integrating Development Authority (Ghana)
IHP	Division of International Hydrological Programme, UNESCO
INHPI	Institut National d'Hygiène Publique (Côte d'Ivoire)
LNSP	Laboratoire National de Santé Publique (Côte d'Ivoire)
NEPAD	New Economic Programme for African Development
ROA	Regional Office for Africa, UNEP
SIDA	Swedish International Development Cooperation Agency
SODICI	Société pour le Distribution de l'Eau, Côte d'Ivoire
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Programme
UN-Habitat	United Nations Human Settlements Programme

Technical

DRASTIC	A term related to a widely utilised aquifer vulnerability methodology
GIS	Geographical Information Systems
GRID	Global Resource Information Database
VISUAL MODFLOW	Software package that provides a graphical user interface to the MODFLOW numerical modelling code for simulating groundwater flow and mass transport

Annex 2: People Interviewed for Evaluation

Training course and Final Evaluation Meeting, University of the Western Cape, Bellville, Cape Town, South Africa, 5-8 July 2005

Emmanuel Naah, PhD	Specialist in Hydrology, UNESCO Regional Office, Nairobi
Salif Diop, PhD	Senior Environmental Affairs Officer, DEWA, UNEP
Patrick Mmayi	Water Consultant, DEWA, UNEP
Catrina Perch	Evaluation Officer, Evaluation and Oversight Unit, UNEP
Prof Alain Nindaoua Savadogo	Project Coordinator, Burkina Faso
Dr Ibrahima Deme	Project Coordinator, Senegal
Aïssata Boubakar Hassane	Project Representative, Niger
Dr Amadou Zanga Traore	Project Coordinator, Mali
Dr Felix Azonzi	Project Coordinator, Benin
Dr Bruce Banoeng-Yakubo	Project Coordinator, Ghana
Dr Jean Patrice R Jourda	Project Coordinator, Côte d'Ivoire
Dr Daniel Munga	Project Coordinator, Kenya
Dr Shafiek Adams	Project Coordinator, South Africa
Dr Daniel Nkuwah	Project Coordinator, Zambia
Dr Dagnachew Legesse	Project Representative, Ethiopia
Dr Tamiru Alemayeru	Project Coordinator, Ethiopia
Segun Adelana	Project Representative, South Africa
Prof Yongxin Xu	Project Coordinator
Rodney Bishop	Water Planner, Cape Town Unicity
Prof Gerrit van Tonder	University of the Free State, South Africa
Mike Smart	Principal Scientist, Dept. of Water Affairs and Forestry, Western Cape
Jaco Nel	Former Senior Geohydrologist, DWAF, now affiliated to UWC

Community leaders and representatives in:

Lusaka, Zambia

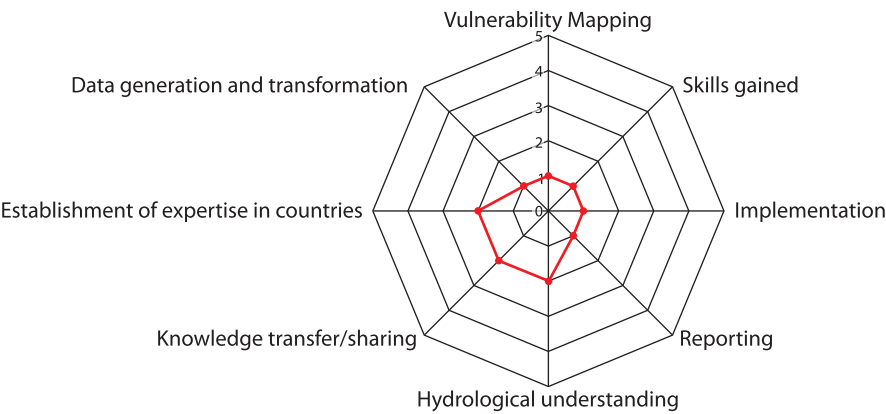
Cookie Mwando	Youth Secretary
Keloin Nydwana	Vice Youth Chairperson
E Katoyo	Branch Chairman
Loveness Sekala	Vice Chairperson, Neighbourhood Health Committee
Agripa Phiri	Public Information Officer, Water Committee, John Laing
Jonas Nqlango	Branch Chairman, Treasure Water
Charles Maliko	Coordinator, Water CPP
Brian Daka	Treasurer, Makeni Neighbourhood Health Committee
Henry Mtine	Engineering Director, Lusaka Water and Sewerage Company
Gabriel Chikama	Scientific Services Manager, Lusaka Water and Sewerage Company
Adam Hussen	Director, Zambian Department of Water Affairs

