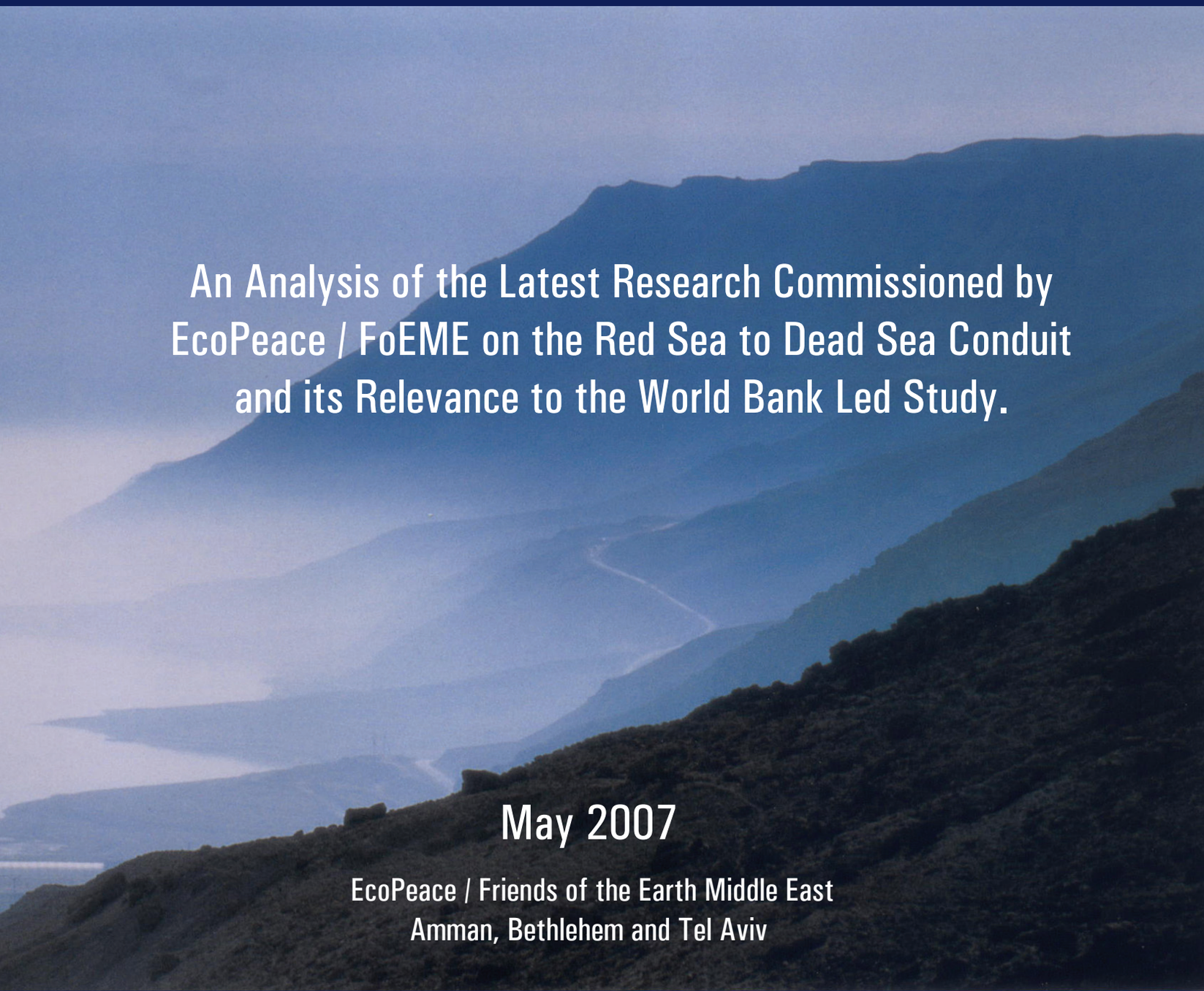
Friends of the Earth Middle East



An Analysis of the Latest Research Commissioned by EcoPeace / FoEME on the Red Sea to Dead Sea Conduit and its Relevance to the World Bank Led Study.

May 2007

EcoPeace / Friends of the Earth Middle East
Amman, Bethlehem and Tel Aviv

USAID
United States Agency for International Development

ANERA
American Near East Refugee Aid

This publication was made possible through the support provided by USAID – Middle East Regional Cooperation (MERC) program, Bureau for Global Programs, US Agency for International Development under the terms of award No. TA- MOU 03- M23-024. The opinions expressed herein are those of EcoPeace / FoEME and do not necessarily reflect the views of the US Agency for International Development.

Special Thanks are expressed to the American Near East Refuge Aid (ANERA) for facilitation of this project.

Gratitude is also expressed to The Royal Scientific Society (RSS), The Geological Survey of Israel (GSI), and Water and Environment Development Organization (WEDO) for their partnership and cooperation in this scientific pioneering effort for the Middle East.

Report Authors: Gidon Bromberg, Michael Hershan, Abdel Rahman Sultan and Pernille Rydahl.

FoEME Project Coordinators: Munqeth Mehyar, Tala Momani, Gidon Bromberg, George Manarius and Georgina Abu Rizik

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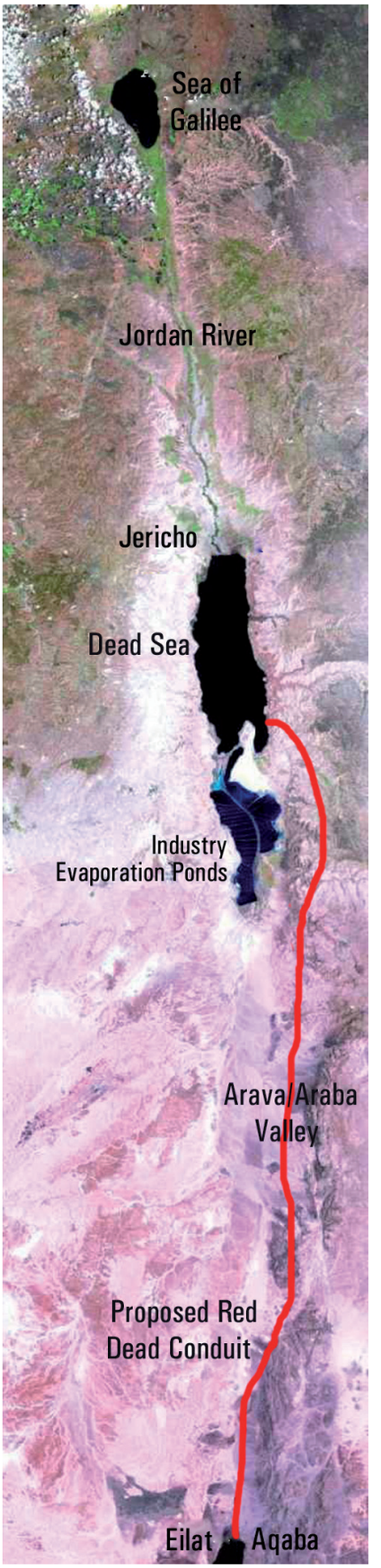

