



Palestinian National Authority  
Palestinian Water Authority



السلطة الوطنية الفلسطينية  
سلطة المياه الفلسطينية



Sustainable Management of the West Bank and Gaza Aquifers

UNIVERSITY OF  
NEWCASTLE



Department for  
International  
Development

**DFID**

## Evaluation of Economic Sustainability Indicators for Water Resources Management Options in Palestine

### Standardised 1st level indicators

	MO1	MO2	MO5	MO6	MO7	MO8
Internal rate of return IRR	0.47	0.00	0.50	1.00	0.01	0.21
Agricultural water production cost	1.00	1.00	1.00	1.00	1.00	0.00
Public network production cost	0.92	0.95	0.17	0.96	0.00	0.17
Public network production cost per beneficiary	0.00	0.97	0.50	1.00	0.73	0.50
Industrial/agricultural water productivity	1.00	0.93	0.00	0.96	0.95	0.02
Aquifer water level	0.00	0.50	0.25	0.50	0.50	0.50
Reliability of supply from aquifer	1.00	1.00	1.00	1.00	1.00	1.00
Aquifer water quality	0.50	0.50	0.50	0.50	0.50	0.50
Wastewater discharge	0.00	0.85	0.85	0.81	1.00	0.88
Agricultural pesticide use	0.00	0.48	0.40	0.46	1.00	0.48
Industrial effluent	0.00	0.97	0.80	0.87	0.93	0.87
Water connection	1.00	0.00	1.00	1.00	0.00	0.49
Water quality	0.66	0.00	0.66	0.66	1.00	0.66
Water Usage	1.00	0.00	0.00	0.00	1.00	1.00
Agricultural jobs	0.33	0.33	0.00	0.66	0.33	1.00
Industrial jobs	1.00	0.00	0.51	0.51	0.00	1.00
Source yield and livelihoods	1.00	0.00	0.51	1.00	1.00	1.00
Expenditure on water	0.00	1.00	1.00	1.00	1.00	0.51

SUSMAQ- SUS # 52 V 1.1

July 2005

<p><b>Disclaimer</b></p> <p>This report is an output from the SUSMAQ project “Sustainable Management of the West Bank and Gaza Aquifers”. The findings, interpretations and conclusions expressed are those of the authors and should not be attributed to other collaborators on the SUSMAQ project.</p> <p>The project does not guarantee the accuracy of the data included in this publication. Boundaries, colours, denominations and other information shown in maps, figures, tables and the text does not imply any judgment on legal status of territory or the endorsement of boundaries. The typescript of this report has not been prepared in accordance with procedures appropriate to formal printed texts, and the partners and funding agency accept no responsibility for errors.</p>	<p><b>Contact Details</b></p> <p>Professor Enda O’Connell Project Director University of Newcastle upon Tyne Tel: +44 (0)191 222 6405 Fax: +44 (0)191 222 6669 Email: P.E.O’Connell@ncl.ac.uk</p> <p>Eng. Fadle Kawash Deputy Chairman Palestinian Water Authority Ramallah, Palestine Tel: +972 (0)2 295 9022 Fax: +972 (0)2 2981341 Email: fkawash@pwa-pna.org</p> <p>Dr. Amjad Aliewi Operations and Technical Manager House of Water and the Environment Al-Irsal Road, Al-Bireh, Palestine Tel:+972 (0)2 240 1776 Fax: +972 (0)2 240 1776 Email: amjad.aliewi@hwe.org.ps</p>
<p><b>The SUSMAQ Project</b></p> <p>The aim of the project is to increase understanding of the sustainable yield of the West Bank and Gaza aquifers under a range of future economic, demographic and land use scenarios, and to evaluate alternative groundwater management options. The project is interdisciplinary, bringing together hydrogeologists and groundwater modellers with economists and policy experts. In this way, hydrogeological understanding can inform, and be informed by, insights from the social sciences. The results of the study will provide support to decision-making at all levels in relation to the sustainable yield of the West Bank and Gaza aquifers.</p> <p>The project runs from November 1999 to October 2004, and is a partnership between the Palestinian Water Authority, University of Newcastle upon Tyne. The project is funded by the United Kingdom Government’s Department for International Development (DfID).</p>	<p><b>Project Results Dissemination</b></p> <p>The project disseminates its results through the project website <a href="http://www.ncl.ac.uk/susmaq">www.ncl.ac.uk/susmaq</a>, newsletters, workshops, technical meetings, publications in conference and scientific journals.</p>
<p><b>Bibliographical Reference</b></p> <p>This report should be referenced as: SUSMAQ (2005). Evaluation of Economic Sustainability Indicators for Water Resources Management Options in Palestine. Report No. SUSMAQ - SUS #52 V1.1, Sustainable Management of the West Bank and Gaza Aquifers, Palestinian Water Authority (Palestine) and University of Newcastle upon Tyne (UK).</p> <p><b>Authors:</b> Miles Burton, Khalil Saleh, Felipe Contreras-Jimenez, Subha Ghannam</p>	