Addis Ababa, Ethiopia

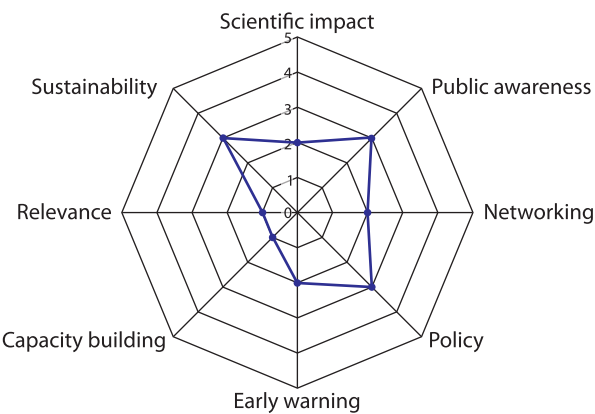
Seifu Legesse	Head, Department of Environmental Legislation, Education and Impact Assessment, Addis Ababa Environment Protection Authority
Azeb Asnake	Head, Research and Water Demand Management Services, Addis Ababa Water and Sewerage Authority

Annex 3: Self-Evaluation Results

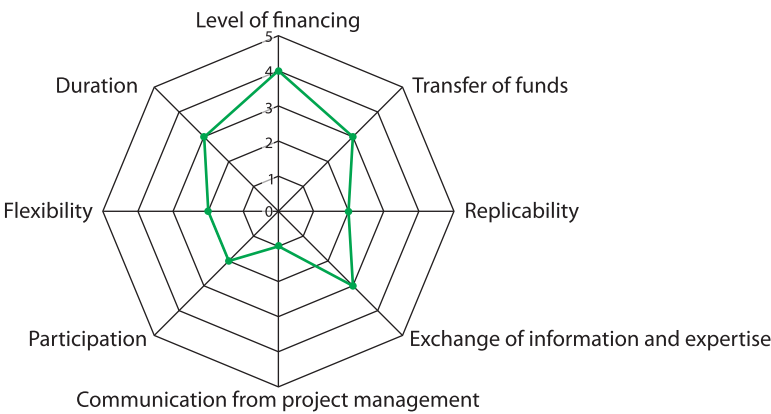
Self-Evaluation Wheel:
Technical



Self-Evaluation Wheel:
Impacts



Self-Evaluation Wheel:
Project Management



Annex 4: Questionnaires

	Outputs	Comments	Recommendations
Attainment of objectives and planned results			
1. Preparation of factual material for information in the review of legislation			
2. Suggested policy options to better safeguard aquifers			
3. Identification of sources of pollution within groundwater protection areas			
4. Improved understanding of the inter-relationship between surface water and groundwater			
5. Improved public awareness of the role of the subsurface in the functioning of a city			
6. Reliable information to enable governments and other decision makers to make environmentally sound decisions.			
7. Technical co-operation among countries so that the establishment of a regional network to monitor groundwater pollution			
8. Enhanced development of public attitudes			
Sustainability			
Establishment of process			
Capacity building			
Education			
Stakeholders participation			
Dissemination of knowledge			
Local/Regional implementation			
Country ownership			
Dissemination of knowledge			
Regulatory impact			
Education			
Implementation approach			
Dissemination of knowledge			
Regulatory impact			
Legal changes			