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1. Introduction

For over a decade, EcoPeace / Friends of the Earth Middle East (FoEME)[1], has dedicated a great deal of time and resources to promote a cooperative approach to water issues, particularly in the Dead Sea Basin and the Jordan River Valley. FoEME has led many campaigns for the stated purposes of 'saving' the Dead Sea from further degradation, and rehabilitating the Jordan River, directly undertaking or commissioning close to a dozen reports for such purposes[2].

The reports most recently commissioned by FoEME with the support of the Middle East Regional Cooperation (MERC) program of USAID[3], through American Near East Refugee Aid (ANERA), engaged for over a two year period, leading Jordanian, Israeli and Palestinian researchers to investigate and map out key potential environmental and socioeconomic impacts, positive and negative, that might occur to the Gulf of Aqaba/Eilat, Wadi Araba/Arava and the Dead Sea as a result of the proposed building and operation of any Red Sea – Dead Sea Conduit (RDC). The study was divided into four subset components, each independently carried out, focusing on the Dead Sea, the Araba/Arava Valley, the Gulf of Aqaba/Eilat and socio-economic issues. Due to limited funding we wish to point out that not all necessary and relevant issues were studied. We therefore had to prioritize and at FoEME we chose to focus on the possible impacts of the RDC on water resources; marine, groundwater and the Dead Sea waters themselves. It is the responsibility of the World Bank and/or any other proponent of the RDC project to ensure that all necessary studies are indeed carried out for all relevant sectors.

The research on the Dead Sea was carried out by the **Geological Survey of Israel** (GSI) resulting in their publication entitled **'A multi-component chemistry-based model for the Dead Sea, Modification of the 1D Princeton Oceanographic Model**.'

The research on Wadi Araba/Arava was also carried out by the **Geological Survey of Israel** (GSI) resulting in their publication entitled, **'Red Sea-Dead Sea Conduit, Geo-Environmental Study Along the Arava Valley.**'

The research on the Gulf of Aqaba/Eilat was carried out by the **Royal Scientific Society/Environmental Research Centre** (RSS) in Jordan, resulting in their publication entitled, **'The Marine Environment Component Study.'**

The research on socio economic issues was carried out by the **Royal Scientific Society/Environmental Research Centre** (RSS) in Jordan and a Palestinian NGO, **Water Environment and Development Organization**, resulting in their two

[1] EcoPeace/Friends of the Earth Middle East is a unique, grassroots, not-for-profit organization that brings together Jordanian, Palestinian and Israeli environmentalists with the primary objective of promoting cooperative efforts to protect our shared environmental heritage. In so doing, we seek to advance both sustainable regional development and the creation of necessary conditions for lasting peace in our region.

[2] See FoEME Website for full list of FoEME publications www.foeme.org

[3] Under USAID award number TA-MOU-03-M23-024

publications entitled, **' Socio-Economic Condition**' for Jordan and '**Socio-Economic Study in Israel and Palestine'**.

These latest studies commissioned by FoEME were in full knowledge of the desire of our three governments; Jordanian, Israeli and Palestinian to have the World Bank lead a study on this very issue[4]. Our purpose was not to duplicate any World Bank effort but undertake initial independent research that would facilitate greater understanding of the complexity of the issues that the project raises and foster maximum public discussion, even prior to any World Bank study being launched.

FoEME has never opposed the idea of a World Bank study on the feasibility and environmental impact of such a project. On the contrary, FoEME supports a comprehensive and independent study being launched. The key critique, yet to be resolved, that FoEME has expressed as regards the World Bank process, relates to the failure to include in the Terms of Reference (ToR) of the World Bank study an independent analysis of alternatives to the RDC project.

The ToR, signed by the World Bank and beneficiary governments, state that the primary objective of the RDC project is to halt the degradation of the Dead Sea environment by remedying its dropping water level.[5] It is widely acknowledged that the declining level of the Dead Sea is largely caused by water diversion from the Jordan River, which has throughout history been the natural source of fresh water for the Dead Sea. FoEME believes that regenerating the partial flow of the Jordan River is an alternative option to the RDC project that must be studied as a means for halting the dropping water level of the Dead Sea. FoEME further believes that it would be a breach of the World Bank's own operational guidelines if the RDC and Jordan River options were not studied and compared, as regards their feasibility, environmental impact, ecosystem risk and financial cost.

The World Bank has given technical assistance to the RDC project, overseeing the process of drafting the ToR and taking responsibility for its implementation. The bank has also convened donor meetings to raise money to undertake a Feasibility Study and an Environmental and Social Assessment and has World Bank staff sitting on the technical steering committee of the RDC project. The World Bank has at all material times been responsible for the drafting of the ToR and has had actual knowledge of the concerns of EcoPeace/Friends of the Earth Middle East during the negotiations of each draft of the World Bank ToR.

Though some issues raised by FoEME were incorporated by the World Bank in the final draft of the ToR, the key critique relating to the Jordan River alternative, including an independent study of the water economy of the region has yet to be included. For the sake of public interest and out of sincere concern to promote sustainable development in the Dead Sea Basin, FoEME with this paper seeks to continue to impact upon the decision making process that is advancing this project.

With the completion of four new studies commissioned by FoEME on the RDC project, this paper seeks to review and analyze report findings in the context of the

[4] World Summit for Sustainable Development, Johannesburg, 2002, Israel/Jordan side event on RDC
[5] Red Sea – Dead Sea Water Conveyance Project, Feasibility Study and Environmental and Social Assessment, dated 19 April 2005 ("the Terms of Reference"),(ToR) paragraphs 1.1, 1.2 and 1.3.

