

**THE WORLD BANK INDEPENDENT EVALUATION GROUP****An Independent Evaluation of the World Bank's  
Support of Regional Programs****Case Study of the Guarani Aquifer Project****John Eriksson and Peter Rogers**

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***ENHANCING DEVELOPMENT EFFECTIVENESS THROUGH EXCELLENCE  
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## **Acronyms**

CAS	Country Assistance Strategy
CC	Coordination Council
CIDA	Canadian International Development Agency
CSO	Civil Society Organization
GEF	Global Environment Facility
MERCOSUR	MercadoSur (Southern Common Market)
M&E	Monitoring and Evaluation
MTR	Midterm Project Review
NC	National Coordinators
NGO	Nongovernmental Organization
NPEU	National Project Executing Unit
OAS	Organization of American States
PAD	Project Appraisal Document
SC	Steering Committee
TA	Technical Assistance
TDA	Transboundary Diagnostic Analysis

# Preface

## EVALUATION OBJECTIVES AND METHODOLOGY

This review of the Guarani Aquifer Project is one of 19 reviews undertaken as part of an independent evaluation by the Independent Evaluation Group (IEG) of the effectiveness of World Bank support for multicountry regional programs over the past 10 years (1995-2004). Seven of the reviews are field-based, including the Guarani Aquifer assessment; the other 12 reviews are desk reviews.

All reviews draw on core program documentation, program progress reports, self and/or independent program evaluations, related Bank country assistance strategies (CAS) and sector strategies, and interviews with key Bank staff. The Guarani Aquifer field review mission during January 16–27, 2006, also involved extensive in-country interviews with government officials, private sector stakeholders, and other knowledgeable individuals. See Annex E for a list of people interviewed and Annex F for a list of references,

There have been limitations in assessing the Guarani Aquifer project since the Project has been operational only since June 2002, and no independent evaluations were available at the time of this assessment. The first midterm management review of the project took place in February 2006.

## EVALUATION CRITERIA

The 19 reviews use the IEG evaluation criteria of relevance, efficacy, and efficiency. In addition, they assess the Bank's performance and examine the performance of the regional program's participating countries. The key evaluative questions addressed under these criteria—designed to deal with the special characteristics of multicountry programs—are as follows.

### *Relevance*

- **Subsidiarity:** To what extent is the program being addressed at the lowest level effective, and either complements, substitutes for, or competes with Bank country or global programs?
- **Alignment:** To what extent does the program arise out of a regional consensus, formal or informal, concerning the main regional challenges in the sector and the need for collective action? To what extent is it consistent with the strategies and priorities of the region/subregion, countries, and the Bank?
- **Design of the regional program:** To what extent is program design technically sound, and to what extent does it take account of different levels of development and interests of participating countries, foster confidence and trust among participants necessary for program implementation, and have clear, monitorable objectives?

## *Efficacy*

- **Achievement of objectives:** To what extent has the program achieved, or is it likely to achieve, its stated objectives, including its intended distribution of benefits and costs among participating countries?
- **Capacity building:** To what extent has the program contributed to building capacities at the regional and/or participating country levels?
- **Risk to outcomes and impact:** To what extent are the outcomes and impacts of the program likely to be resilient to risk over time? To what extent have the risks to project outcomes been identified and measures to integrate them been undertaken?
- **Monitoring and Evaluation:** Has the program incorporated adequate monitoring and evaluation processes and taken care of available findings?

## *Efficiency*

- **Efficient use of resources:** To what extent has the program realized, or is it expected to realize, benefits by using reasonable levels of time and money?
- **Governance, management, and legitimacy:** To what extent have the governance and management arrangements clearly defined key roles and responsibilities; fostered effective exercise of voice by program participants and coordination among donors; contributed to or impeded the implementation of the program and achievement of its objectives; and entailed adequate monitoring of program performance and evaluation of results?
- **Financing:** To what extent have financing arrangements affected positively or negatively the strategic direction, outcomes, and sustainability of the program?

## *World Bank's Performance*

- **Comparative advantage and coordination:** To what extent has the Bank exercised its comparative advantage in relation to other parties in the project and worked to harmonize its support with other donors?
- **Quality of support and oversight:** To what extent has the Bank provided adequate strategic and technical support to the program, established relevant linkages between the program and other Bank country operations, exercised sufficient oversight of its engagement, and developed an appropriate disengagement strategy for the program?
- **Structures and Incentives:** To what extent have Bank policies, processes, and procedures contributed to, or impeded, the success of the program?

## *Participating Countries' Performance*

- **Commitments and/or capacities of participating countries:** How have the commitments and/or capacities of participating countries contributed to or impeded the success of the program? Have one or more countries exercised a primary leadership role?
- **Program coordination within countries:** To what extent have there been adequate linkages between the regional program's country-level activities and related national activities?

# Executive Summary

## Background

1. Surface water and groundwater are plentiful resources in the eastern part of mid-southern South America. The La Plata River Basin system is one major source of surface water used for agricultural and industrial purposes as well as for domestic water supply. In the early 1990s, what had been thought to be a series of unconnected underground reservoirs was discovered to be linked into a system called the Guarani Aquifer system (or Sistema Acuífero Guaraní—SAG).

2. The La Plata River Basin provides a major source of recharge for the SAG, which comprises one of the largest reservoirs of groundwater in the world, with current water storage of 37,000 cubic kilometers and a natural recharge of 166 cubic kilometers per year. The SAG underlies approximately 850,000 square kilometers in southern Brazil, 225,000 square kilometers in northeastern Argentina, 70,000 square kilometers in eastern Paraguay, and 40,000 square kilometers in northern Uruguay. The main use of the aquifer is for domestic water supply, followed by industrial, agricultural, and thermal tourism uses.

## Program Summary Description

3. In 2000, Argentina, Brazil, Paraguay, and Uruguay initiated the Environmental Protection and Sustainable Development of the Guarani Aquifer System Project, to study and plan for the long-term management of the SAG. The project took two years to develop, and was approved by the Global Environmental Facility (GEF), as the main international funder, and by the Bank in July 2002. The Bank serves as the “implementing agency” and the Organization of American States (OAS) serves as the “executing agency.” In practice, this means that the Bank and the OAS perform somewhat overlapping roles, with the Bank providing overall fiduciary and substantive oversight for the GEF and the OAS, with a representative on the ground in Argentina serving as financial and human resources manager. The total cost of the ongoing project was estimated at \$26.8 million, of which half, or \$13.4 million, was financed by a GEF grant, \$12 million by the four countries in equal amounts, and the remainder in the form of technical assistance from other donors.

4. The project’s overall goal is to support the beneficiaries—Argentina, Brazil, Paraguay, and Uruguay—in jointly elaborating and implementing a common institutional and technical framework for the management and preservation of the SAG, with a focus on preventing overuse and contamination (rather than remediation measures). The sub-objectives are:

- To expand and consolidate the current scientific and technical knowledge base of the SAG;
- To create a well monitoring network and SAG information system;
- To develop a transboundary diagnostic analysis (TDA) and strategic action plan );



- To harmonize water policies and management tools among the four participating countries.

5. To fulfill these objectives, the project supports activities falling under seven components: (1) knowledge gathering on the SAG; (2) joint development and implementation of a strategic action plan, including a SAG management framework; (3) development of groundwater management and mitigation measures in four critical local areas; (4) promotion of public participation, social communication, and environmental education; (5) assessment of the potential use of geothermal energy (“clean energy”); (6) project monitoring and evaluation, and dissemination of project results; (7) project coordination and management. The bulk of this work is being undertaken at the regional level, mainly by two large contracts based in Uruguay involving consulting firms and local university researchers. The work is being managed by a multinational General Secretariat and governed by a regional Coordination Council and Steering Committee, comprised of senior technical and managerial officials of the water, environment, and foreign affairs ministries of the member countries.

### **Rationale for a Regional Program**

6. The basic rationale for the regional scope of the project is that the Guarani Aquifer is a shared resource and a regional public good. Each country has an interest in developing and sustaining its surface water and groundwater resources. This requires regional cooperation and coordination, initially for research and analysis, since both surface water and groundwater cross boundaries.

### **Quality of Design and Implementation**

7. Knowledge gathering is critical to this project. The design of the project appropriately includes as its major components two large contracts intended to enhance knowledge about the quantity, quality, and dynamics of the aquifer. But these contracts are one to two years behind schedule. They should have been implemented by now, but were substantially delayed due to complex procurement rules and procedures of both the OAS and World Bank and the bureaucracies of the participating countries. Therefore, the February 2006 Midterm Project Review (MTR) decided to extend the project by two years to March 2009.

Even with the time extension, the goal of implementing a common institutional and technical framework for the management and preservation of the SAG is an ambitious one. Although most of the components are considered highly relevant and effective, costs and strategic complexities make some of them problematic. For instance, the public participation component, though significant, was undermined by the Bank’s failure to develop and implement the strategy in sufficient time to prevent the spread of incorrect and potentially damaging information by some NGOs. The component to assess geothermal use is of questionable value: the Guarani Aquifer’s water temperatures are too low to produce steam for power generation, except if they are combined with other energy sources. Finally, monitoring and evaluation, as well as project coordination and

management, although essential, account for a relatively high 15 percent of total expenditures, due at least in part to the project's regional structures and complexity.

### **Program Achievements**

8. It is unlikely that the overall project goal or even the four sub-objectives will be achieved within the original project year of 2007. The four pilot projects have been monitoring use and contamination of the aquifer and promoted some remedial measures, such as lining solid waste sites. But reported progress on the scientific work has been limited, due primarily to the substantial delays in negotiating the large contracts, as already noted.

9. In the view of stakeholders, the General Secretariat's coordination and management of the project has been reasonably effective. However, the scope and size has not yet been determined for a central coordinating entity that will continue after project the closes, in order to manage unfinished work, such as developing the management framework for the aquifer.