Part B - Technical checklist/rating	
Assessment of groundwater vulnerability	
2.1 INFORMATION ON THE DELIVERY OF THE PROJECT/PROGRAMME ACTIVITIES	Result/Impact
(a) Establishment of country task forces and a regional meeting involving new and participants from the previous project (Phase 1).	
(b) Selection of survey areas that will serve as references for future monitoring studies by the new participants.	
(c) Compilation of data for the assessment of major threats.	
(d) Connecting countries through the network via the internet.	
Identification of hot spots and major threats to aquifers in African urban areas	
(a) Establish a monitoring system in each country as well as a regional database.	
REGIONAL DATABASE	
(b) Compilation and interpretation of data on variations in physical and chemical properties of groundwater (sampling and analysis of water sample: groundwater from boreholes, wells and springs).	
(c) Compilation of data on changes in water quality and contaminants (physical and chemical characteristics).	
(d) Conducting of field surveys, monitoring of wells and boreholes, springs and hydraulically-connected water bodies.	
(e) Design and preparation of maps, identification of hot spots and major threats (scanning and digitization of cartographic, geological maps - realizing vulnerability maps using existing software of Geographical Information System - GIS).	
(f) Sampling and assessing ground water quality (both in west African countries and new countries).	
Actions for safeguarding groundwater aquifers in urban areas	
(a) Training course on estimation of groundwater recharge (substituted with groundwater protection).	
(b) Training on the implementation of GIS in groundwater pollution mapping.	
(c) Promotion of concerted action to create public awareness.	
Hydrogeological conceptualization of groundwater pollution mapping	
(a) Testing and adaptation of existing conceptual hydrogeological models.	
(b) Developing a clear conceptual model of the groundwater setting, in terms of both aquifer system and status of exploitation in each city.	
Vulnerability	
Resource	
(c) Training of technical staff selected in the participating countries in the use of suitable tools; and	

Annex 5: Plan of Action for the Biennium

The plan of action recommended for the 2003-04 biennium is to establish and fund an extension to the present project for a further two years. A draft project document for this extension has been prepared by UNEP, based on projected funding by the Belgian Government. The following is a summary of the proposed project extension:

Title of Sub-Programme:	Environmental Assessment and Early Warning
Title of Sub-Programme Element:	Environmental Assessment and Reporting
Title of Project:	Assessment of the Pollution Status and Vulnerability of Water Supply aquifers in African Cities
Project Number:	60
Geographical Scope:	Africa
Implementation:	UNESCO/IHP- Division of International Hydrological Programme under leadership of UNEP Division of Environmental Assessment and Early Warning (DEWA)
Project Duration:	24 months (October 2002 - September 2004)

	Total (US\$)	%
Project Costs (in US\$)		
External Funds (Contribution by the Belgian Government)	400,000	80
Cost to DEWA (in kind)	15,000	3
Cost to UNESCO/IHP (in kind)	15,000	3
Cost to 10 Countries (in kind)	70,000	14
Total	500,000	100

We would recommend that this document be used as the basis of the plan of action for the next two years. The document requires some redrafting in the light of the recommendations of this evaluation (Section 6). We would also recommend that a hydrogeologist be used in the drafting team to ensure that the targets set out in the project document are pertinent to the aims of the project, attainable within the project, and tied to the outputs demanded by the project.

We would also suggest that careful attention should be paid to the following features of this evaluation:

Employment of a local liaison officer or equivalent for West Africa: We believe this to be a most important recommendation that would considerably improve the management of the project in this region.

GIS reinforcement training: Training will be needed for the staff of new countries entering the project, but ongoing training is also considered important to maintain the skills in existing participating countries.

Groundwater pollution transport modelling: The purchase of VISUAL MODFLOW for Windows and training in its use should be a priority for the first year of the project extension.

Public information seminars: We recommend that a series of public seminars be held to disseminate information from the project to local communities, as envisaged (but not undertaken) in the existing project. These seminars would be in addition to the technical seminars, and would form part of the overall awareness-raising activities of the project.

New countries: The number of new countries should be severely limited and, for logistical reasons, their geographical spread should also be limited. The secure introduction of Ghana to the existing network of countries should be prioritised so that this can act as a template for the introduction of additional countries. The new countries or cities should be chosen from very practical viewpoints; the chosen cities must be dependent on groundwater for their potable water supplies so that they have an incentive to join. In addition, there should be in place institutional and analytical facilities sufficiently advanced to ensure the project's success.

Annex 6: Long Term Strategy

The purpose of the plan of action for the next biennium is to consolidate the excellent progress made in the present project. The long-term strategy is to carry this consolidated programme of groundwater pollution monitoring and early warning through the next decade.

The fundamental bases of the proposed long-term strategy will be twofold:

- To increase the skill base of the participating countries;
- To increase the impact and profile of the project to ensure an increase in awareness of the importance of groundwater pollution to water resources and public health.