World Bank ToR. Our purpose is to inform decision makers and the public at large as to how this new information needs to impact any study to be undertaken. The ToR in fact explicitly recognizes that a wealth of knowledge and data has already been collected and that therefore in Phase I of the study the consultants are being asked first to review previous studies and experience associated with the project[6].

This paper reviews the latest reports produced by GSI, RSS and WEDO and highlights key points of concern to FoEME as regards the four issues studied. The paper then details the justification for studying the Jordan River alternative and why its exclusion from the ToR may constitute a breach of World Bank Operational Guidelines.

These comments are in addition to earlier comments made by FoEME to the World Bank and our own governments as regards the ToR[7]. FoEME seeks to make it clear that the analyses undertaken below, the interpretation and weight given to findings and all other comments made, represent solely the opinion of EcoPeace/Friends of the Earth Middle East and not that of GSI or RSS or any of our funders. While recognizing that positive findings were identified in all the new studies commissioned, FoEME is in this paper highlighting concerns and missing details such as the Jordan River alternative for the purpose of seeking to improve any study to be undertaken and the quality of information made available to decision makers and the public at large.

2. An Assessment of Report Findings

2.1 The Dead Sea Study

2.1.1 Dead Sea study findings of concern to FoEME: 'A multi-component chemistry-based model for the Dead Sea, Modification of the 1D Princeton Oceanographic Model.' Geological Survey of Israel (GSI).

- Inflow of seawater (or reject brine) into the Dead Sea will have a major impact on its limnology, geochemistry and biology.
- Dead Sea water column will become stratified with a relatively diluted upper water layer.
- The mixing between calcium rich Dead Sea brine and sulfate rich seawater will result in gypsum precipitation that could lead to whitening of the surface water.
- Dilution of the surface water will probably result in microbial blooming
- Blooms once present can remain for long periods and determine to a large extent the properties of the lake for many years.
- Lower water layer likely to develop reducing conditions – release of hydrogen sulfide.
- Over the long run the composition of this unique lake will change.

2.1.2 Relevance to the World Bank study

- In the present ToR only **15 months** are allocated to conduct all the necessary studies on areas identified as knowledge gaps. The GSI design of a one dimensional limnological model for the Dead Sea took **24 months** to produce.

[6] Terms of Reference, paragraph 3.3 and 3.4.1
[7] See FoEME's prior Comments to World Bank ToR at http://www.foeme.org/publications.php?ind=28

GSI recommend the outstanding need for calibration and detailed scenario building of the one dimensional model as well as the formulation of two and three dimensional models. Given the seriousness of the findings listed above and the fact that the Dead Sea has features that GSI states have never been modeled before, additional time is needed for extensive peer review and public consultation. Time must also be allocated for analysis, estimation and the necessary public discussion of the inherent risk that any model produced might ultimately fail.

- Considering the above factors FoEME questions whether the 15 month period allocated to undertake all studies is realistic and is concerned that political pressures to complete the study as soon as possible may have influenced this outcome.
- Of further concern to FoEME is the provision in the ToR which requires our own governments, through the Technical Steering Committee created for the project, to approve the performance and extent of any additional studies, such as the model discussed above, prior to such studies being conducted[8]. The current language of the ToR opens the door for potential political intervention in the type, extent and level of peer review of studies to be undertaken.

2.2 Wadi Araba/Arava Study

2.2.1 Wadi Araba/Arava study findings of concern to FoEME: 'Red Sea-Dead Sea Conduit, Geo-Environmental Study Along the Arava Valley.' Geological Survey of Israel

- Estimated annual exploitation figures of groundwater in the Arava Valley are between 40-55 million cubic meters per year.
- The groundwater and in particular the water in the alluvial aquifer system which are low in salinity are of prime importance to agriculture and tourism in the valley.
- The vulnerability of the ground water resources to leaks from the RDC is a major concern.
- Tectonic activity along the Arava Valley is complex and can endanger many facilities on both end points of the conduit.
- Due to potential flash floods, watersheds in the northern and southern part of the Arava Valley pose a high risk to the proposed conduit if built on an open or near surface level.
- Watersheds in the middle part of the Arava Valley pose a medium to low risk to the proposed conduit if built on an open or near surface level.

2.2.2 Relevance to the World Bank study

- The GSI study identifies five additional studies to be undertaken. These relate to groundwater vulnerability, a digital terrain model, fault line study, surface displacement and siesmicity and amplification study. The same time concerns and potential for political interference mentioned above are relevant here too.

[8] Terms of Reference, paragraph 3.4.2

- The GSI study focused on the risk to ground water and conduit infrastructure due to constant leakage, flashfloods and tectonic activities. Still to be investigated are the risks posed to people, homes, livestock, agricultural produce and public infrastructure such as roads, water provision etc, should the conduit burst for any reason and either create a flashflood or further contribute to flooding. The World Bank ToR does make mention of the 'special risk'[9] associated with a seismic event that could cause 'catastrophic failure' but there is no discussion as to the weight this special risk should have in the project's evaluation.
- Further yet to be considered are the many public statements by leading politicians in support of the RDC project that they intend to use the waters of the RDC to create an artificial sea water lake in the midst of the Arava Valley surrounded by hotels and use fresh water produced by the proposed desalination process to greatly increase agricultural lands. Current language in the ToR dealing will induced impacts[10] that might be associated with the RDC appears to be inadequate considering the size of these proposed additional projects that might cause greater harm to the loss of open spaces, loss of fauna and flora and contamination of groundwater resources then the RDC itself.
- An economic feasibility study of the RDC project is apparently being launched independently of the World Bank study by the office of the Israeli Vice Premier. That study is believed to include consideration of the potential for tourism and agricultural expansion associated with RDC. However the Israeli study will not cover environmental and social aspects, instead focusing only on the economic issues. The World Bank study cannot ignore the size and seriousness of the consequences associated with these additional proposed developments. A new chapter must be included in the ToR that would investigate the potential environmental and social impacts of these proposed projects.