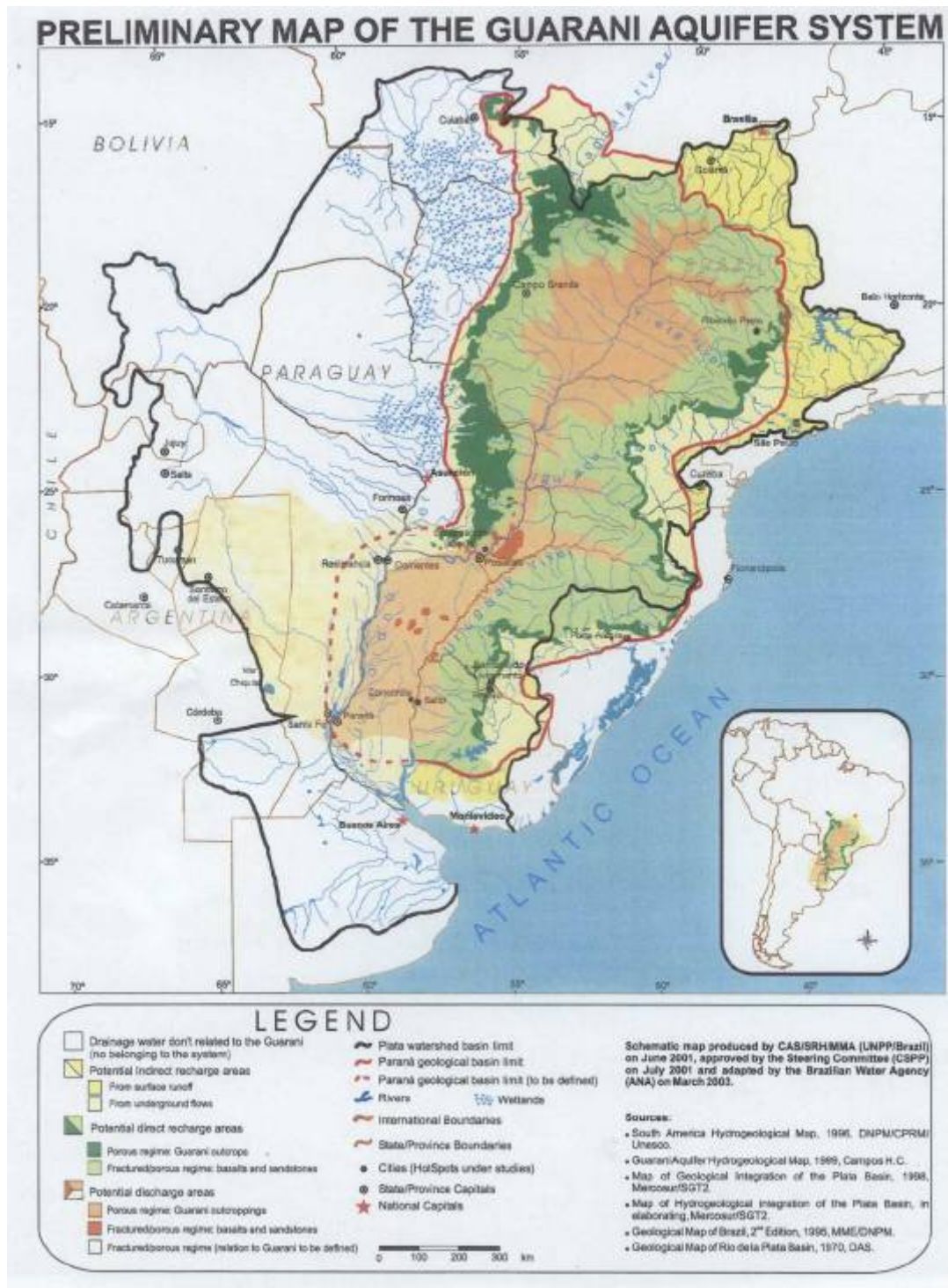
10. Capacity building is a key aspect of the project, and significant progress has been made in creating and strengthening institutions as proposed by the project. Each of the institutions created—Steering Committee, Coordination Council, National Project Executing Units, and General Secretariat—appears to be working reasonably well in guiding and managing the project. Initial collaborative work by the universities and professional consultants under one of the large contracts is enhancing capacity on groundwater science and technology. In addition, all of the institutions set up by the SAG have now incorporated civil society participation. But it is not clear that the institutions in each of the four countries that are to manage and preserve the SAG will be up to the task by the project's extended completion date in March 2009.

### **Effectiveness of World Bank Performance**

Overall, the Bank appears to have maintained effective working relationships with the GEF, the OAS, and other donor partners. Stakeholders give Bank staff high marks for its technical expertise during project preparation and implementation. Yet, procurement procedures have been cumbersome due to the frequent need for approvals from the OAS, the GEF, and the World Bank, and disbursements have been slow as a result of delays in negotiating major multimillion dollar contracts under the project.

# 1. Introduction

Figure 1.1



## CHALLENGES FACING THE SECTOR

1.1 Surface water and groundwater are plentiful resources in the eastern part of mid-southern South America. The La Plata River Basin system is a major source of surface water used for agricultural and industrial purposes as well as for domestic water supply.

1.2 Along with surface water, sub-surface water or groundwater has been tapped in the subregion, especially for drinking water, for decades or longer. In the early 1990s, what had been thought to be a series of unconnected reservoirs was discovered to be linked into a system called the Guarani Aquifer System (or Sistema Acuífero Guaraní—SAG—in Spanish).<sup>1</sup> The water is found in the pores and fissures of sandstones, formed during the geological times of the Mesozoic Era (between 130 million and 200 million years ago). Thick layers of relatively impermeable basalt have typically confined the aquifer.

1.3 The SAG comprises one of the largest reservoirs of groundwater in the world, with current water storage of 37,000 cubic kilometers and a natural recharge of 166 cubic kilometers per year, of which the La Plata Basin is a major source. The water can be found between 50 meters to 1500 meters deep, with temperatures varying between 33°C and 65°C. The SAG underlies approximately 850,000 square kilometers in southern Brazil, 225,000 square kilometers in northeastern Argentina, 70,000 square kilometers in eastern Paraguay, and 40,000 square kilometers in northern Uruguay (see Figure 1.1). With a total area of about 1,185,000 square kilometers, the aquifer is somewhat over twice the size of France.<sup>2</sup>

1.4 Approximately 24 million people live in the area delimited by the boundaries of the aquifer and a total of 70 million people live in a larger area benefiting from water diverted from the aquifer (for example, São Paulo). The main use of the aquifer is for domestic water supply, followed by industrial, agricultural and tourism uses.

1.5 While there is not an overall current crisis requiring remediation with respect to the Guarani Aquifer System, exploitation in some areas, such as Ribeirao Preto, has grown rapidly, and some experts believe withdrawal may be exceeding recharge rates.<sup>3</sup> The intention of project efforts is to prevent significant depletion or contamination within and across national boundaries. So far, pollution is more significant in surface water systems in the subregion, such as the La Plata River Basin, than in the SAG.

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<sup>1</sup> The commonly used Spanish acronym for the Guarani Aquifer System, “SAG,” which is the same in Portuguese, will be used throughout this report.

<sup>2</sup> The dimensions of the aquifer are still approximate. One sub-objective of the project is to arrive at more precise measurements.

<sup>3</sup> Comment from a project team member, April 2006.

## REGIONAL PROGRAM SUMMARY DESCRIPTION

1.6 The study delineating the main outlines of the Guarani Aquifer in the early 1990s, undertaken by four universities in the subregion with support from the Canadian International Development Agency (CIDA), concluded that additional external funding would be needed to obtain scientific and technical knowledge sufficient to intelligently assess the development of the aquifer resources. When support from CIDA ended, the universities approached the OAS but were told that it did not support academic research. The OAS referred them to the World Bank, who in turn contacted the Global Environment Facility (GEF) because of the multicountry environmental implications. Ultimately four countries—Argentina, Brazil, Paraguay, and Uruguay—requested support from the GEF for a TDA study and studies of future aquifer management and use, and potential project development.

1.7 The project became known as the Environmental Protection and Sustainable Development of the Guarani Aquifer System Project took two years to develop. After approval by the GEF council, the project was approved by the Bank’s Board in May 2002. The total cost was estimated at \$26.8 million, of which \$13.4 million was financed by a GEF grant; \$12.0 million came from counterpart contributions by recipient countries; and \$1.4 million, largely in technical assistance (TA), came from other donors (Germany, the International Atomic Energy Agency, and the Netherlands). According to the Trust Fund Grant Agreement of the GEF between the General Secretariat of the OAS and the World Bank, the four countries are designated as “Beneficiaries”; the OAS is designated as the “Recipient,”<sup>4</sup> and the World Bank is designated as the “Implementing Agency” of the GEF.<sup>5</sup>

1.8 The project development goal is to support the beneficiaries—Argentina, Brazil, Paraguay, and Uruguay—to jointly elaborate and implement a common institutional and technical framework for the management and preservation of the SAG.<sup>6</sup> There are seven components of the project. The first two components encompass four project sub-objectives as identified in Table 1.1. As can be seen from the table, over 80 percent of the estimated cost of the project is allocated to research, analysis, dissemination, and management. This is consistent with the project’s main focus on prevention of overuse and contamination rather than remediation measures. The bulk of the project work is being undertaken at the regional level, mainly by two large contracts based in Uruguay, composed of consulting firms and local university researchers. A relatively small portion (14 percent of the total estimated cost) is devoted to pilot projects in four local areas in the four participating countries. The overall project is managed by a multinational

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<sup>4</sup> In the World Bank PAD, the OAS is designated as the “Project Executing Agency.”

<sup>5</sup> *Global Environment Facility Trust Fund Grant Agreement: Environmental Protection and Sustainable Development of the Guarani Aquifer System Project*, GEF Trust Fund Grant Number TF050950, effective date July 27, 2002, pp. 2-3.

<sup>6</sup> *Trust Fund Agreement, op. cit.*, p. 14.

General Secretariat<sup>7</sup> and governed by a regional Coordination Council and Steering Committee.

1.9 Financing of a second phase to the SAG Project by the GEF will depend, among other things, on agreement by the participating countries on the yet-to-be produced strategic action plan and the accompanying management framework. These documents also will heavily influence the size and shape of any central coordinating mechanism, such as the General Secretariat.

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<sup>7</sup> The Spanish acronym, SG, will be used in this report.

**Table 1.1 Goal: Elaboration and Implementation of a Common Institutional and Technical Framework for the Management and Preservation of the SAG**

Sub-objectives	Components	Estimated Cost (\$ million)	As % of Total
Expand and consolidate the current scientific and technical knowledge base of the Guarani Aquifer System	<b>1.</b> Expand and consolidate the current scientific and technical knowledge base of the Guarani Aquifer System	9.9	36.9%
Create well monitoring network and SAG information system			
Develop strategic action plan and TDA	<b>2.</b> Joint development and implementation of a coordinated SAG management framework		
Harmonization of water policies and management tools among the four participating countries		7.1	26.5%
	<b>3.</b> Development of groundwater management and mitigation measures in four critical local areas	3.7	13.8%
	<b>4.</b> Promotion of public participation, social communication, and environmental education	1.3	4.9%
	<b>5.</b> Assessment of geothermal energy potential use	0.3	1.1%
	<b>6.</b> Project monitoring and evaluation, and dissemination of project results	0.5	1.9%
	<b>7.</b> Project coordination and management	4.0	14.9%
	<b>Total</b>	26.8	100.0%

## **2. Relevance: Rationale, Alignment, and Design**

2.1. *Summary.* The Guarani Aquifer Project is relevant to the issues of integrated water resource management in the region. Given the transboundary nature of the aquifer, its likely (slow) movement across boundaries, and its interaction with transboundary surface bodies of water, a major portion of the research and analysis supported by the project must necessarily be undertaken at a regional level. Thus, the project follows the subsidiarity principle. Attention to water management issues in development planning in the region has increased, but there has been little consideration of groundwater management and of the interaction (or conjunctive use) between groundwater and surface water systems. The Guarani Aquifer Project itself appears to have strong official support from the four participating countries, as well as from a number of (but not all) civil society organizations. The project design is sound and well-articulated. Although the number of indicators—over 60—is very large and should be streamlined, the project components and sub-objectives are relatively clear and monitorable. But the four impact indicators are not measurable as defined.

### **SUBSIDIARITY PRINCIPLE**

2.2. The basic rationale for the Guarani Aquifer Project's regional scope is that the aquifer lies beneath four countries. It is therefore a shared resource and a regional public good; each country has an interest in developing and sustaining its water resources. So far most of the efforts have focused upon surface water; now the use of groundwater is also receiving attention. The main emphasis of the project is prevention of overuse and contamination rather than remediation. This requires regional cooperation and coordination, especially for research and analysis, since both surface water and groundwater cross boundaries.

2.3. Who are the potential winners and losers at the regional, country, and local levels? Depending upon the direction and rate of groundwater fluctuations, water quality could deteriorate in the direction of the flow. Within and among countries, serious conflicts may arise among water users as the artesian pressures drop, or new large-scale irrigation is developed. There is also potential for conflict between users and polluters within and among countries. A regional approach to relevant research and analysis is therefore advantageous for both economic and political reasons.

### **ALIGNMENT WITH COUNTRY, REGIONAL, AND BANK GOALS AND STRATEGIES**

2.4. While the management of surface water is a big issue in the region, particularly in Brazil where the demands for water are currently large, the management of groundwater is a new issue for the four countries. Transboundary groundwater has not been considered until this project. New analyses and approaches are required both within the countries and among them on bilateral and multinational bases.

2.5. Water sector policies have not been aligned with the development policies of other sectors, nations, and regions, and groundwater has not been considered in an



integrated sense. In mid-January 2006, the National Water Resources Council of Brazil approved a National Integrated Water Resources Management Plan, which includes a chapter on groundwater for the first time. But the plan approached groundwater as a separate issue and did not deal with the conjunctive use of groundwater with surface water, or with the use of both resources in broader Brazilian development objectives.<sup>8</sup> Other countries are not as far along in the process and in no case is water viewed as an important consideration outside of the narrow concept of the water sector.