These two bases will be used to make the public aware of the need for pollution prevention action and to give politicians the evidence to enact *and enforce* pollution prevention legislation. The long-term aim of the programme must be to empower a population to enforce pollution prevention measures, otherwise providing monitoring and early warning systems will remain an academic exercise.

In order to fulfil this long-term aim, the strategy action plan would cover three main sectors:

Improved facilities: The strategy would ensure that all countries have access to the necessary physical facilities to undertake their work, including computers, scanners, digitisers and relevant software. They must also have access to the internet and e-mail.

Emphasis should also be placed on improving access to analytical facilities. At present, these are limited in some countries but, as the project expands, access to a wider range of determinants (e.g. nutrients, organic compounds, microbiology) will be required at a reasonable cost. New laboratories may be needed to meet these needs.

Training: The most cost-effective way of improving the skill base in a country is through training. In the long term, this could be provided in several ways:

- Training seminars to provide specific skills, including computer skills (word processing, data processing, graphics);
- Training seminars to provide skills in specific software (e.g. ARCVIEW, MODFLOW);
- Training in hydrogeology, groundwater contamination, and water resource management;
- Training in management skills;
- Training in techniques for water sampling and laboratory analyses.

Such focused training could be provided as one-off seminars through a central training agency, or, more usefully, as part of an overall training strategy involving a mix of centralised and local, internal training, new training and reinforcement training. The national skill base would also be raised by the members of the taskforces being able to use the experience and data from the project as material for post-graduate studies (MSc or PhD). This academic aspect could be enhanced by granting bursaries to members of staff.

Publicity: The long-term sustainability of the programme will depend upon its ability to attract long-term funding, which will in turn depend upon its ability to raise the profile of the project on the international development scene. In order to do this, the project should seek to initiate a high-profile publicity campaign, perhaps even utilising the services of professional publicists. Such a campaign should include high-quality reproduction of the project's reports and bulletins, together with press releases, dissemination of project news to national and regional media channels, and interviews with project staff in newspapers and periodicals, and on radio and television news programmes.

Annex 7: Terms of Reference for the Final Project Evaluation

Objective and scope of the evaluation

The objective of this terminal evaluation is to review and evaluate the implementation of planned project activities and outputs against actual results, establish project impacts based upon the objectives and results described in the project outline, and gauge the potential for sustainability and the execution performance.

The focus will be on two questions:

- Whether the assessment and technical capacity-building efforts, including stakeholder involvement and collaboration, have been relevant, timely and effective;
- Whether the technical information produced is of a scientific quality and standard that can serve as a reliable reference model, and contribute to national and regional urban groundwater assessment activities.

The evaluation assessed, among other things:

- Delivered outputs: The project's success in producing each of the programmed outputs, in terms of their quantity, quality, usefulness and timeliness;
- Project outcomes and impact: The project's success in achieving its outcomes;
- Project sustainability;
- Execution performance: Effectiveness and efficiency of project management and supervision of project activities.

The analysis of impact and outcomes achieved should include, *inter alia*, an assessment of attempts to integrate the project's findings into water resource management methods and plans at national and sectoral levels, and the level of involvement of national decision-makers and stakeholders with the aim of integrating some of the outcomes of the data studies into other activities.

The sustainability assessment should address financial sustainability, stakeholder ownership, and national institutional frameworks and governance, and identify how the outcomes of the project have been upscaled and replicated. The extent of synergies created with related activities such as the GEMS/Water project and the UNFIP/Habitat project on 'Water for African Cities' should also be discussed.

The evaluators will rate the overall implementation success of the project and provide individual ratings of implementation aspects as described in Section 3 of this TOR. The ratings will be presented in the form of a table with brief justifications based upon the findings of the main analysis.

The evaluators shall make recommendations on how to advance technical cooperation among participating countries and replicate the project activities in other countries in Africa, how to effectively inform national decision-making processes on groundwater resources protection and management, and how to strengthen linkages with other relevant regional and international projects, and make recommendations that may assist future UNEP and UNESCO interventions in programmes and deliveries.

Furthermore, the evaluation shall highlight lessons learned, both positive and negative, from the standpoint of the design and implementation of the project, which should be geared towards enhancing regional technical capacity and making technical information useful to governments and decision-makers.

The evaluation should critically review activities supported by UNEP and UNESCO through this project. The performance indicators provided in the project document and those developed by the evaluators should be used together with the evaluation parameters of appropriateness, effectiveness and efficiency, impact and sustainability. The evaluators should, during this review, assess the soundness of the project design, objectives, results, outputs and activities.