2.3 Gulf of Aqaba/Eilat Study

2.3.1 Gulf of Aqaba/Eilat findings of concern to FoEME: 'The Marine Environment Component Study.' Royal Scientific Society/Environmental Research Centre, Jordan.

- Construction activities at the seawater intake will destroy benthic habitat at the site of intake.
- Depending on the recommended option chosen, seawater intake will impact upon seawater circulation for a 3km stretch either side of the intake point.
- A slight increase in surface water temperatures and decrease in salinity at the northern head of the Gulf of Aqaba can be expected.
- Water intake effect on sea level not expected to be locally confined; rather the whole Gulf of Aqaba and Red Sea would be impacted by the RDC intake due to compensation seawater inflow from the Red Sea.

[9] Terms of Reference, paragraph 12.3.11
[10] Terms of Reference, paragraph 12.3.10

2.3.2 Relevance to the World Bank study

- The RSS study states that the RDC project is unique as no pumping at this level has ever been implemented before and therefore no data exists for a similar sized project. This would seem to indicate the need to further study the issue through computer modeling over and above experimentation and literature review undertaken by RSS. The World Bank ToR make no mention of undertaking modeling and therefore the same time concerns and potential for political interference mentioned twice above are also relevant here.

2.4 Socio-Economic Studies

2.4.1 Socio-economic findings of concern to FoEME: ' Socio-Economic Condition.' Royal Scientific Society/Environmental Research Centre and Water Environment and Development Organization.

- There is overall support for the RDC project amongst Jordanian Dead Sea, Araba and Aqaba residents surveyed. Dead Sea and Araba residents had great interest in additional water resources but also expressed significant concerns over any negative impact of mixing Red Sea and Dead Sea waters. Aqaba residents were concerned about impact of pumping on marine life, tourism and noise pollution.
- Almost 3/4 of the tourists surveyed on the Jordanian side of the Dead Sea were in favor of the RDC project expressing concern as to the continuing drop of the water level. However over 50% were alarmed by any impact mixing might have on medicinal values. Almost half of the tourists were not alarmed if sea water mixing only results in a slight change of water color.
- Representatives of the mineral extraction industry at the Dead Sea expressed overwhelming support for the RDC project yet were equally concerned by any impact mixing of sea water would have on the quality of their production process.
- Hotels at both the Dead Sea and Aqaba will be fully supportive of the RDC project. Hotels at the Dead Sea were very interested in increased water availability but 50% surveyed expressed concern that the new infrastructure associated with the project would negatively impact hotel occupancy.
- Mixed results for the RDC project were reported amongst Israeli Dead Sea, Arava and Eilat residents. While general support for the project was recorded, significant concern was expressed over impacts on tourism in Eilat and the results of the mixing of waters on Dead Sea tourism. Half of the Arava residents surveyed opposed the RDC project outright and a majority surveyed saw importance for the study of other alternatives in addition to the RDC.
- An almost absolute majority of tourists on the Israeli side of the Dead Sea were yet to have an opinion for or against the RDC project. Some did however have significant concerns as to any negative effects related to infrastructure and the mixing of the waters and the vast majority thought that other options in addition to the RDC should be studied.
- Only residents of Jericho were surveyed on the Palestinian side. The vast majority was in favor of the project but expressed real concern as to the impact of mixing and was interested in alternative options to the RDC being studied.

2.4.2 Relevance to the World Bank study

The Jordanian, Palestinian and Israeli surveys undertaken, show the need for extensive consultation to take place with respect to the RDC project. They reveal that in 2005/6, when the surveys were carried out, a vast majority of people knew either nothing or only speculation about the project, with relatively few in all countries actually having read about project details. Considering the scale and possible irreversible impacts of the RDC project, all parties concerned should be eager to increase public awareness as to the issues involved and encourage maximum public discussion. An interesting detail from the Palestinian and Israeli surveys was that the more people had read about the RDC project, the more concerns they expressed, perhaps due to better understanding of the complexity of the project.

FoEME is concerned by World Bank statements that the public consultation process will be sponsored and directly involve government officials[11]. For the sake of independence and openness of opinion, it is important that public consultation also take place in an atmosphere of confidence. Broad World Bank statements that the study will be undertaken in a way that 'reflects and respects the unique political culture of the Middle East,' are of concern, for the ease in which they could be misused and applied to affect the independence of any study.

3. The Jordan River Alternative

3.1 Background

Until the 1950's the Jordan River carried an average of 1.3 billion cubic meters of fresh water annually in to the Dead Sea making the Jordan River the primary source of fresh water for the lake. Today this figure has been reduced to just 70 – 100 million cubic meters per year. Israel, Jordan and Syria divert 95% of the water that once flowed through the Jordan River upstream.

By diverting fresh water from Jordan River tributaries and replacing it with sewage, not only has the Dead Sea been devastated but also the culturally and historically important Jordan River has been turned into little more than an open sewage channel. This is contrary to natural and cultural heritage values subscribed to by Israel and Jordan under international conventions. In recent years grass roots activities in Israel, Jordan and Palestine have been taking place to try to raise awareness as to the state of both the Jordan River and the Dead Sea in an effort to improve the inflow of water for both.

FoEME recognizes that there are constraints involved in conducting a Feasibility Study and Environmental Assessment. However a study which seeks to address the declining levels of the Dead Sea without addressing what constitutes the root cause of the decline is in our opinion grossly flawed.

Key professionals knowledgeable of the issues in both Israel and Jordan have made statements in favor of a study of the Jordan River option. An Israeli government decision taken in 2003 required the preparation of a policy document on the future of

[11] 'Red Sea – Dead Sea Water Conveyance Concept,' World Bank Information Note, March 2006.

the Dead Sea to be compiled by the Ministry of the Environment and the Ministry of National Infrastructure.[12] The Israeli Government decision requested a review of three possible scenarios and their impact on the Dead Sea; **business as usual**; **seawater conduit** and **freshwater supply**. The freshwater supply refers to a study of restoring a considerable portion of the natural sources of water that flowed into the Dead Sea.[13]

By 2006 however only the **business as usual scenario** was completed leading Israeli professionals who took part in the policy document to issue the following declaration: "All who took part in preparing the current policy paper on the future of the Dead Sea call on the government to implement the above recommendations… in line with previous government decisions, are the studies…. of restoring most of the natural flow (particularly of the Jordan and the Yarmuk) to the Dead Sea. This should be done parallel to the feasibility study of the Red Sea — Dead Sea conduit (the "peace conduit"), due to be undertaken by international consultants under the auspices of the World Bank."[14]

The Royal Scientific Society in their opening statement of the Socio-Economic Study not only support the Jordan River study but unequivocally state that if the parties could only cooperate it would be the solution of choice.