2.6. A regional consensus for the SAG originated in research 15 years ago that discovered the potential interconnectedness of several smaller regional aquifers into an aquifer of global importance. At the same time, the demands on water resources were growing rapidly, which led to calls for improved management of existing resources and the development of new ones: for example, in Brazil the new water law of 1997 led to a complete revamping of water policy.

2.7. In addition, regional hot spots that affected water availability or quality were being discovered. For example, Uruguay is concerned that use of the Guarani Aquifer waters in Concordia, Argentina, will adversely affect the growing hot-springs tourist industry in bordering Salto, Uruguay. Groundwater contamination by solid waste disposal practices has become an issue for the border towns of Rivera, Uruguay, and Santana do Livramento, Brazil.

## **REGIONAL CONSENSUS**

2.8. According to the project appraisal document (PAD), the Guarani project has received strong national-level support from governmental institutions in each of the four countries that have actively participated in project preparation activities and workshops. The Brazilian Secretariat of Water Resources sponsored, with its own resources, a meeting in 2000 where the Guarani Aquifer Project was first identified and discussed with the other three countries as a project concept for GEF support. Subsequently, the Secretariat of Water Resources of Argentina, the National Hydrographic Directorate of Uruguay, and the ministries of Energy and Mining and of Public Works, respectively, of Paraguay, as well as the recently created Paraguayan Secretariat of Environment, have sponsored project workshops in Santa Fe (Argentina), Asuncion (Paraguay), and Salto (Uruguay). All four governments staffed their respective project preparation units using local financial resources. Representation at national meetings has been at the secretarial and ministerial levels and the four ministries of Foreign Affairs agreed to develop a first joint document indicating the countries' agreement with the project's objectives and developing some basic principles for collaboration regarding the Guarani Aquifer System. This support was confirmed in meetings between the mission and official and unofficial stakeholders in each of the four countries.

2.9. The project also received support from state governments in Brazil and provincial governments in Argentina (for example, the state of São Paulo, the state of

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<sup>8</sup> Telephone conversation between Peter Rogers and Bendito Braga, Director, Agencia Nacional de Aguas (ANA), Brasilia, Brazil, March 1, 2006.

Parana, and the province of Santa Fe). Support and collaboration also has been forthcoming from five major universities in the region<sup>9</sup> and a number of nongovernmental organizations (NGOs) have been actively involved in project preparation activities. Interest was demonstrated by a number of articles published in national magazines, newspapers, and on-line outlets, as well as special television reports within the region. According to the PAD (p.19), the governments' awareness that transaction costs of this project would be relatively high was not a "major obstacle to project preparation."

2.10. But the perception of the project has not been unanimously positive among all elements of civil society. Some NGOs—mainly in Argentina and Brazil—believed the project would lead to the privatization of the aquifer, benefiting industrial interests in North America. The project communications strategy, disseminated 18 months after the project had begun, has helped to counter these perceptions, but only after they had spread in both countries. NGO education activities, financed by the project's "Citizens' Fund," also have helped explain the scientific nature and potential benefits of the project to the region.

2.11. At the supranational level, both MERCOSUR (the Southern Common Market), through its Subgroup 6 (Environment), and the OAS supported project preparation. MERCOSUR had been contemplated as the executing agency for the project, but this option was rejected in part because MERCOSUR at this point is not a legal entity that would permit it to receive grant resources.

## **DESIGN OF THE REGIONAL PROGRAM**

2.12. Through the OAS, Argentina, Brazil, Paraguay, and Uruguay requested support from the GEF and the World Bank for a TDA and for studies of future aquifer management and use and potential project development. As noted above, this became the Guarani Aquifer Project. But transboundary aquifer management is in its infancy. There are no tried and true models that could be copied from other cases, underlining the need to experiment with a variety of project designs. In addition, because there is a dearth of detailed geohydrological data and water-use data, the project focuses on hard science and engineering, as well as institutional software to manage the aquifer.

2.13. An elaborate set of national and regional institutions and committees was established under the project. These are summarized here and discussed in further detail in Section 4: (a) a multinational Steering Committee at the governance level; (b) a

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<sup>9</sup> Universidad Nacional del Litoral and Universidad de Buenos Aires, Argentina; Universidade Federal do Parana, Brazil; Universidad Nacional de Asuncion, Paraguay; and Universidad de la Republica Oriental del Uruguay.

national coordinators council at the technical level; (c) the General Secretariat; and (d) a national project executing unit (NPEU) in each country.<sup>10</sup>

2.14. A central design issue is whether the overall project goal of “elaboration and implementation of a common institutional and technical framework for the management and preservation of the SAG” is realistic, given the scope and resources of the present project. The goal is an ambitious one, even with the proposed two-year extension of the project. Reasonable expectations from the present activities are an improved knowledge base and a framework of how the four countries can manage the aquifer resource at the regional and local levels. Such an outcome could define the aquifer’s extent and sustainability, its potential and current uses, and its vulnerability to pollution and contamination, as well as identify areas for protection and activities that would benefit from integrated management.

2.15. The seven components of the project have been summarized in a previous section (see Executive Summary and Table 1.1). The question of whether these are the right components and whether they are sequenced appropriately bears directly on the project’s design. While some components are clearly relevant and others are open to question.

- 1) **Knowledge gathering** to this project. A critical aspect of this component will be to map the volume, location, quality, contamination, and movement of the aquifer waters. Radioactive isotope materials will be used to measure the age of water at different points in the aquifer in order to help estimate water flow and potential rates of movement of pollution. Another important aspect of this component is the interaction between surface water and groundwater resources and their combined use. Water managers tend to think about surface water and groundwater as separate entities, governed by different institutional and legal controls. The set-up and organization of the SAG appears to make the same mistake. Water is a fungible asset—although it sometimes needs to be cleaned—so any plan for the use of the water has to be able to consider the supply of water a function of the real prices of both surface water and groundwater.

Two large contracts, headed by the firms of Lavalin and Tahal, for \$4.5 million and \$1.5 million, respectively, are conducting the knowledge gathering. The information generated by this component will be made available to a “node”—the lead water agency, which would also be the lead agency for continuing SAG responsibility at the national level after the project has been completed—in each of the four participating countries.

- 2) **Institutional strengthening:** This component involves the development of a strategic action plan and management framework (which is to be part of the plan). These depend on an adequate knowledge base that will identify the priority areas that need initial management and remedial attention. Contributing to the strategic action plan are small research studies by local universities, supported by a

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<sup>10</sup> Figure 4.1 in the Governance, Management, and Legitimacy section below shows an organizational flow chart for the project taken from Annex 11 of the PAD.

Universities Fund under this component. Among other issues, the strategic action plan will address the combined use of groundwater and surface water. Sufficient output from the scientific and technical component of the project, as well as the legal and social analyses contained in the TDA, should therefore be available before work begins on the strategic action plan and management framework. Owing to delays in the contracting process, sufficient scientific and technical knowledge will not be available until 2007 at the earliest. The TDA will not be available for three months. Because of these delays, the recent MTR decided to extend the project by two years to March 2009.

- 3) **Pilot projects:** The four selected pilot projects have merit in that they illustrate to the public the usefulness of better management of the aquifer. They also provide some scientific data about the aquifer, as well as lessons for joint management of these pilots and future local projects. The pilots, which include two sites that straddle international borders, were chosen because they present current or potential aquifer issues, such as competitive use of geothermal energy, intensive use of aquifer water, and urban or agricultural contamination or pollution of aquifer areas and possible salinization.
- 4) **Public participation:** Given the interest in the aquifer and the potential for public misunderstanding about its nature and potential uses, the public participation component also makes sense. But the Bank failed to develop and implement the strategy in sufficient time to head off incorrect and potentially damaging information promulgated by some NGOs.
- 5) **Potential geothermal use assessment:** The relevance of assessing potential geothermal use is questionable, since the recorded temperatures of Guarani Aquifer water vary only between 33°C and 65°C degrees—insufficiently hot to produce steam for power generation, except in combination with other sources of energy, such as fossil fuels.
- 6) and 7) **Monitoring and evaluation and project coordination and management** are both necessary components. But the cost of coordination and management at \$4 million, 15 percent of the total project cost, is relatively high. This undoubtedly reflects in part the cost of the multicountry, regional structures established to govern and manage the project.

2.16. The four pilot project activities at the country level are expected to demonstrate the consequences of unregulated groundwater development, as well as the benefits and avoided costs achieved through remedial measures. Successful country activities, exchange of experience, and harmonization of relevant regulations should foster confidence for further collaboration across boundaries, joint project implementation, and data sharing among the participating countries.

## CLARITY AND MONITORABILITY OF OBJECTIVES

2.17. As already stated, the overall project goal is to "elaborate and implement a common institutional and technical framework for the management and preservation of the SAG." The SAG also is presented as a preventative action, coupled with the concept of sustainable development. While the overall goal is clear, no indicators are provided that can directly measure progress toward the goal. Even with the proposed two-year extension, meeting the project goal with the stated resources, sub-objectives, and components will be a challenge. Annex 18-1 of the PAD gives a list of 70 "basic physical performance indicators" for project management (see Annex G below), which also are reflected in the PAD logframe (see Annex D below). The planned information system should be able to track improvements in most of these indicators. But the list is long, and there are undoubtedly opportunities for shortening it. The February 2006 MTR recommended that the number of performance indicators be pared down.

2.18. The majority of indicators are at lower levels: 17 input indicators; eight process indicators, and 27 output indicators. There are five outcome indicators and four indicators at impact levels. In addition, four "environmental stress reduction" indicators and five "environmental status" indicators are shown. All indicators are listed in Annex H below.<sup>11</sup>

2.19. While most of the indicators are generally clear and monitorable, their classification is not always appropriate. This is particularly true of the "outcome" indicators (for example, people trained), many of which would normally be classified as "output" indicators. The four "impact" indicators come closest to measuring the extent to which the overall project goal has been achieved, but they are not stated in quantifiable terms (they are labeled as "initially nontargeted"):

- Pollution risks diminished or controlled;
- Overdraft risks diminished or stabilized;
- Risk of future intercountry groundwater conflicts diminished; and
- Future mitigation and stabilization costs reduced.

2.20. Subject to the above-mentioned qualifications, most of the indicators look reasonable for standard projects. But they may not be the best set for a large, unique project like the Guarani Aquifer Project. Monitorable indicators are not obvious for preventative goals. In order to claim success, a counterfactual development study would be necessary to show what would have happened if the project had not been undertaken.

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<sup>11</sup> Most, but not all, of these indicators also are included in Annex D.

### 3. Efficacy: Outcomes, Impact, and Sustainability

3.1. **Summary.** Achievement of the overall project goal of “elaboration and implementation of a common institutional and technical framework for the management and preservation of the SAG” would yield considerable benefits to the region and to participating countries. But while progress has been made on several of its sub-objectives, and a complex set of institutions for governance and management has been created, the project is still a long way from achieving its overall goal. One reason is long delays in negotiating two large and important technical contracts. Another possible reason is the project’s failure to make completing the TDA’s legal and social analyses a priority. The GEF envisioned the TDA occurring at the beginning of the project. But the Project Team points out that the lack of basic information about the Guarani groundwater project, as opposed to surface water projects, precluded an earlier implementation of the TDA.<sup>12</sup> Moreover, the project team decided it would be best to defer the required participation of stakeholders in the TDA until better information was available and until the communications strategy had addressed the opposition to the project by some NGOs.

3.2. The technical work and the TDA are essential to the strategic action plan. Therefore, the project clearly will not be able to achieve its overall goal within the original timeframe of mid-2007. Even with a two-year extension, full accomplishment of the overall goal is an ambitious challenge. In addition to the delayed technical work, adequate institutional capacity may not be created in all four countries by project completion. And if the project does not achieve its goal, the participating countries and the Bank face substantial risk to their reputations.