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# 1 Introduction

## 1.1 Scope of report

This report describes how economic Basic Indicators (BIs) have been evaluated as part of assessments of the sustainability of a range of water resource Management Options (MOs), for a set of scenarios being considered within the SUSMAQ project (SUSMAQ Report #39). The BI evaluations provide data in support of policy making, using a multi-criteria analysis (MCA) methodology (SUSMAQ Report #41) implemented as part of decision support toolkit (DST) software (SUSMAQ Report #56).

## 1.2 Overall approach

The economic BIs are subdivided into two groups: EN01-03 relate to investment efficiency, and EN04-05 relate to social versus productive benefits. Full definitions of all indicators are given in SUSMAQ Report #38. Other related economic indicators such as “Agricultural Job Creation” and “Industrial Job Creation”, although socio-economic in character, were considered to be more social than economic orientated and have therefore been considered as Social Basic Indicators.

The BIs are evaluated for a demonstration study of the sustainability assessment methodology for the West Bank. For this demonstration study, the economic indicators are evaluated only for the three regions of the West Bank since data was not available for Gaza due to difficulties under the restricted communication conditions during the final data compilation period. The evaluation takes account of all water sources serving these three regions, which includes the parts of the Western Aquifer Basin (WAB), Eastern Aquifer Basin (EAB) and North-Eastern Aquifer Basin (NEAB) within the West Bank and surface, desalinated and other sources. The evaluation was carried out using the SUSMAQ Package Database, based on the Palestinian National Water Plan (NWP) database developed by the PWA, which contains information on planned water sector projects. In the NWP database, individual investment projects (eg. Building a new pumping station, rehabilitation of a distribution network) are grouped together into ‘packages’, each of which can deliver additional/improved water availability. The SUSMAQ database includes information at this package level. A full list of data held in the SUSMAQ package database is given in SUSMAQ Report #56.

It is not possible to calculate baseline values for the economic BIs since they are evaluated from measurement of the new project investments in the Package Database. The indicator values over the 25-year Package Database planning period are calculated, as far as possible, using information from the NWP database for groups of packages representing each MO being tested. However due to the incomplete state of the data-base at this point of time, calculations with sufficient data for credibility of the results were only possible for those Management Options representing additional supply options or demand management options. This in principle covers MOs 1: Groundwater supply; 2: Rainwater Harvesting; 4: Mekerot Supply; 5: Desalination; 6: Demand Management; 7: Protection/Conservation; 8: Re-use; 13: Surface Water and 14: Importation as described in SUSMAQ Report #39. However in practice MOs 4, 13 and 14 have not been included in the NWP database at this point of time and therefore measurements were not possible for these MOs. The same approach to

evaluation of BIs as illustrated in the demonstration study can be extended in the future to cover the other MOs as and when the database information is updated and completed. In SUSMAQ Report #39 the NWP database is analysed regarding the omission or incompleteness of data and this analysis can be utilised as a basis for the necessary updating and completion of the database.