"Since the main reason of the Dead Sea decline is diversion of the Jordan River and other springs that naturally flow into the Dead Sea for agricultural, industrial and municipal services in Israel and Jordan. Then a simple and direct idea to save the Dead Sea would be to implement an integrated, cooperative plan between the three parties (Jordan, Israel and Palestine) to efficiently manage the Dead Sea basin and distribute the surrounding water resources equally assuring that considerable amount of fresh water flows back to the Dead Sea. This plan represents a cure of crises from its original cause. If this plan is well studied analyzed and skillfully managed then it will be much easier, more feasible and with very low impact on the environment compared with other solutions."[15]

3.2 The hard questions that should be studied

It would be unreasonable to consider alternatives that are plainly unfeasible as part of the Feasibility Study and Social and Environmental Assessment; this is precisely the grounds upon which the current ToR seeks to dismiss the Jordan River alternative.

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[12] Israeli Government decision no. 2863, 5 January 2003

[13] **Setting the Policy Agenda for the Future of the Dead Sea: Interim Report Examining the "business as usual" scenario,** Jerusalem March 2004, State of Israel, Ministry of the Environment, Ministry of National Infrastructure Policy Division, The Geological Survey, The Jerusalem Institute for Israel Studies, Center for Environmental Policy, page 2, (English language summary).

[14] **The Dead Sea Basin -** ***Assessment of Current Situation and Prospects for the Future*** **Under Continued Dead Sea Water-Level Decline,** Jerusalem 2006
The Jerusalem Institute for Israel Studies, Ministry of the Environment, Ministry of National Infrastructures, the Geological Survey, State of Israel, page Xiii, (English language summary).

[15] **'Socio-Economic Condition.' Royal Scientific Society/Environmental Research Centre**, Page 6

In order to partially restore the flow of the Jordan River, riparian countries would have to reduce the amount of water being diverted upstream for domestic and agricultural use. This can be achieved through the promotion of public and private water conservation measures, more realistic water pricing, agricultural sector reforms and capitalization of unexploited water resources.

At present agriculture consumes over 57% of Israel's total water utilization[16] while employing approximately 2% of the workforce and accounting for only 1.8% of GNP[17] while in Jordan agriculture is estimated to use 73.9% of the total water consumption,[18] employing 5% of the workforce for a return of 2.8% of GDP.[19] These extremely poor economic returns for water are the result of significant government subsidies for water being used in agriculture and the lack of education and incentives to better conserve water resources. These practices enable massive water diversion at unreasonably low prices, which leads to the widespread misuse of our most scarce resources in the region - water. Government subsidies facilitate the cultivation of inappropriate crops, such as tropical fruits, which need excessively large amounts of water for this region. Without independently studying the opportunities of better water management in the region, an outcome of the RDC project will be to further encourage unsustainable water practices. Introducing more efficient agricultural practices will dramatically reduce the strain on existing water resources and increase the feasibility of regenerating the flow of the Jordan River.

Demand management reforms can be accompanied by exploitation of under utilized sources of water; reuse of treated sewage water, desalination and yet untapped groundwater. Former Israeli Water Commissioner Professor Dan Zaslavski has estimated that regenerating the flow of the Jordan River to bring water to the Dead Sea will cost no more than $800 million,[20] substantially less than the $5 billion it is estimated that will be required to complete the RDC project. In addition to the comparatively low cost, the regeneration of the Jordan River will in itself deliver hundreds of millions of dollars worth of benefits each year as the Jordan River has immense historical, cultural and natural values and its unexploited value for tourism is significant.

These factors indicate in the opinion of FoEME, that it is advantageous to include in the RDC project an independent study of the feasibility of restoring the flow of the Jordan River as a means of halting the decline of the Dead Sea. Consideration of this course of action should be given in the ToR so that decision makers and the general public are fully informed of their options in dealing with the difficult situation that the region finds itself in with respect to water.

[16] Israel Central Bureau of Statistics, "Agriculture in Israel, Table 12: Water Production and Consumption by Source and Purpose," latest figures are from 2004.
[17] "Economic report on agriculture and rural areas, 2005", Israeli Ministry of Agriculture and Rural Development, 2006
[18] United Nations Food and Agriculture Organization, AQUASTAT – Information System on Water and Agriculture (1993 figures).
[19] World Bank national accounts data, and OECD National Accounts data files, 2005.
[20] Professor Dan Zaslavski, "The water Level in the Dead Sea and the Two Seas Canal," October 2006, p.4 -5.

3.3 Ancillary Advantages of the Jordan River Alternative

Other benefits in rehabilitating the Jordan River include:

- Rehabilitating the Jordan River is a commitment of the Peace Treaty signed in 1994 between Jordan and Israel.

- The 'Peace Dividend' described in the ToR in relation to the RDC project would be substantially greater in any initiative to revitalize the Jordan River. The banks of the Lower Jordan River, which constitute the border between Jordan, Israel and the Palestinian West Bank, have become a closed military zone. By working together to revitalize the River the area could be opened up for controlled sustainable development given its immense historical, cultural and religious significance as well as its natural beauty.

- Opportunities would be created for joint tourism development among Israelis, Jordanians and Palestinians, which will further reinforce any 'Peace Dividend'.

- A Jordan River option would safeguard the cultural, religious and historical value of the Jordan River Valley and the Dead Sea while the RDC project ignores the Jordan River.

- The financial cost of rehabilitating the Jordan River could be significantly less than the cost of the RDC project.[21]

- There would be a sizeable net environmental gain from rehabilitating the Jordan River and the Dead Sea with no negative environmental implications. This must be compared to the significant risks associated with the RDC project.

- There might also be a sizeable financial gain from rehabilitating the Jordan River in terms of tourism revenue in both the Jordan Valley and the Dead Sea.