#### ACHIEVEMENT OF OBJECTIVES

3.3. **Project goals will not be achieved on time.** As stated above, it is most unlikely that the overall project goal or even the four sub-objectives delineated in the previous section will be achieved within the current project timeframe. Even with a time extension of two years, achievement of the goal is an ambitious challenge. What can be reasonably expected from the present activities is a definition of what water uses are sustainable and which activities would benefit from integrated management. As noted in the previous section, the actual integrated management of the use of Guarani waters is still many years ahead.

3.4. **Progress on components:** The following summaries report on progress in each of the seven project components.<sup>13</sup>

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<sup>12</sup> According to the GEF, countries can produce a TDA that “contains the facts of the actual or likely future dispute, conflict, or problem and its root causes and that can be shared with key stakeholders for their views. This collaborative, factual analysis is an essential starting point for determining priorities for action and for diagnosing root causes that produce the stress on the transboundary system. Thus, the TDA can be thought of as the first step in producing a strategic action program to address the priorities.” (unidentified GEF document).

<sup>13</sup> The discussion of the seven components encompasses the four “sub-objectives” of the project.

- 1) **Expansion and consolidation of the current scientific and technical knowledge base of SAG.** This component has suffered from lengthy delays caused by disagreements over the scope of the terms of reference of the two major technical contracts. One contract, currently under way, is preparing a hydrology study of the entire system and a basic database. The other contract, which is just being initiated, will provide very detailed studies of the chemical, physical, and dynamic aspects of the system, as well as models of the four pilot areas. The first contract will then prepare a model of the entire system, based on the information generated by both contracts. These studies promise to provide a greatly expanded knowledge base for further action on the potential uses of the Guarani Aquifer. A system of well monitoring and a SAG information system also are included in this component, but have yet to be initiated by one of the contracts.
- 2) **Joint development of a strategic action plan, including a coordinated management framework, and harmonized water policies and management tools,** which would reduce future qualitative and quantitative threats to the SAG. This component has been seriously delayed. The TDA, which is a prerequisite for the strategic action plan, was initiated only recently. The need for the TDA early in the process was not anticipated at the project design stage. The information needed for the plan and the TDA—on water volume, quality, use, and contamination—was not available as early in the project as expected. In addition, as noted previously, the project team felt that required stakeholder participation in the TDA needed to be deferred.
- 3) **Development of groundwater management measures within identified critical areas (hot spots).** Pilot project staff, in conjunction with universities and a consortium of consultants and other stakeholders, are developing appropriate measures for groundwater protection and development in the four areas. (See further discussion in paragraph 6 below.)
- 4) **Promotion of public participation, social communication, and environmental education.** Public communication was problematic at the outset, since the communications strategy for the project was delayed 18 months. This component was given lower priority than setting up the governance and management structures and pilot projects. In the meantime, some NGOs in Argentina and Brazil spread through various media, including a widely circulated film, the misconception that the project was controlled by multinational corporate interests that intended to privatize the aquifer and appropriate the water for industrial use. The Bank team, Steering Committee, and the General Secretariat were concerned that this misinformation would impede aspects of the contracting process, such as attracting high-quality firms and consultants, who might be deterred by the bad publicity. Finally, now that the communications strategy has been implemented—through seminars, broadcast and print media, and outreach efforts by the General Secretariat—public understanding and acceptance seems greatly improved. In addition, small grants (up to \$10,000 each) from the project-supported Citizens' Fund have been provided to NGOs engaged in outreach and education efforts with public groups, especially in schools.
- 5) **Assessment of geothermal energy potential use.** This component has not yet started. Some stakeholders view it as an unnecessary part of the project, claiming that

the known temperatures are not high enough to generate significant energy, or at least would have to be augmented by substantial amounts of traditional thermal energy. The component has therefore been given lower priority.<sup>14</sup>

6) **Project monitoring and evaluation, and dissemination of project results.** The four pilot projects sites have active local governmental and nongovernmental bodies planning data collection, monitoring, and remedial actions. The General Secretariat has appointed a full-time facilitator for each site to work with local groups to promote and monitor pilot activities. The Ribeirão Preto, Brazil, group has amassed the most information about the heavy domestic, industrial, and agricultural use and contamination of aquifer waters at that site. The Itapúa, Paraguay, group is the furthest behind; that site is suffering from the impact of heavy agricultural use. The progress of the two binational sites—Rivera, Uruguay-Santana do Livramento, Brazil; and Concordia, Argentina-Salto, Uruguay,—is between the first two groups' already mentioned. Both sites have active binational commissions and mapping systems in place to monitor users and uses of aquifer waters, but data and systems are not yet in place for system-wide monitoring, due to delays in contracting. The largest contract, headed by Lavalin, is to implement in 18 months an operational system to monitor water use in a representative sample of about 180 wells out of an estimated total of 10,000 wells throughout the SAG. The February 2006 MTR decided to streamline the large and ambitious list of 70 performance indicators shown in the PAD. This streamlined list will be organized in a “common framework” (or “result framework”) to be approved by the GEF.

7) **Project coordination and management.** The General Secretariat is playing the main project coordination and management role and is perceived by stakeholders to be doing a credible job. But after the project, these roles may need to be taken over by some successor entity.<sup>15</sup> This is a major issue that is only now beginning to receive significant attention.

## CAPACITY BUILDING

3.5. Capacity building is a major component of this project—for participating government entities, universities, and NGOs—in the science of groundwater assessment and the technology of monitoring and accessing groundwater. The project also seeks to create institutions for groundwater management, and to educate civil society on what to expect from the development of groundwater. So far, significant progress has been made in the institutional aspects of capacity building, with the development at the international level of the Steering Committee, the National Coordinators Council, and the General Secretariat. At the country level, NPEUs have been created. Finally, in two of the four pilot projects, binational commissions have been established. Some of these institutions, such as a steering committee and at least a small secretariat, are likely to be maintained beyond the end of the project. But definitive choices in this regard have yet to be made.

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<sup>14</sup> The research consortia led by Tahal is studying this issue.

<sup>15</sup> The scope of this entity, as mentioned in Section 8 below, will depend largely on the outcome of the studies being undertaken in the present project.



3.6. **National institutions:** A critical element of institutional capacity involves building the capacity of the national institutions that will be expected to implement Guarani groundwater management after the project comes to a close. The evaluation team did not investigate this question but feels this could be an issue in some of the participating countries. As indicated below in paragraphs 3.15-3.16, possible inadequate national implementation capacity is a risk to outcomes and impact.

3.7. **Newly created institutions:** Each of the institutions created appears to be working quite well, even though they were created for this region without any prior examples of such groundwater management institutions. Already on the forefront of groundwater science and technology, encouraging signs can be seen from the collaborative work of the universities and professional consultants in the consortium.<sup>16</sup> Capacity in civil society has been created through the Citizens' Fund-supported educational activities of the NGOs and through civil society participation in the binational commissions set up at the pilot project sites. In addition, all of the institutions set up by the SAG have incorporated civil society participation.

#### **REALIZED DISTRIBUTION OF COSTS AND BENEFITS**

3.8. The PAD's discussion of the potential benefits of the Guarani Aquifer System states:

The benefits from the project are of both a national and regional nature, and mainly relate to the avoidance of future costs. ... A further benefit would be the preservation of a strategic reserve to supplement other water supply options within the region. (World Bank 2002, PAD, p. 20)

3.9. The primary beneficiaries are likely to be densely populated areas over or near the aquifer. For example, the city of São Paulo, with a population of over 20 million in the metropolitan area, is already tapping the Guarani Aquifer by pipeline. All the project components, with the possible exception of the geothermal energy assessment, should benefit such population centers, assuming that the knowledge and planning translate into a good management system over the long haul. Currently more than 300 cities use the Guarani Aquifer water for domestic supply because the cost of pumping Guarani waters is less expensive than collecting and treating existing surface water supplies.

3.10. **Suggested studies to assess costs and benefits:** The PAD employed an "incremental cost" analysis to value expected benefits from the project. This approach summed up the existing water-related investments in each of the seven component areas and added them to the project costs, yielding a "benefit" of \$30.3 million, as compared with the project cost of \$26.8 million.<sup>17</sup> This assumes that project benefits are roughly

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<sup>16</sup> The "consortium" refers to one of the large contracts under the project, composed of consulting firms and individuals from local universities. The consortium would not be expected to continue after the end of the project.

<sup>17</sup> PAD, *op. cit.*, Annex 4, pp. 56-62.

equal to project costs, an assumption that has no empirical or theoretical underpinnings. The analysis does not permit any breakdown of benefits and costs by country. What is really needed is an analysis of benefits and costs of alternative approaches. The first question to be asked should be “What is the problem?” rather than a narrow technical series of questions that suggest solutions. For example, broad economic studies could be pursued in the following four areas.

- 1) **What is the role of water in the four countries?** The role of water (from whatever source) for economic and social development in each of the four countries needs to be established. Integrated water resources management (IWRM) is just that: the integration of water into all social and economic policies and actions within the nations and the region. Specifically, this would involve assessing the supply of and demand for water from all sources and for all uses. Such an assessment would involve a careful examination of the countries’ overall development plans for the next five to 25 years, looking for the expected shifts in demands among the various water-using sectors, and should show how long it would take to incorporate the groundwater into overall water availability. Water-demand studies, based upon realistic costs and prices for the various sectors, need to be conducted. In particular, the study should focus on for the effect on water demand of the trade and transportation developments likely under MERCOSUR, analogous to the massive shifts that occurred in the European Union.
- 2) **What are the economic consequences of the exploitation of the Guarani Aquifer?** A comparative study should be conducted on the economic consequences of environmental deterioration due to the exploitation of the Guarani Aquifer. Such a strategy would be broader than the current concerns over localized groundwater contamination from municipalities and industries. For example, it should examine the opportunity costs of reduced artesian pressure leading to reduced inflow to surface streams, with consequent reduction of availability to various users, loss of wetlands, and other ecological amenities.
- 3) **What is the role of the Guarani Aquifer in sustaining the four countries’ society and livelihoods?** A study should examine the role of the aquifer in sustaining the countries’ society and livelihoods in the long run. While such a study is likely to be highly speculative, it is, however, a fundamental part of assessing what the target for future development in the region might be. Currently, the Guarani Aquifer is like a “backstop technology” in energy studies. As noted previously, the recorded temperature range for aquifer waters would not provide a competitive source of energy at current technology and price structures. But adding hotter energy from fossil fuel sources, for example, to aquifer water could be cost-effective, depending on the cost of fossil fuel. One part of the proposed study would suggest the necessary technology, and would estimate the cost of alternative fuel sources and the level of demand at which Guarani geothermal energy would cease to be a “backstop” and become a competitive energy resource.
- 4) **What are the economies of scope and scale involved in regional action?** The PAD and current discussions in the General Secretariat emphasize the importance of identifying the need for joint action to manage the aquifer at the country level. However, based on new information from the pilot scientific and technical studies

about the volume, location, chemical composition, usage, contamination, and dynamics of water flow, it is unclear whether economies of scale and scope require regional action by the four countries instead of local and bilateral actions. There are already many bilateral agreements concerning shared surface water and other resources in place in the SAG region, and such joint actions also could be undertaken for managing the groundwater resources. In addition, the potential use of the resource is not the same across all countries. A specific study focusing on the scope and scale of appropriate actions could help identify which actions should be taken at the country level (such as creating a coordinating secretariat) and which can and should be carried out at bilateral, and even unilateral, levels.

3.11. ***Distribution of costs and benefits:*** With regard to the distribution of costs, the project is less than half completed and no framework for longer-term development plans for the SAG is in place. Hence, it is impossible to make any proposals about sharing of costs (or benefits).