Terms of reference

The evaluators shall:

- a) Determine the relevance of the project to priorities identified in Africa by WEHAB and NEPAD and conformity with the mandates and programmes of UNEP and UNESCO.
- b) Determine to what extent the project's objectives were met and the planned main results attained, taking into account the outcomes, outputs and activities listed in the original project document:
 - To what extent the project has developed a variety of approaches to groundwater protection, ranging from legislative measures at national level to municipal measures at local level;
 - To what extent the project has improved public awareness of and attitudes towards water resource management issues;
 - To what extent the project has, through the delivery of reliable information, enabled governments and other decision-makers to make environmentally sound decisions on land use and groundwater management;
 - To what extent the project has fostered technical cooperation between the participating countries and stimulated higher professional competencies in the region.
- c) Determine the quality and usefulness of the technical reports, training manuals and formats, data and information systems, and the use and quality of the project website in the dissemination of its results.
- d) Assess the cost-effectiveness of the activities of the project and whether they have achieved the goals and objectives within planned and/or reasonable time and budget.
- e) Determine the level of participation of various stakeholders in the project (e.g. governments, policy- and decision-makers, universities, institutions, NGOs and community-based organisations).
- f) Establish the training uptake and follow-up in practice of lessons learned, tools, methods, and sound water resource management practices generated by the project.
- g) Establish the role of the country teams and their contributions to the implementation of the project and any follow-up activities.
- h) Assess the effectiveness of technical support and administrative and financial support provided by UNEP-DEWA and UNESCO-IHP.
- i) Assess the contribution of the project's outputs and activities to building capacity and catalysing informed sustainable national water resource management in the participating countries.
- j) Establish cooperation and synergies created with other international and regional initiatives and other activities on water resource management in Africa.
- k) Review the adequacy of the outline of the project document (activities, outputs, results and objectives), developed M&E systems, tracking of data and reported results, and the usefulness of the M&E system for project management – in particular with regard to ensuring that activities were carried out according to the time-plan.
- l) Review the project's implementation approach and assess whether the project document and work plan were clear and realistic to enable effective and efficient implementation, whether the project was executed according to the plan, and how well the management was able to adapt to changes during the life of the project to enable implementation. The evaluators should also establish how well the project identified and managed its risks.
- m) Review sustainability arrangements and the follow-up of project activities and outputs, including contributions to other international and regional activities. Assess possibilities for mobilising extra budgetary funding of activities.
- n) Determine whether this project or its components have potential for replication. The evaluators shall also identify any steps taken towards replication within the framework of the project and assess the relevance and feasibility of these steps.
- o) Identify problems encountered and lessons learned during the project implementation.
- p) Provide recommendations for the follow-up of the project and the design and execution of future activities that focus on water resource management.

Methodology and rating

This final evaluation will be conducted as an in-depth evaluation using a participatory approach through which the responsible project staff are kept informed and regularly consulted throughout. The consultant

will consult with the UNEP-DEWA Senior Environmental Affairs Officer and the UNESCO-IHP Regional Hydrologist on any logistical and/or methodological issues to properly conduct the review in as independent a way as possible given the circumstances and resources offered. The findings of the evaluation will be based upon:

- Interviews with UNEP-DEWA and UNESCO Nairobi project staff;
- Field visits to one or two participating countries to interview staff from participating institutions, and informed government officials, decision-makers and NGOs, if deemed feasible within the evaluation budget;
- Interviews with representatives from all national participating lead institutions involved in the project;
- Interviews with consultants/specialists involved in the implementation of specific project activities;
- Interviews of a sample and/or survey of trained scientists and other stakeholders;
- Desk review of the project document, outputs, financial and monitoring reports (such as the quarterly and semi-annual reports to UNEP), and relevant correspondence, as well as the technical mid-term review report;
- Desk review of the technical reports prepared, bulletins and related documents for reference and methodology adoption;
- Desk review of the website.

The success of project implementation will be rated on a scale of 1 to 6, with 1 being the highest rating and 6 being the lowest. The following implementation aspects should be considered for rating purposes:

- Attainment of objectives and planned results;
- Achievement of outputs and activities;
- Cost-effectiveness;
- Impact;
- Sustainability;
- Stakeholders' participation;
- Country ownership;
- Implementation approach;
- Financial planning;
- Replicability;
- Monitoring and evaluation.