3.4 What does the World Bank ToR say in relation to the Jordan River?

The introduction to the ToR states that "the natural flow of the Jordan River is fully appropriated for what is considered essential use by the various water sectors." The World Bank position could not be stated in the ToR more unequivocally. "No degree of reform and change in management of freshwater resources in the region is likely to keep pace with the demand, attain even the minimum standard of water availability or significantly contribute to the restoration of the Dead Sea."[22]

The Terms of Reference do however include a requirement that "The Technical Steering Committee shall provide the Consultant with a report on alternatives/options that have been proposed, studied and/or are being undertaken under a variety of

[21] Professor Dan Zaslavski, "The Water Level in the Dead Sea and the Two Seas Canal," October 2006, p.4.
[22] Terms of Reference, paragraph 1.2.

initiatives to arrest the Decline of the Dead Sea. The report will include water management measures and/or water conservation measures and options such as expanded use of treated wastewater and brackish waters and desalination in order to meet the current and future demands for water. The report will discuss whether the option of increasing Jordan River flows to the Dead Sea is or will be attainable taking into account all considerations… "[23]

Considering the categorical statement against the Jordan River option in the introduction to the ToR it might seem surprising to see a willingness to study the option later in the text. A full and careful reading of the ToR explains what would otherwise appear quite confusing.

On all other issues throughout the ToR it is an independent consultant hired by the World Bank that is involved in either carrying out or scrutinizing all aspects of the report. This last paragraph mentioned above relating to alternatives at the regional level is the only 'task' given to the consultant that does not mention any independent research, study or review and ability to scrutinize. Since twelve out of fourteen members of the Technical Steering Committee are Jordanian, Israeli and Palestinian government representatives, it is in fact the beneficiary parties themselves who will be wholly responsible for preparing information on the Jordan River alternative. It is therefore no wonder that the World Bank is comfortable to appear accommodating to the Jordan River option since it stripped any notion of independence and transparency from the relevant section of the ToR, tying the hands of the independent consultant to accept government findings and integrate them into the report without any questions asked. No independent consideration is given to project alternatives other then different RDC alignments and the no project option in the Feasibility Study.

A study that claims to have saving the Dead Sea as its primary objective without any independent examination of the root causes of the problem and an investigation into whether those causes can be mitigated as a means of addressing the problem, in the opinion of FoEME puts the credibility of the World Bank into question.

4. The World Bank's Operational Guidelines

At FoEME we believe that the project ToR might be in breach of a number of the Bank's own policies, which include, but are not limited to, the following:

- OP 4.01 Environmental Assessment
- OP 4.04 Natural Habitats
- BP 4.01 Environmental Assessment
- OP 4.07 Water Resources Management

4.1 Environmental Assessment of Alternatives

OP 4.01 Environmental Assessment – Environmental Screening, paragraph 4 requires that, ***For Category A projects, the borrower retains independent EA experts not***

[23] Terms of Reference, paragraph 13.1.19.

affiliated with the project to carry out the EA. For Category A projects that are highly risky or contentious or that involve serious and multidimensional environmental concerns, the borrower should normally also engage an advisory panel of independent, internationally recognized environmental specialists to advise on all aspects of the project relevant to the EA.

It is clear in light of the scale and potential impact of the RDC project that it comes under the definition of a Category A project. Therefore the statement that, "The Technical Steering Committee shall provide the Consultant, for use in the Environmental and Social Assessment, with a report on alternatives/options that have been proposed, studied and/or are being undertaken in a variety of initiatives to arrest the decline of the Dead Sea"[24] appears to be in breach of this policy. The Technical Steering Committee is comprised almost entirely of representatives of the beneficiary parties. Therefore the ToR gives the beneficiaries themselves a mandate to prepare the most crucial aspect of the Environmental Assessment, which is a clear indication that the ToR fails to meet even a minimum standard of objectivity.

OP 4.01 Environmental Assessment – Environmental Screening, paragraph 2 requires that the EA ***examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts... The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible***.

The study of Jordan River alternative provides an opportunity for policy makers to compare the RDC project with an alternative that not only brings with it no environmental risks but in itself is a preventative measure. Yet the World Bank has been unwilling to give any objective consideration to the Jordan River alternative preferring instead to discuss RDC mitigation measures and this appears contrary to this Operational Policy.

OP 4.01 Environmental Assessment – Environmental Screening, paragraph 8(a) clearly states that the ***EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (<u>including</u> the without project situation)...***

OP 4.01 - Annex B: Content of an Environmental Assessment Report for a Category A Project, paragraph 2 states that ***The EA report should include the following items: (f) Analysis of alternatives. Systematically compares feasible alternatives to the proposed project site, technology, design, and operation—<u>including</u> the "without project" situation—in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible.***

[24] Terms of Reference, paragraph 13.1.19.

The use of the word "including" indicates that the guidelines envision the without project situation as just one of a number of alternatives to be compared to the RDC project. Yet apart from the report on alternatives at the regional level, provided by the Technical Steering Committee, the without project situation is the sole alternative that is considered by the World Bank study.

The Technical Steering Committee is given the mandate in the ToR to provide to an independent consultant, a report on alternatives at the regional level. As mentioned above, this point alone denies the report any sense of partiality and cannot reasonably satisfy any World Bank policy calling for a comprehensive analysis of alternatives, especially where the policy relates to categories of projects that are of a high risk nature.

4.2 Environmental Damages

OP 4.04 Natural Habitats – Project Design and Implementation, paragraphs 3 and 4 state that ***The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats... The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project...***

As discussed above, as long as there are feasible alternatives to the RDC project in the Jordan River which are not independently studied then it would appear that according to this Operational Policy the World Bank should not be supporting the RDC project as it involves the significant conversion of pristine natural habitats along the whole length of Wadi Araba/Arava and the impairment of ecological functions. The Jordan River is a prime example of a natural habitat that has been degraded and according to this Operational Policy the World Bank should be promoting its rehabilitation.

BP 4.01 Environmental Assessment – Annex B: Application of EA to Dam and Reservoir Projects states that the Bank must, ***ensure that the project design adequately takes into account demand management as well as supply options (e.g., conservation of water and energy, efficiency improvements, system integration, cogeneration, and fuel substitution).***

Paragraph 1.2 of the ToR, quoted above, dismisses out of hand the possibility that demand management of water resources might contribute to the restoration of the Dead Sea. Since it is the Technical Steering Committee rather than an independent consultant that will carry out any study related to demand management, one can only expect that the recommendations will support existing water allocations, pricing and management practices.