3.12. ***Additional benefits:*** There are additional benefits that are more difficult to assess than the direct use and the strategic reserve benefits mentioned above. For example, there are significant benefits associated with international agreements in general, since they ease trade and transit restrictions while also reducing costs of trade. In the case of groundwater, it is possible to allocate or trade the water directly, substitute for surface water, or coordinate agricultural production via irrigation. At the present stage of the project, little attention has been paid to the various project benefits—short- and long-run; direct and indirect—because so little progress has been made on the major components.

## **RISKS TO OUTCOMES AND IMPACTS**

3.13. ***Substantial risks:*** The PAD identifies 15 “critical risks:” eight from outputs to objectives and seven from components to outputs (see Annex I for details). Four risks are assessed as “substantial” and the other 11 are “modest.” The risks assessed as substantial (and corresponding proposed mitigation measures) are:<sup>18</sup>

- 1) **Agreement on an appropriate administrative structure for aquifer management cannot be reached.**<sup>19</sup>
  - *Mitigation measure:* Start discussions early in the process and take into account the interests of the four countries, including the different stakeholders and decision-making groups.
- 2) **Institutional roles remain unclear or unsupported politically or financially, especially at the subnational government levels.**
  - *Mitigation measure:* Build a strong climate of collaboration through frequent and transparent communication during project preparation and implementation. Work with the project Steering Committee to improve institutional functioning.

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<sup>18</sup> PAD, *op. cit.*, pp. 31-32.

<sup>19</sup> The focus of this risk is on the administrative structure for the Guarani Project. It does not necessarily imply a continuing, permanent structure beyond the current project.

- 3) **Project-supported research and analysis of the aquifer are not carried out in a timely manner**, leading to delays in providing critical information to the strategic action plan.
  - *Mitigation measure*: Monitor research and analysis continuously and strengthen where needed.
- 4) **There is lack of collaboration between partners, stakeholders, governmental units, and NGOs.**
  - *Mitigation measure*. Disseminate information to civil society and design institutional arrangements to include organizations; build a strong climate of collaboration. General Secretariat should enhance these efforts.

3.14. Experience shows that classifying risks 3 and 4, above, as substantial was correct. Delays in contracting caused delays in investigations. Expediting the contracting process would have mitigated this problem. Although there was some collaboration among stakeholders, some elements of civil society spread misinformation about the project, due in part to the delay in implementing the communications strategy.

3.15. ***Additional risks***: In addition to the risks described by the PAD, this review finds two other broad risks: (a) that the project will not have built a foundation for sustainable management; and (b) that the project may not meet its stated goals.

3.16. ***No foundation for sustainable management***: If the countries and donor partners fail to lay the foundation for integrated, sustainable management and use of the Guarani Aquifer, ongoing and future efforts to manage regional groundwater and surface water resources will be jeopardized. The project will not be sustainable if it does not succeed in building strong and enduring institutional foundations.

3.17. The inability to form viable cross-boundary regional partnerships due to political differences among the participating countries is a related institutional risk. It appears modest currently, but there is a potential for escalation of intercountry tensions. An example is the current contentious disagreement between Argentina and Uruguay, over planned major foreign investments of paper mills located on the Uruguayan side of the Uruguay River, which Argentina claims would pollute the river water it draws for domestic use.

3.18. ***Project too complex***: The second risk is that the Guarani Aquifer may be too complex to study and model using the planned frameworks and resources, as noted in the previous subsection on project design.

3.19. At this point in time, both these risks are assessed as medium risks. In both cases, incurring these risks will affect the countries' and Bank's reputations for successful project implementation and for preparing a feasible management framework.

## 4. Efficiency: Governance, Management, and Financing

4.1. *Summary.* Governance and management arrangements for the SAG are detailed, representative, and balanced, although procedures appear to be overly micromanaged. While management would like to increase staff size, it was purposely designed to be relatively small, reflecting the GEF international water projects' goal of compact administrative structures. Consultants are hired to support the General Secretariat on a task basis, but do not have resource management responsibilities. Donors seem to work well together in spite of the dual layer of the Bank and the OAS. But the dual clearance and approval processes have been one source of the delays in contracting and other actions.

### EFFICIENT USE OF RESOURCES

4.2. The cost-effectiveness of a knowledge generation activity is difficult to assess, especially when the activity is still ongoing, like the Guarani Aquifer Project. The management and coordination component of the project, at 15%, is relatively high. On the other hand, a significant portion of this component has been devoted to the creation of new institutions. If the project objective of establishing a common institutional and technical framework for the management and preservation of the Guarani Aquifer System is accomplished, the resources applied to the project will turn out to have been well used.

### GOVERNANCE, MANAGEMENT, AND LEGITIMACY

4.3. *Governance and management structure:* Figure 4.1, taken from Annex 11 of the PAD, illustrates the rather complex governance and management structure of the Guarani project. Each box in Figure 4.1 contains an important element of the project's governance and management structure:

- The multinational **Steering Committee (SC)** operates at the governments' ministerial or secretary level, with each country represented by three ministries: water resources (usually in public works ministries), environment, and foreign relations. The SC meets twice a year; with the chair represented by Paraguay for the first half of the project, and by Argentina for the second half. The SC approves policies and strategies affecting the four participating countries.
- The **Coordination Council (CC)**—or **National Coordinators (NC)**—consists of senior technical level officials and heads of national project executing units. The CC meets four times a year in different countries and reports to the SC. It prepares positions for the SC and carries out its policies. The NC also gives directions and instructions to the General Secretariat, clears hiring and contracting decisions, and serves as a link between the Secretariat and the Steering Committee.
- The **General Secretariat manages the** day-to-day activities of the project, with headquarters in Montevideo, and a multinational professional staff of six. The General Secretariat is hired and directed by the OAS and overseen by the CC.

- Four **NPEUs**, one for each country, review and carry out proposed measures affecting their respective countries and oversee activities within their countries (for example, the pilot projects). NPEUs are headed by each country's senior water resources technical official, who is the project national coordinator, and include members of national and local government agencies, civil society, and NGOs.

4.4. **Functions of entities:** The functions of these various entities are briefly identified in the GEF Trust Fund Agreement with the OAS and the Bank, but without much detail:

Section 3.03. (a) The Recipient shall carry out the Project through a SAG General Secretariat, with a secretary general and staff in numbers and with qualifications and responsibilities satisfactory to the Bank, and with the assistance of a steering committee (with rotating chairmanship as decided by the Beneficiaries, starting with a chairman to be appointed by Paraguay in 2002), a coordination group and national Project execution units, as the composition and functions of said steering committee, coordination group and national Project execution units shall be described in the Project Implementation Plan.<sup>20</sup>

4.5. While the governance structures seem quite representative, the General Secretariat did express concern about needing to refer to the Steering Committee for minor decisions, which delayed implementation. Furthermore, having two organizations—the OAS and the World Bank—each carrying out their respective roles, as opposed to one organization carrying out both sets of responsibilities, was seen by the General Secretariat as difficult to justify. Currently, the Bank acts a fiduciary agent for the GEF, ensuring that funds are spent and activities carried out according to the agreement among the GEF, the Bank, and the OAS. The Bank also provided significant substantive support, including considerable technical input during the preparation phase of the project and supervision and technical support during implementation (see Section 6 below for more detail on the Bank's role). The OAS has hired the General Secretariat staff, which works with the OAS officer located in Buenos Aires to oversee and manage the project on the ground. This has included management of the citizens (NGO) and universities small grants funds, as well as the contracting process for the two major TA contracts. Both the Bank and the OAS were involved in the clearance and approval processes for the two major research contract operations. The mission concludes that the governance structures could be rated relatively high on representativeness but low on cost-effectiveness.

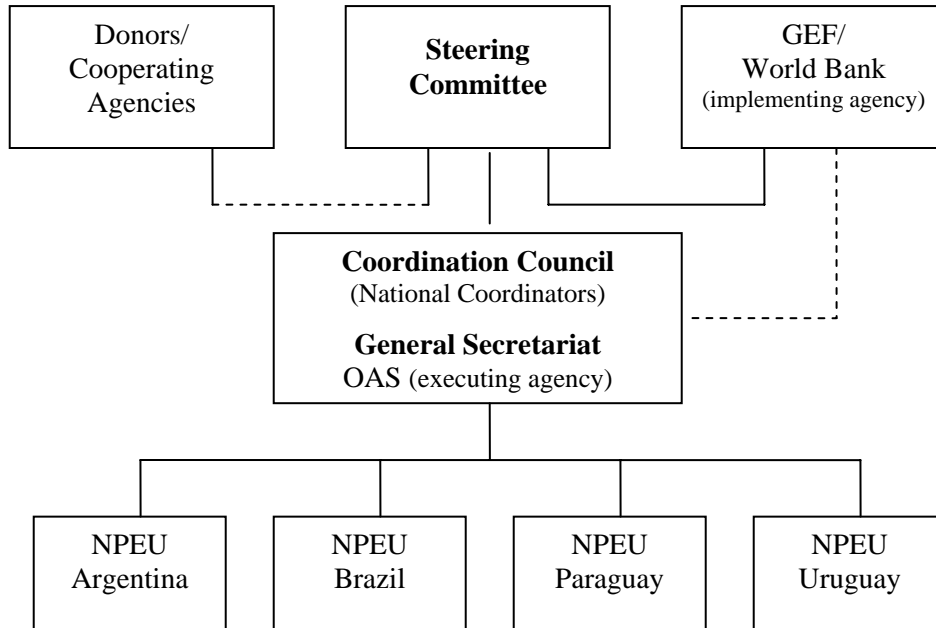
4.6. The mission was told that the OAS has a track record in supporting water resource management activities in the region, and that it also has a reputation, which the Bank lacks, as an “honest broker” among the countries. But this view is not unanimous and at least one official expressed the opinion that the OAS role was redundant. Both the Bank and the OAS require satisfaction of their respective procurement and financial reporting requirements, which the General Secretariat claims is one cause of the delays in implementation. Given the strengths that each organization brings in this case, the

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<sup>20</sup> GEF, *op. cit.*, p. 6.

mission supports the current arrangement but also agrees with streamlining and harmonizing procedural requirements between the Bank and the OAS.

**Figure 4.1 Guarani Aquifer Project Institutional Arrangements**



## FINANCING

4.7. Financing for the Guarani Project is relatively straightforward. Half, or \$13.4 million, is in the form of a grant from the GEF; \$12.0 million is in the form of counterpart-finance from recipient countries; and \$1.4 million is from other donors (see section on Donor Performance below), for a total project cost of \$26.8 million. Project staff informed the mission that the counterpart from countries has been entirely in the form of in-kind contributions. No details were provided.

4.8. The General Secretariat considers its budget to be very tight and the staff in need of augmentation. Bank and OAS management point out that the overhead for the project was deliberately designed to be lean. Given the responsibilities of the General Secretariat, its budgetary resources appear tight to the mission. Bank and OAS management respond that short-term contract consultants can meet additional secretariat needs for substantive expertise.

4.9. A major financial problem has been slow disbursements. This results from delays in negotiating major multimillion dollar contracts under the project. But a number of smaller contracts would have created even more complications and longer delays, given the need to pass approval processes in four countries, plus those of the Bank and the OAS. So what were originally envisioned as 11 smaller contracts were packaged together in a \$4.5 million master contract, headed by Lavalin.

## DONOR PERFORMANCE

4.10. The main donor to the Guarani Aquifer Project has been the GEF. Both the World Bank, as “implementing agency,” and the OAS, as “executing agency,” contribute to the salaries of their respective staffs working on the project. The Bank has assigned a sector manager in the Latin American and Caribbean Region as task manager for the project and an operations officer, to manage and oversee the project. The OAS has assigned a division chief for Sustainable Development and Environment, based in Buenos Aires, as a coordinator for the project.