A brief terminology of the implementation aspects is available upon request. Each of the items should be rated separately and then an overall rating given. The following rating system is to be applied:

HS = Highly Satisfactory
 S = Satisfactory
 MS = Moderately Satisfactory
 MU = Moderately Unsatisfactory
 U = Unsatisfactory
 HU = Highly Unsatisfactory.

Evaluation report format and procedures

The evaluation report shall be a detailed report, written in English, of no more than 30 pages (excluding annexes), which will include:

- i) An executive summary (no more than 3 pages)
- ii) Introduction and background
- iii) Scope, objective and methodology
- iv) Project performance and impact
- v) Conclusions and rating of project implementation success
- vi) Lessons learned
- vii) Recommendations
- viii) Annexes, if any, fully typed.

The final report shall be submitted in electronic form in MS Word to the following persons:

Segbedzi Norgbey,
Chief, Evaluation and Oversight Unit, UNEP,
P.O. Box 30552,
Nairobi 00100, Kenya.
Tel.: (254-20) 7623387
Fax: (254-20) 7623158
Email: segbedzi.norgbey@unep.org

With copies to:

Salif Diop,
Senior Environmental Affairs Officer,
Head, Ecosystems Section and Water Unit,
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The evaluation report will be printed in paper copy and published on the Evaluation and Oversight Unit's website (www.unep.org/eou).

Resources and schedule

The contract for this evaluation will begin on 3 July 2005 and end on 29 August 2005 (four weeks spread over eight weeks). The consultant will submit a draft report to EOU on 15 August 2005, with a copy to the Senior Environmental Affairs Officer, DEWA, and the Regional Hydrologist, UNESCO Nairobi, for initial comments. Comments on the final draft report will be sent to the consultant by 22 August 2005, after which the consultant will submit the final report no later than 29 August 2005.

In accordance with UNEP policy, all UNEP projects are evaluated by independent evaluators contracted by the EOU. The evaluators should not have been associated with the design and implementation of the project. The evaluators will work under the overall supervision of the Chief of Evaluation and Oversight and in close collaboration with a staff member from the EOU. The evaluators should have the following minimum qualifications: (i) experience with project management and implementation, and in particular with projects that generate data and information networks, knowledge and information; (ii) scientific expertise in water-related assessments; and (iii) experience with project evaluation. Working experience in the region is required and excellent command of spoken and written English and French. Knowledge of UNEP and UNESCO programmes and activities are desirable.

The evaluators will travel to South Africa to meet with participants on the course on Fractured Rock Aquifer Assessment, which will be held from July 4-6 2005 at the University of the Western Cape in Cape Town. The consultant may also travel to Zambia and Ethiopia to visit other participating countries.

Schedule of payment

The evaluators will receive an initial payment of 40% of the total amount due upon signature of the contract. Final payment of 60% will be made upon satisfactory completion of the work. The fee is payable under the individual SSAs of the evaluators and is NOT inclusive of all expenses, such as travel, accommodation and incidental expenses. Ticket and DSA will be paid separately.

In case the evaluators cannot provide the products in accordance with the TORs, the timeframe agreed, or the products are substandard, the payment to the evaluators could be withheld, until such a time as the products are modified to meet UNEP's requirements. In case the evaluators fail to submit a satisfactory final product to UNEP, the product prepared by the evaluators may not constitute the evaluation report.

9 June 2005

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This project, Assessment of the Pollution Status and Vulnerability of Water Supply Aquifers of African Cities, is a follow up to the project, The Urban Pollution of Surficial and Groundwater Aquifers in Africa. The focus of the two projects has been on pollution threats to groundwater arising from unplanned expansions, effluent leakages in open sewers, leaking septic tanks, latrines, domestic waste disposal, and uncontrolled industrial and commercial activities. The objective is to extend the projects' scope and coverage to other African countries in order to establish a pilot network of early warning contamination and trend detection for urban and peri-urban water supply aquifers. This has been achieved through four main clusters of activities.

This report presents the results from the final evaluation of the project. The objective of the evaluation was to review and evaluate the implementation of planned project activities and outputs against actual results, establish project impacts as described in the project outline, and evaluate the project's execution performance and potential for sustainability.

For further information:

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