OP 4.07 Water Resources Management paragraph 2 states that ***the bank assists borrowers in the following priority areas: Restoring and preserving aquatic ecosystems...***

The Jordan River is a prime example of an aquatic ecosystem in need of restoration and the Dead Sea is one that requires preservation. The Jordan River alternative provides for both of these concerns, while the RDC project risks causing damage to a number of fragile ecosystems including the Dead Sea itself.

5. Final Remarks

It is not easy for a regional organization such as FoEME, an organization committed to regional cooperation and peace building, to express concerns as regards such a high exposure initiative as the RDC that genuinely has peace interests at its core. The comments and concerns raised by FoEME are therefore expressed with the intent of further consolidating peace building efforts, in realization that peace efforts must be grounded on best available information. It is in this light that FoEME raises our concerns detailed above. When decisions are made prior to thorough and independent research having been completed there is good cause for concern. Statements reported in the media that further research as regards the RDC is no longer needed and a government company should be created to go ahead and support the building of the RDC today, are further causes for legitimate concern[25].

FoEME's call to the World Bank, our own governments and the donor community, is to sit around the table and openly discuss the issues raised by civil society. The response given to date that the ToR of the RDC are finalized and would be too difficult to renegotiate are only causing further delays. FoEME has proposed several creative options such as negotiating a side agreement as regards the study of the Jordan River alternative. Through discussion other ideas might also arise.

At FoEME we do believe that all parties involved in this issue are truly committed to saving the Dead Sea and building lasting peace in our region. Involving civil society only at the stage of public consultation after the framework for the discussion has been defined and narrowed will fail to capture the energy and vitality that civil society groups could bring on board.

[25] Globes Israel Business News, April 30,2007

Annex 1.

"A Multi-Component Chemistry-Based Model for the Dead Sea: Modifications to the 1D Princeton Oceanographic Model"

EXECUTIVE SUMMARY

The Dead Sea is a severely disturbed ecosystem, greatly damaged by anthropogenic intervention in its water balance. During the 20th century, the Dead Sea level dropped by more than 25 meters, and presently (2006) it is at about 420 meters below mean sea level. Over the last decade the average rate of water level decline is ~1 m/yr, while salt accumulates at the bottom of the lake at a rate of ~0.1 m/yr. Accordingly, lake volume decreases by some 700 million cubic meters annually. Due to the high density of the Dead Sea brine, this volume translates to an annual freshwater deficit of about 850 million cubic meters. The negative water balance of the lake is mainly due to the diversion of water from its catchment area by Israel, Jordan, Syria and Lebanon, as well as the result of the industrial activity in the southern basin of the Dead Sea, which at its current level would otherwise be dry. In 2002 Israel and Jordan jointly announced their interest in stopping the water level decline and the deterioration of the surrounding infrastructure by constructing a Red Sea - Dead Sea conduit (RSDSC) that will pipe water from the Red Sea to the Dead Sea. The proposed project includes also a desalinization plant that will utilize the 400 meter elevation difference between the Seas. In 2005 Israel, Jordan and the Palestinian Authority submitted to the World Bank terms of reference (TOR) for a "Feasibility Study - Environmental, Technical and Economic, and Environmental and Social Assessment". This TOR puts forward, among others, the environmental concerns associated with the proposed RSDSC project. On January 10 2006 the World Bank announced that steps towards the realization of the feasibility study would take place in 2007.

The qualitative impact of seawater mixing in the Dead Sea has been described in several publications of the Geological Survey of Israel (GSI), suggesting that the inflow of seawater (or reject brine after desalinization) into the Dead Sea will have a major impact on its limnology, geochemistry and biology. During the filling stage, to a level to be decided upon by the concerning parties, the water column will become stratified with a relatively diluted upper water layer. The salinity and density of this water are difficult to predict as they will be a function of numerous parameters such as depth of stratification, rate and timing of seawater discharge, rate of evaporation, water turbidity and more. When the desired level is reached, seawater will continue to be discharged to the lake so as to keep pace with evaporation and maintain a stable water level. Once stratification develops, the salts derived from the seawater will accumulate in the upper water layer. Consequently, the composition, salinity and density of the upper layer will change with time. Halite (NaCl-table salt), which currently precipitates from the Dead Sea, will cease precipitating, while the mixing between the calcium-rich Dead Sea brine and the sulfate-rich seawater will result in gypsum ($CaSO4{\cdot}2H2O$) precipitation. It is not known at what rate these gypsum crystals would sink to the bottom of the lake and whether

it will lead to whitening of the surface water. Dilution of the surface water will probably result also in microbial blooming whose duration is not known. The lower water layer is likely to develop reducing conditions, including bacterial sulfate reduction and presence of hydrogen sulfide (H2S), similar to the conditions that prevailed in the Dead Sea prior to its overturn in 1979. The entire water column is expected to re-mix when the density of the upper water layer will equal that of the lower waters. In spite of the large volume and high salinity of the Dead Sea relative to that of the inflowing water, over the long run the composition of this unique lake will change.

In order to correctly evaluate and quantify the long-term processes expected to take place in the Dead Sea following seawater inflow, it is necessary to develop a limnological model for the Dead Sea that comprises all parameters that determine the behavior of the lake. The model will thus help determine the extent to which the project is feasible, and the optimal conditions for its implementation. If the RSDSC will materialize, the model may become a valuable tool in the operation of the conduit, enabling the operator to predict the behavior of the lake for the long and short-term and thus assist in the determination of appropriate operational policy.

The significance of the model lies in its ability to correctly simulate the evolution of the water stratification as a function of time, under different inflow rates and volumes at different water compositions and temperatures. However, in addition to the general challenge of modeling a lake, modeling of the Dead Sea dynamics and seawater mixing is a highly challenging task as the lake has several unique features which have not been modeled before. Among these are the large range of salinities and densities, the lake's unique composition, and the precipitation of salts from the water body.

Modeling is further complicated by the need to simulate mixing of freshwater and seawater in the Dead Sea, because such mixing imposes a large range of salinities, densities and compositions, which rarely exist in nature, and for which the existing limnological/oceanographic models are not tuned to run. Thus, new and unique modules must be formulated, coded and incorporated into existing codes which serve as the basis for the Dead Sea model.