4.11. Grant cofinancing funding in relatively smaller amounts from other donors has totaled \$1.3 million-1.4 million.<sup>21</sup> These include:

- A contribution of \$300,000 from the OAS.
- The German technical assistance agency has provided \$600,000 in TA and related materials to Paraguay.
- The International Atomic Energy Association has provided \$300,000 in radioactive isotope materials and associated TA to measure the age and flow of water (with a proposed additional \$300,000 to a possible second phase of the project).
- The U.K. government and Dutch governments have provided \$100,000 in trust funds for TA through the Groundwater Management Advisory Team. .

4.12. Procurement procedures are too long because approvals from the OAS, GEF, and World Bank were often required. While some stakeholders insisted that the OAS be an “executing agent” because of its long experience in the region, others argued that the OAS did not have the technical depth that the World Bank had, which was particularly necessary at the preparation stage.

4.13. Taking the above considerations into account, the current management arrangements appear to the mission to have merit. The incumbents of the pertinent Bank and OAS positions seem well-suited for their responsibilities and have good working relationships. But the Bank and the OAS need to agree on streamlined budget allocation procedures, including identification of a level below which the executive director of the General Secretariat would not have to obtain Bank or OAS clearance.

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<sup>21</sup> PAD, *op. cit.*, Table 2, p. 13 and Annex 5, p. 63. The PAD (p. 13) also cites \$50,000 in cofinancing provided by beneficiaries and \$370,000 from the Bank Netherlands Partnership Program to the University Capacity Building Fund (p. 63).



## **5. Monitoring and Evaluation**

5.1. The PAD (Annex 18) calls for a monitoring and evaluation (M&E) system to be developed and implemented. The project has a functioning M&E system but many of the numerous indicators identified (over 60) are at the process level rather than at the output and outcome levels. The number of indicators is probably excessive and includes some that are not measurable or cannot be easily measured. The four impact measures are not stated in quantifiable terms. The project midterm review in February 2006 recognized these weaknesses and decided to revise indicators to make them better reflect the expected outcome and outputs of the project.

5.2. One reason for the delay in establishing a fully working M&E system has been the delay in negotiating and mobilizing the two major research contracts responsible for generating key performance data, such as an accurate census of the number of aquifer wells in operation and how they are being used. In some cases where the indicators can be measured, there is a lack of baseline data due to the dearth of information on the SAG.

5.3. But significant reporting elements of the M&E system are in place. Periodic reports from the four pilot sites and from other project activities, including the Citizen Fund and the University Fund, are fed into an M&E system managed by the General Secretariat. The national coordinators report on counterpart contributions directly to the General Secretariat. While a more accurate count and analysis of use are needed, the M&E system has established for the first time that the number of groundwater wells in operation number more than 10,000, as compared with earlier estimates of about 3,000.

## **6. World Bank Performance**

6.1. *Summary.* The Bank has devoted high-quality management and oversight to the Guarani Aquifer Project. Although all four country assistance strategies (CASs) deal with water issues, linkages made to the Guarani Aquifer Project vary from significant, in the case of Brazil, to nonexistent, in the cases of Paraguay and Uruguay.

### **COMPARATIVE ADVANTAGE**

6.2. Stakeholders agreed that the key advantage the Bank contributed was its convening power. Stakeholders also praised the substantial technical background of the first Bank task manager, who took an active role in project preparation and oversaw the first two years of implementation. But this positive view of the Bank was tempered by the fact that the Bank was perceived in some government and nongovernment quarters as dominated by its major shareholders. Therefore, the involvement of the OAS, with long experience as an international “honest broker” in the region, was seen as preferable to the Bank’s. On balance, the mission values the current arrangement involving both entities for the reasons given above. The second task manager, who is also a sector manager, contributed extensive experience in the water management sector. Establishing a project institutional presence at the pilot-site level has been a widely recognized innovation. (See Section 4, above, on Donor Performance for further discussion.)

### **THE BANK’S COORDINATING ROLE WITH OTHER DONORS**

6.3. The Bank appears to have maintained effective working relationships with the GEF and other donors.

### **QUALITY OF SUPPORT AND OVERSIGHT**

6.4. Notwithstanding the issues with procedures, Bank staff was given high marks for its technical expertise during project preparation and in the early years of implementation. This included finalizing the technical contracts, identifying local facilitators for the pilot projects, supporting the development of local action plans and the communications strategy, finalizing contracts, and facilitating procurement of equipment for the secretariat and field work, etc. The problem-solving skills, responsiveness, and interpersonal skills of all involved Bank staff were praised.

### **STRUCTURES AND INCENTIVES**

6.5. The Bank management structure is relatively straightforward. While it is somewhat unusual for a sector manager to be a task manager, in this case, the sector manager knows the region well and is skilled at handling the high-level diplomatic sensitivities involved in a multicountry project. He leads two supervision missions a year to the project and typically makes more frequent brief visits to the General Secretariat in Montevideo. Stakeholders believe he plays an important role in representing Bank management and that he devotes sufficient time to the project as task manager. He is

supported by a regional operations officer, who also manages the University Fund and the associated Trust Fund.

## **LINKAGES TO OTHER BANK COUNTRY OPERATIONS**

6.6. **Brazil:** Only two of the Bank country assistance strategies (CASs) for the four countries mention the Guarani Aquifer Project as such. But all four CASs deal with water resources in one way or another. The 2003 Brazil CAS gives the most attention to water resource management issues and cites a number of water programs supported by the Bank. It also has a section on regional development, including environmental sustainability. It briefly discusses the Bank's contribution to the design of the Guarani project.

6.7. **Argentina, Paraguay, and Uruguay:** Both the 2004 and draft 2006 Argentina CASs discuss water management in the context of sustainability, and both include brief references to the Guarani project. The 2005 Uruguay CAS does not mention Guarani, but does call for stronger water resource management. One of its pillars is environmental resource management. One of the 2003 Paraguay objectives is infrastructure, including water supply, but its CAS makes no reference to the Guarani project.

## **DISENGAGEMENT STRATEGY**

6.8. **Project closing date:** The Guarani Aquifer Project is scheduled to conclude in March 2007. Secretariat and Bank staffs estimate that, because of the prolonged contracting processes, project closing will need to be delayed. The midterm project review of February 2006 decided to extend the project by two years.

6.9. **Follow-on projects:** Any follow-on investment projects are likely to be unilateral, or bilateral at most. The role of a follow-on project will be largely determined by the results of the ongoing project studies and those yet to begin. At the regional level, a modest regional monitoring and analysis capability is envisioned by the head of the General Secretariat. An additional GEF grant is one possibility for financing a regional entity, along with country contributions. Another possibility is an endowment funded by a private foundation located in the region.

6.10. **Future governing and management structures:** A future SAG regional institutional mechanism would likely be a slimmed down version of the current governance and management structures. It would retain structures similar to the current multinational Steering Committee and the NPEUs. It is also conceivable that by 2009, MERCOSUR would have the required juridical status to provide the legal umbrella for the coordinating secretariat that the OAS provides now.

## 7. Country Participation

7.1. The larger and relatively wealthier countries, Brazil and Argentina, have substantial technical cadres in both the government and business communities, along with the financial resources to mobilize them. Of the four countries, Paraguay is the one with the least technical capacity and resource base to encourage studies and developments in the aquifer region.

7.2. Even taking into account the countries' technical and financial strengths, there are still participation problems. For example, in Brazil there appears to be a split in capacities between the water agency (ANA), the original proposer of the SAG, and the environment ministry, where it is currently located. ANA has most of the relevant technical skills and at least some staff believe project management would be more effective if it were returned to ANA. In Argentina, there appears to be a certain amount of ambiguity about responsibility for project management, with some thinking that the resources made available through the SAG have diverted attention from Argentina's domestic water development policies. Recent conflicts about using and polluting surface water in the Plata between Uruguay and Argentina reveal the depth of emotions over transboundary water conflicts.

7.3. Program coordination within the countries appears to be progressing well. The nature of the strong NPEUs and the urgings of the Secretariat have created effective mechanisms for coordinating program activities within the countries. Moreover, the existence of the pilot project institutional structures within the countries provides a strong back-up for support to the binational commissions where they have been set up.

7.4. One issue is that the conjunctive use of surface and groundwater takes place both within countries and across countries. As noted previously, only Brazil has a national water plan that includes a discussion of groundwater. But even the recently issued Brazilian plan does not address the joint or conjunctive use of *both* surface and groundwater. By the end of the project, at a minimum, this issue will need to be defined for each of the four countries, and measures proposed to address it.

## 8. Conclusions

### SUMMARY OF FINDINGS

8.1. This is a unique and pioneering project for the Bank. Its main focus is on knowledge generation and preventing future problems, rather than remedying current crises. Such a project could not have been supported without grant financing—whether from the GEF or some other source. Country interests have been complementary in the design and implementation of the project. The two-year project preparation period provided sufficient time for country interests to be taken into account.

8.2. **Delays:** But the long delays in the negotiation of institutional contracts are a source of concern, as is the delay in undertaking the critical transboundary diagnostic analysis. It would appear that high-caliber scientific and technical talent has been recruited, but implementation is still in the very early stages. The project has also been very late in engaging the right kind of economics expertise to analyze the benefits and costs of broadly different alternative approaches. Finally, more consideration must be given to the regional entity that will continue once this project is closed in 2009, if there should be one at all. If so, its functions and size must be determined, as well as how it could be financed (see paragraph 8.8, lesson 5, below, for more discussion).

8.3. **Regional scope:** The basic rationale for the Guarani Aquifer Project's regional scope is that the aquifer underlies the boundaries of four countries. The project addresses a potential inequity in use of a shared resource. The aquifer also has characteristics of a regional public good. Each country has an interest in developing and sustaining its water resources. So far most of the efforts have focused upon surface water; now groundwater is also receiving attention. The goal of the project is prevention of overuse and contamination rather than remediation. This requires regional cooperation and coordination, especially for research and analysis, since both surface water and groundwater cross boundaries.

8.4. **Measurability and attainability of overall goal:** The overall project goal is stated as the "elaboration and implementation of a common institutional and technical framework for the management and preservation of the SAG." While this goal is clear, none of the provided indicators can directly measure progress toward it. Moreover, it is not clear that the resources, sub-objectives, and components of the project are sufficient to achieve it. In addition, this study identifies the risk that national institutional capacities in some of the four countries may not be adequate to manage Guarani groundwater management by project completion.

8.5. **Institutional structure:** A complex array of governance, management, and implementing institutions has been established for the project and they seem to have worked effectively, though failure to delegate authority to the General Secretariat is an issue. It is unclear how much of this structure will be retained at the end of the project. At a minimum, a small coordinating entity with some policy, monitoring, and communications functions is anticipated. But this would require financing—from a

second GEF grant and/or income from a foundation endowment or another donor—which has not yet been secured.

8.6. **Bank performance:** Bank performance has been satisfactory. Stakeholders give high marks to the quality of Bank supervision, but fault complex and slow procurement procedures, which are further complicated by OAS procedural requirements.

8.7. **Performance and impact indicators:** Measurable performance indicators have been established at the input, process, and output levels, but some indicators are misclassified and a number are not being regularly measured at the regional level. These performance indicators are being measured at the four local pilot-project areas. The four impact indicators are not measurable as presently defined.