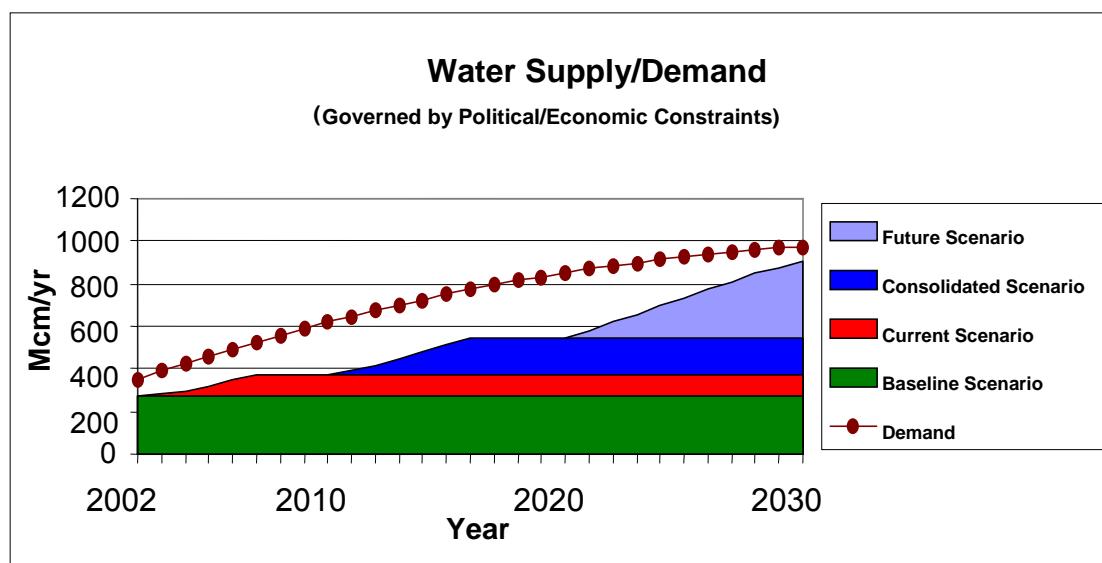
### 1.3 Scenario definition

The BIs are evaluated for three hydropolitical/socio-economic scenarios representing possible alternative futures for Palestine (SUSMAQ Report #39):

- Current scenario;
- Consolidating scenario;
- Future scenario.

The fundamental principle in selecting this approach to scenario definition is the uncertainty of time scale applicable to each scenario which is turn will be principally dependent on political developments. Economic BIs have therefore been evaluated in relation to the constraints applicable to these scenarios as governed by their definitions. These definitions have been converted into limits or ceilings of water development in each scenario and related to each Management Option. The SUSMAQ database packages have then been applied in accordance with their priority rating (converted into an anticipated start date) in the database until the ceilings have been reached. In this way the time period applicable to each of the current and consolidating scenarios is determined by the constraints and practical implementation schedules of the priority projects and not theoretically as in previous studies. This results in a consequent period of no development (the “ceiling”) within that particular scenario if the defined constraints still apply and can be used to illustrate the deteriorating service levels, environmental conditions and health and economic impacts that would occur as illustrated in Figure 1.1 below.

**Figure 1.1: Illustrative Water Supply/Demand by Scenarios**



This can also be consequently used to support lifting of these constraints and introduction of a more socially conscientious approach. The background and development of the above process is presented in detail in SUSMAQ Report #39.

#### ***1.4 Regional assessments***

Since the hydrogeological, social and economic conditions differ markedly in different parts of the Palestinian Territories, indicators describing 'average' conditions may not be representative of the actual state they are intended to describe. Also, the SUSMAQ MOs are not all applicable equally in different parts of the Palestinian Territories. The Palestinian Territories were therefore subdivided into 4 regions, based on administrative boundaries:

- West Bank North: Nablus, Tulkarem and Jenin;
- West Bank Central: Ramallah, Jerusalem and Jericho;
- West Bank South: Bethlehem and Hebron;
- Gaza.

The data used in the calculations are available from projects often at the governorate level. Where projects stretched across governorates or regions these were divided pro-rata in accordance with the proportionate part of the project or group of projects within each region.

In this demonstration study, the indicators were evaluated separately for the West Bank North Region for each of the hydropolitical/socio-economic scenarios and for only the current scenario in the other two regions. The indicator values are given in Appendix A (Tables A.1 to A.5).

It was considered that this configuration of demonstration studies best illustrated the impact of the differences within the current scenario across the three regions of the West Bank and the developing impact in one region as the scenarios change. In principle this should both illustrate the impact of the increasingly drier conditions from north to south and the deteriorating economic and social conditions from Central to North then South regions. Over time it should also be expected to illustrate the increasing relative sensitivity of the environment as development and populations increase and the potentially improving economic and social conditions. In this way the varying impact and sensitivity of indicators within one scenario over the various regions and the varying relative impact of different indicators within the same region over time can be illustrated.



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