## IMPLICATIONS FOR EFFECTIVE SUPPORT

### 8.8. *Lessons*

- 1) **Give more attention to the interaction between surface water and groundwater resources.** The Guarani Aquifer project appears to be approaching about surface water and groundwater as separate entities to be governed by different institutional and legal controls. Water is a fungible asset and any plan for the use of the water should consider the supply of water a function of the real prices of both surface water and groundwater. The fact that the GEF has funded a large transboundary study of the Rio de la Plata Basin (which is almost coterminous with the Guarani Aquifer) with no concern for the surface groundwater interactions, indicates that international financial institutions themselves are confused about the conjunctive use of groundwater and surface waters. At a minimum, by the end of the project, this issue will need to be defined for each of the four countries and measures proposed to address it. This lesson will be relevant when funding other transboundary water studies where interrelated groundwater and surface water resources are present.
- 2) **Fully consider the alignment of water sector policies with national and regional development policies.** Effective water resources management requires that water development be considered together with investment and planning for other sectors in a country. Without such integration, water sectors may be either overlooked or invested in excessively.
- 3) **TDA should not be delayed.** Unfortunately, NGO opposition to the project led to a lack of basic data and the volatility, causing the TDA to be delayed well into the implementation phase. The TDA is an important input for the modeling studies and the strategic action plan. The PAD does not give a clear statement of what is involved in the TDA, but does stress its importance.
- 4) **Fully address institutional and economic issues, not just technical issues.** The project addresses a large and complex technical problem embedded in diverse and sometimes volatile social and political environments, marked by shifts in

governments and by rivalries and tensions among the participating countries. Yet, the leading implementers of the project are largely drawn from the engineering elites in the four countries, who tend to see the project in engineering terms. As a result, there is a tendency to focus on technical details and ignore, or marginalize, the fundamental institutional and economic issues. Economic analysis is still needed to explore: (a) the integration of water into all social and economic policies and actions within the nations and the region; (b) the economic consequences of environmental deterioration due to the exploitation of the aquifer; (c) the role of the aquifer in the sustainability of society and livelihoods in the four countries in the long run; and (d) economies-of-scope and -scale .

- 5) **Identify the appropriate level for addressing aquifer management issues.** Descriptions in the PAD and discussions in the secretariat suggest emphasize the importance of identifying the need for common and joint actions to manage the aquifer at the regional level (that is, among the four countries). However, given the findings of the pilot scientific and technical studies, it is unclear whether economies of scale and scope will *always* require regional action by the four countries, rather than local and bilateral actions. There are already several bilateral agreements operating in the Guarani Aquifer region concerning shared surface water and other resources, and similar agreements about managing groundwater resources may be negotiated. Moreover, the potential use of the resource is not symmetrical across all countries. Therefore, a specific study is needed to delineate the scope and scale of appropriate actions that should be taken at the regional level (including the creation of a coordinating secretariat), and those that can and should be carried out at bilateral, and even unilateral, levels. This is not to say that *no* regional entity would be required. Even if most action turned out to be at the local level, a small secretariat devoted to policy issues, monitoring, some coordination, and communications could be useful.
- 6) **Give more attention, earlier, to public participation and communication (one of the seven project components).** A timely communications strategy was necessary to avoid public confusion and apprehension about the project. A communications strategy was developed 18 months into the project, after misinformation about the project had been widely spread by some NGOs, potentially impeding the technical contract mobilization process.
- 7) **The main risk is that the project will not be sustainable if it does not succeed in building national institutional foundations** able to continue beyond the life of the project. In addition, there is the risk that the Guarani Aquifer may be too complex to study and model using the planned frameworks and resources, as noted in the previous subsection on project design. In both cases, incurring these risks will damage the countries' and Bank's reputations for successful project implementation and for preparing a feasible management framework.

## Annex A: Background Information on the Regional Program

1.	<b>Program (or project) number</b>	P068121
2.	<b>Program Dates</b>	
	Approval Date (estimated and actual)	July 2002
	Completion Date (estimated and actual)	2007, extended to 2009
3.	<b>Sectoral or thematic areas</b>	International Waters, Natural Resources Management
4.	<b>Regional or subregional</b>	Regional and Subregional
5.	<b>Regional partnership or project</b>	Project
	Does it comprise country projects? If yes, do the country projects:	No
	• Conform to a template	N/A
	• Address the same problem(s)	N/A
	• Regularly interact with each other (e.g., through information sharing, research, M&E)?	N/A
6.	<b>Rationale for the regional program:</b>	
	• Strategic focus: regional commons, transboundary problems, regional integration, or other cooperative actions?	Regional commons (underground water reserves)
	• Intended direct impact (regional/subregional and/or participating countries)	Regional, subregional and participating countries



## Annex B: Governance and/or Management Arrangements

<b>Management Entities for Project Implementation</b>		
1.	What are the management arrangements for project implementation? List the project implementing and management units and describe roles and responsibilities of:	OAS through General Secretariat - NPEU for Argentina, Brazil, Paraguay, and Uruguay
	<ul style="list-style-type: none"> <li>• Task Manager and/or Task Team Leader</li> </ul>	Team Leader: Karin Erika Kemper; Abel Mejia
	<ul style="list-style-type: none"> <li>• Oversight Manager               <ul style="list-style-type: none"> <li>○ in the Bank and/or</li> <li>○ outside the Bank</li> </ul> </li> </ul>	Sector Manager/Director: John Redwood /Abel Mejia
<b>Regional Governance and/or Coordinating Body(ies)</b>		
2.	Name, location, and Internet address of the regional governance and/or coordinating body (ies) for the project.	Multinational Steering Committee (SC) National Coordinators Councils (NC)
3.	For each of these governance and/or coordinating bodies, what is the:	
	<ul style="list-style-type: none"> <li>• Size</li> </ul>	SC: 12 NCs: vary
	<ul style="list-style-type: none"> <li>• Membership/composition</li> </ul>	SC: water resources (usually in public works ministries), environment, and foreign relations ministries NCs: senior technical level officials and heads of national project executing units
	<ul style="list-style-type: none"> <li>• Membership criteria</li> </ul>	SC: governmental, ministerial, or secretary level
	<ul style="list-style-type: none"> <li>• Functions/responsibilities</li> </ul>	SC: approves policies and strategies affecting the four participating countries. NCs: reports to the SC. Prepares positions for the SC and carries out its policies. Gives direction and instructions to the General Secretariat.
	<ul style="list-style-type: none"> <li>• Meeting frequency</li> </ul>	SC: twice a year NCs: four times a year
<b>Regional and/or Country-Level Implementing Agency(ies)</b>		
4.	Name, location, and Internet address of implementing agency (ies) for the project.	<p>General Secretariat (OAS): Dr. Luis Piera, 1992. Ed. MERCOSUR, 2do piso, 11200 Montevideo, Uruguay Contact: Luiz Amore, General Secretary, <a href="mailto:sag@sg-guarani.org">sag@sg-guarani.org</a>, <a href="mailto:amore@tba.com.br">amore@tba.com.br</a></p> <p>Agencia Nacional de Aguas: Setor Policial Sul, Area 5, Quadra 3, Bloco L, 1 andar, Brasilia, Brazil. Contact: Benedito Braga, Diretor, <a href="mailto:benbraga@ana.gov.br">benbraga@ana.gov.br</a></p> <p>Dirección General de Protección y Conservación de Recursos Hídricos, Secretaria del Ambiente, Avenida Madame Lynch 3500, Asunción, Paraguay. Contact: Ing. Alfredo Silvio Molinas Maldonado,</p>

		<p>Ministro, <a href="mailto:ministro@seam.gov.py">ministro@seam.gov.py</a></p> <p>Secretaria de Obras Publicas, Hipolito Irigoyen 250, Piso 11 Of. 1107, C1086AAB Buenos Aires, Argentina Contact: Ing. Hugo Pablo Amicarelli, Subsecretario de Recursos Hidricos, <a href="mailto:hamaca@mic.gov.ar">hamaca@mic.gov.ar</a></p> <p>Ministerio de Transportes y Obras Publicas, Dirección Nacional de Hidrografía, Rincón 575, 2 Piso, Montevideo 11000, Uruguay. Contact: Ing. Alejandro Arcelus, <a href="mailto:arcelus@nbcnet.com.uy">arcelus@nbcnet.com.uy</a></p>
5.	Function of implementing agency(ies)	<p>General Secretary and Secretariat staff is contracted by the OAS to coordinate the conduct of project activities through the NPEUs. The Secretariat prepares project documents and reports, supports M&amp;E, and drafts the TDA and the strategic action program. It will also ensure the flow of information and be aware of the concerns of the indigenous community organizations and other regional/local bodies.</p> <p>The NPEUs are responsible for recommending consultants and conducting activities at the country level. They will support the General Secretariat and OAS by facilitating timely completion of project activities and quality control/quality assurance.</p>

## **Annex C: Financial Data (estimated)**

<b>Sources of funding</b>	<b>Total (Millions)</b>
Bank (GEF)	13.4
Counterpart financing	12.0
Other donors	1.4
<b>Total Cost:</b>	<b>26.8</b>

## Annex D: Goals, Objectives, Outcomes, Outputs, and Activities

**Overarching Goal:** Elaborate and implement a common institutional and technical framework for the management and preservation of the SAG in Argentina, Brazil, Paraguay, and Uruguay.

Objectives	Activities/ Inputs	Outputs	Outcomes
<p><b>1. Expansion and consolidation of current scientific and technical knowledge base of the Guarani Aquifer System</b></p>	<p>\$9.91 million</p>	<p>1a. Well inventory carried out in all four countries.            1b. At least 70 percent of all wells assessed in terms of use and water availability, quantity, and quality.            1c. Aquifer system’s western and southern limits defined.            1d. A preliminary conceptual aquifer model is available to help improve understanding of its principal features.            1e. Geological and hydrogeochemical maps of priority areas produced.            1f. A general regional hydrogeologic map—as well as thematic maps on potentiometry with network flows, surveys of recharge and discharge areas, isotransmissivity, and isoproductivity—are available.            1g. Water quality is assessed and pollution patterns distinguished in terms of the origin, impacts and ways to remediate the pollutants.            1h. Specific isotope studies are carried out to support a better understanding on Guarani Aquifer System’s origin and age, evolution, hydrodynamic behavior, boundary conditions, recharge-discharge relationships, and geothermal character.            1i. Different water uses are assessed, including forecasts relying on alternative socioeconomic scenarios simulated through digital aquifer modeling, to support direct decision-making models.            1j. Descriptive maps of the aquifer showing present development and abstractions, including water uses, geographic distribution, and socioeconomic and environmental data, as well as typical well productivity, are available.            1k. Regional technical rules are legal instruments developed to control well design, construction, and operation.            1l. Regional aquifer vulnerability and associated risks assessed, with special emphasis on transboundary areas.</p>	<p>Pollution Risks diminished or controlled</p>

<p><b>2. Joint development and implementation of a management framework for the Guarani Aquifer System</b></p>	<p>\$7 million</p>	<p>2a. Permanent monitoring network comprised of at least 184 wells (5 percent of total number of known wells) in place; adequate equipment, sampling procedures and frequencies, analytical methods, and sample management protocols are available.  2b. Information and documentation system network implemented primarily via Internet, set up, and adequately operated and maintained with sustainable financing identified and available.  2c. One SISAG Focal Point in each country equipped, set up, and functioning in each country.  2d. Documentation available containing the strategic action program for the four countries, legal and institutional frameworks, and accompanying material relevant to decision making, such as regional mapping, diagrams and tables related to the state of the aquifer system, and including identification of financing agencies and donors, and future information needs beyond first program phase  2e. At least eight workshops and meetings held among stakeholders of multiple levels, nationally and internationally, to arrive at sustainable technical, scientific, legal, institutional, political, and diplomatic agreements.  2f. Technical consensus proposal for a legal framework to manage the Guarani Aquifer System elaborated.  2g. Multicountry agreement on an institutional, financial, and technical framework to jointly manage the Guarani Aquifer System exists and is being implemented.  2h. Specific support provided to water managers and strengthened institutional frameworks by means of technical assistance on demand, technical exchanges, and 40 twinning (staff exchange) arrangements.  2i. At least eight events—seminars, meetings, workshops—help to improve water management, with benefit to at least 25 of the countries' organizations active in the groundwater field.  2j. TDA documentation produced and disseminated.</p>	<p>Overdraft risks diminished or controlled</p>
<p><b>3. Public and stakeholder participation, education, and social communication</b></p>	<p>\$1.3 million</p>	<p>3a. Regional public communication and participation plan formulated and documentation available.  3b. Information and document dissemination is continuously provided by the Guarani Aquifer Geographic Information System, especially via its web site.  3c. Guarani Citizens' Fund established and \$240,000 in grants awarded to CSOs.</p>	<p>Risk of future inter-country groundwater conflicts diminished</p>

		<p>3d. Community-level activities carried out by CSOs to enhance public participation, communication, and education.</p> <p>3e. Pertinent public communication materials, adapted to each country and with special emphasis on pilot areas, produced and disseminated.</p> <p>3f. Information dissemination campaigns in each country carried out at a local level.</p> <p>3g. Scoping study carried out, with emphasis on indigenous peoples' rights to water and natural resources.</p> <p>3h. Workshops, training, and direct consultations have taken place in Argentina, Brazil, and Paraguay.</p> <p>3i. Relevant project documentation has been translated into indigenous languages and disseminated.</p>	
<b>4. Project monitoring and evaluation and dissemination of project results</b>	\$0.43 million	<p>4a. Project monitoring and evaluation system is implemented and functioning.</p> <p>4b. At least biannual workshops (by country) held for technical discussions, consultations, and project progress information and feedback.</p> <p>4c. Progress reports, together with project result and performance reports, generated and disseminated at least once per year.</p> <p>4d. Project/country stakeholders participate in at least four relevant international events, including GEF-IW meetings, to share and validate project results.</p> <p>4e. Project web page well-maintained.</p>	Future mitigation and stabilization costs reduced
<b>5. Development of Management and Mitigation Measures within identified "Hot Spots"</b>	\$3.73 million	<p>5a. Socioeconomic participatory stakeholder assessments carried out.</p> <p>5b. Local awareness raised through public participation by means of workshops, consultations, and communications campaign.</p> <p>5c. Scientific studies executed and geological, hydrogeological, and hydrogeochemical information available and periodically updated.</p> <p>5d. Databases on wells, water uses and aquifer parameters are available via SISAG and local information networks.</p> <p>5e. Specific subregional digital hydrogeological models are available to support decision making.</p> <p>5f. Local aquifer management plan elaborated, including institutional arrangements, well permits system, well and recharge protection areas, subregional monitoring networks, and minimum distance criteria for well construction and operation.</p> <p>5g. Specific transboundary management framework developed to</p>	

		<p>allow testing and assessment of specific strategies, tools, and actions to solve problems and provide input to regional actions.</p> <p>5h. Institutional, legal, managerial, social, and environmental experiences documented to allow replicability of assessments.</p> <p>5i. Geohydrological knowledge of area increased, especially regarding recharge and discharge characteristics and aquifer vulnerability.</p> <p>5j. Socioeconomic assessment, including water usage and well inventory, carried out with emphasis on indigenous populations.</p> <p>5k. Public information campaign carried out.</p> <p>5l. Management needs identified and proposal, including priority actions and localities, elaborated.</p> <p>5m. Participatory social assessment, consultations, and local information dissemination carried out.</p> <p>5n. Technical assistance for local aquifer management planning provided.</p> <p>5o. Local aquifer management plan elaborated.</p>	
<b>6. Assessment of geothermal energy potential</b>	\$0.28 million	<p>6a. Geothermal data and pertinent information updated and new thematic maps produced.</p> <p>6b. Four-country task force created to undertake scientific assessment jointly with international experts and agencies.</p> <p>6c. Analyses of socioeconomic, financial, and environmental feasibility of possible future geothermal activities and areas carried out by task force.</p> <p>6d. Conceptual identification of possible pilot projects in the four countries is available.</p>	
<b>7. Project coordination and management</b>	\$4.04 million	<p>7a. Project is well-managed and objectives are reached.</p>	

## Annex E: Persons Consulted

Name	Title	
<b><i>Argentina</i></b>		
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## Annex G: Basic Physical Performance Indicators

Indicator	Comp	Unit	Target				
			Global	Year 1	Year 2	Year 3	Year 4
<i>General Development Performance Indicators</i>							
<b>Input:</b>							
Annual project operating plans produced and agreed upon by the four countries by the month of November	P	#	4	1	1	1	1
Proof of annual national budget allocations, contemplating counterpart funds in agreement with the project operating plans produced, by the month of December	P	#	16	4	4	4	4
UNEPs with a min. of one full staff-person established	P	#	4	4			
Agreements with cofinanceiers finalized and signed	P	#	3	3			
Studies for Component 1 contracted to firms	1	#	10	7	2	1	
Minimum wells visited and sampled	1	#	1,000	400	400	200	
Studies for Component 2 contracted to firms	2	#	8	2	3	2	1
Studies for Component 2 contracted to individuals	2	#	75	16	20	32	7
Computer equipment packages for GIS nodes purchased/installed	2	#	4		4		
Studies for Component 3 contracted to firms	3	#	5		5		
Studies for Component 3 contracted to individuals	3	#	8	3	1	4	
Studies for Component 4 contracted to firms	4	#	3	2			1
Studies for Component 5 contracted to firms	5	#	9	8	1		
Studies for Component 6 contracted to firms	6	#	1			1	

Studies for Component 6 contracted to individuals	6	#	4			4	
TA consultancy contracts for Component 7 assigned to individuals	7	#	12	8	4		
Computer equipment packages for secretariat purchased/installed	7	#	7				
<b>Output:</b>							
Water sample analyses carried out	1A	#	1,000	400	400	200	
Isotope determinations and conclusions produced	1A	#	600	300	300		
Workshops on technical issues	1A	#	10	4	3	2	1
Incremental number of wells being monitored per year (cum.)	2A	#	184			36	184
SISAG modules installed	2B	#	4	4			
Workshops on information system and well monitoring network	2A/B	#	3	1	1	1	
Events—seminars, meetings, workshops—held to improve water management (450 participants each)	2C	#	9	2	2	2	3
Twining programs carried out by water managers	2C	#	40	5	15	15	5
Short-term TA consulting contracts for water management institutions	2C	#	50	10	15	20	5
Training scholarships (program fees and stipends)	2C	#	50		20	20	10
Workshops and meetings held between stakeholders at multiple levels, to arrive at sustainable agreements	2D	#	12	2	2	4	4
Biannual workshops held for technical discussions, consultations and project progress information and feedback	3	#	32	8	8	8	8
Grant amounts awarded to CSOs from the FGC	3	#	240,000	90,000	90,000	60,000	
Public monitoring workshops carried out	4	#	4	1	1	1	1
Comprehensive progress, along with project result and performance reports, generated and disseminated	4	#	4	1	1	1	1

International events with participation of project/country stakeholders	4	#	4	1	1	1	1
Project annual workshops held after year 2	4	#	3		1	1	1
Stakeholder assessments in pilot areas carried out	5	#	4	4			
Scientific studies executed within the pilot project areas	5	#	30	10	14	6	
Heological, hydrogeological and hydrogeochemical maps available via SISAG	5	#	30		10	20	
Specific subregional digital hydrogeological models available for decision-making support	5	#	3			3	
Community communication programs implemented	5	#	4		4		
<b>Outcome:</b>							
Minimum percentage of all wells with water use, availability, quantity and quality assessed by year 2	1A/2	%	70	50	70	70+	70+
Regional hydrogeological maps produced	1A	#	8		4	4	
Conceptual models and specific Hydrogeological maps produced	1A	#	6		3	3	
Persons (government/universities/public utilities, etc.) trained in improved water management	2C	#	4,000	400	900	1,350	1,350
Percentage of population in the aquifer region reached to heighten their awareness about the aquifer existence and importance by year 4	3	#	10				10
<b>Process:</b>							
Multicountry agreement reached on the institutional and technical framework for the management of the SAG	P (2C)	%					100



Transboundary diagnostic analysis, identifying the primary threats to the SAG, carried out: - initial diagnostic - final diagnostic	P (2E)	%		100		100
Strategic action program for the sustainable management of the aquifer, as defined in the PAD, developed	P (2C)	%	25	50	75	100
Consensus proposal for a joint legal framework for the management of the SAG set forth	2C	%				100
Monitoring network implemented and functioning	2A	%			25	100
Mitigation and management measures regarding groundwater pollution and depletion in “hot spots” implemented and monitored	5	%			50	100
<b>Impact (initially nontargeted):</b>						
Pollution risks diminished or controlled	P					
Overdraft risks diminished or stabilized	P					
Risk of future intercountry groundwater conflicts diminished	P					
Future mitigation and stabilization costs reduced	P					
 <b><i>Environmental Performance Indicators</i></b>						
<b>Stress Reduction:</b>						
Operational communications campaign (with a defined percentage of the target population reached) implemented	3 (B,C, D)	%		30	60	100
Water-quality threats identified, quantified, and their evolution monitored	1A, 2A	%		100		
Norms for well design, construction, and maintenance issued, taking into account subregional variations	1B	%		50	100	

Groundwater pollution and depletion in specific “hot spots” identified	5	%	50	100
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**Environmental Status:**

Goals, criteria, and standards for the transboundary diagnostic analysis and sustainable management of the SAG agreed upon: - for initial diagnostic - for final diagnostic	P (2E)	%	100	100
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SAG western and southern boundaries, recharge and discharge areas, and surge zones	1A	%	75	100
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Conceptual and mathematical models of the aquifer system completed	1A	%		100
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Up-to-date, operative, shared information system, implemented for transboundary information dissemination, decision-making support, and management of the SAG	1B	%	75	100
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*Source:* PAD, Table A18-1, pp. 138-140.

## Annex H: Critical Risks

Risk	Risk Rating	Risk Mitigation Measure
<b>From Outputs to Objective</b>		
Countries discontinue agreement to assess, generate, and share data about the aquifer; relevant data and information is not available or shared.	M	Build a strong climate of collaboration through frequent and transparent communication during project preparation and implementation. Use Project Steering Committee to reinforce agreement.
Institutional arrangements cannot be agreed on or do not function; agreements on compatible protocols, methodologies, processes, and organizations cannot be reached.	M	Work with project Steering Committee to find solutions.
Counterpart funding not available.	M	The major part of contribution is in-kind. Use discussions in Steering Committee to resolve issue.
Capacity-building measures do not produce quality contributions from all countries.	M	Monitor quality of inputs from all four countries and strengthen where needed.
Agreement on light and fair administrative structure for aquifer management cannot be reached.	S	Start discussions early in the process and take into account interests of the four countries, including the different stakeholder and decision-making groups.
Local stakeholders, communities (CSOs) and NGOs are not appropriately involved in project implementation.	M	Disseminate information to civil society and design institutional arrangements to include organizations.
Institutional roles not clarified, or supported politically or financially, especially at the subnational government levels.	S	Build a strong climate of collaboration through frequent and transparent communication during project preparation and implementation. Work with project Steering Committee to improve institutional functioning.
Countries fail to carry out their obligations under regional agreements and plans.	M	Use Steering Committee mechanism and communication to resolve. General Secretariat to emphasize efforts in enforcing obligations.

Risk	Risk Rating	Risk Mitigation Measure
<b>From Components to Outputs</b>		
Collaboration among partners in the four countries weakens.	M	Build a process of continued interaction as well as adequate monitoring of joint project results.
Investigations are not carried out in a timely manner, leading to partial slippage.	S	Monitor input continuously and strengthen where needed.
Governments and the public do not remain interested in broad participation in the project.	M	Involve civil society from the beginning and inform them of options for participation to foster inclusion.
Local interest in pilot measures is low; public does not participate in the project.	M	Secretariat to provide information to local stakeholders and incorporate concerns into design from beginning.
Aquifer management system is not agreed upon or established.	M	Build a strong climate of collaboration between all stakeholders through frequent and transparent communication. Work through Steering Committee to reinforce decision-making processes.
Timely follow-up is not achieved.	M	Encourage local ownership of the project through workshops and seminars; prepare the implementation strategy during the project period and secure funding for implementation.
Collaboration among partners, stakeholders, governmental units, and NGOs is not possible or fails.	S	Disseminate information to civil society and design institutional arrangements to include organizations; build a strong climate of collaboration. General Secretariat to enhance efforts in this regard.
<b>Overall Risk Rating</b>	<b>M</b>	

Risk Rating- H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

Source: PAD, pp. 30-31.