The present report summarizes the recent advances in the development of a one dimensional(1D) limnological model for the Dead Sea (1D-DS-POM) which is being formulated by the GSI, based on the 1D Princeton Oceanographic Model (1D-POM).

A major driving force for any limnological/oceanographic dynamic model is the density differences due to differences in the salinities and temperatures of the water bodies involved. In the Dead Sea however, because of salt precipitation from the brine and mixing with water having different compositions, the density of the resulting brine cannot be determined only from its salinity and temperature. Rather, the new density must be calculated from the chemical composition. Accordingly, as a first step, 1D-POM was modified from a salinity-based to a multi-component chemistry based model. The new 1D-DS-POM transports and mixes individual ions rather then the bulk salts. The density of the brine is then determined from its chemical composition using the Pitzer approach, modified by Krumgalz for the Dead Sea. This module has been coded and incorporated into the model as a unique equation of state.

The calculation of the degree of saturation of the brine with respect to halite or gypsum was written as a separate module, based on the thermodynamic approach of Pitzer and Krumgalz for hypersaline waters. Calculation of the amount of precipitated salts from an oversaturated solution to attain saturation commonly involves a time consuming numerical procedure. During the course of the work a fast algorithm for the quantitative "removal" of salts from oversaturated brine was developed and implemented into the model. All the thermodynamically-based procedures described above rely on the concentration of the chemical constituents given in molal units (mole/kg H2O). However, mass transport equations

(turbulent diffusion) are based on salinity units (gr/kg solution). Thus, we added to the 1D-DS-POM an efficient units transformation module. The forcing of the Dead Sea system (and thus the boundary conditions of the model) are the meteorological conditions above the water. These data have been collected by Israel Oceanographic and Limnological Research from a buoy in the Dead Sea every 20 minutes for over a decade. Calibration of the 1D-DSPOM will be based on the limnological data collected from this meteorological buoy as well as on data collected during bi-monthly cruises to the Dead Sea conducted between 1992 and 2001.

In order to run and calibrate the model, the mass (water and salt) and energy balances of the Dead Sea must first be established independently. These balances were determined based on the existing meteorological and limnological data. Calculations indicate that the annual water inflow to the Dead Sea is about 350 million cubic meters, implying that most water inflow to the lake are the observed surface inflows, with only limited volume that discharges to the Dead Sea below the water surface.

The rate of evaporation from the surface of the Dead Sea was found to be ~1.15 m/yr while salt accumulates at the bottom of the lake at a rate of about 10 cm/yr.

Preliminary (pre-calibrated) long-term (50 year) 1D-DS-POM runs indicate that stratification and dilution of the surface water will take place under most scenarios in which the inflows to the lake are increased. In fact, even if the additional water diverted to the Dead Sea would only compensate for the current water deficit and maintain the level at its current (or future) level, stratification would still develop.

Under these scenarios the surface density would continuously decrease over the coming decades. The model further indicates that long-term stratification and decrease in surface salinity and density can occur even while lake level declines, provided that the volume of inflow water is greater than that which evaporates from the surface of the lake. This paradox is explained by the net withdrawal of Dead Sea brine by the chemical industries. Stratification develops under such conditions because the water added to compensate for the brine withdrawal dilute the surface water as it lacks the salts that were withdrawn from the lake.

Biological field experiments are being conducted in experimental ponds in the vicinity of the Dead Sea for over four years. These experiments indicate that microbial blooming, which colors the brine in greenish to brownish hue, can occur in the Dead Sea when the brine is diluted by 10% or more of seawater. Increased dilution leads to enhanced blooming while the supply of phosphate, which is the limiting nutrient in the Dead Sea brine, results in particularly strong blooming. Long- term (up to 3 years) experiments showed that blooming, once initiated, may last for a long duration without further addition of phosphate. It is however not clear why such prolonged bloomings were not recorded in the history of the lake. The biological experiments suggest that microbial bloomings in the Dead Sea are likely to accompany the RSDSC. Their extent would be greatly determined by the salinity of the surface water which, assuming the blooming is not desired, should be kept as high as possible.

The expected impact of seawater mixing in the Dead Sea on the limnology of the lake, corroborated by the initial 1D-DS-POM runs as well as the biological field experiments, and their ramifications, underline the need for a further in-depth study of the RSDSC. Among others, this study should include the calibration and detailed scenario-building by the 1D-DS-POM as well as the formulation of 2D and 3D models which should provide insights into the long-term spatial evolution of the Dead Sea.

Annex II

An Environmental and Socioeconomic Cost Benefit Analysis and Pre-design Evaluation of the Proposed Red Sea / Dead Sea Conduit

"Geo-Environmental Study Along the Arava Valley"

EXECUTIVE SUMMARY

The Arava (Araba) Valley extends over a 165-km long section of the Dead Sea rift valley, between the southern tip of the Dead Sea and the Gulf of Elat (Aqaba). It is between 5 and 15 km in width and is hemmed on both sides by mountain ranges built of Precambrian to Tertiary rocks. The eastern rim is precipitous with elevations reaching 1000 m (Edom Mts.) where crystalline rocks and sandstones are exposed. The hills to the west consist mainly of limestone, dolomite and marl, are lower (up to +500 m) and rise gradually westward toward the Negev Highlands. The Arava proper is a subsiding basin covered and underlain by a thick veneer of alluvial clastic sediments deposited since Neogene times.

The path of the proposed Red Sea – Dead Sea Conduit (RDC) along the Arava Valley will initiate a variety of design challenges due to numerous geoenvironmental factors: immediate proximity to shallow groundwater resources; flash-flood risks to open/near surface sections of the conduit; a cluster of tectonic related features such as high seismicity, active faults, high amplification potential of the sediments and recent surface displacements. These will have to be thoroughly analyzed in the course of a substantial study.

Five possible alignments for the future water carrier were studied by the Harza JRV Group in 1997-8. These routes were examined from environmental, technical and economic points of view, and the eastern alternatives, passing along the Jordanian side of the Arava Valley, were recommended as the most favorable.

These alignments will include sections which are very close to the surface or are planned as open canals, and will thus be vulnerable to flash floods both during construction and continuous operation. The maximum discharge for each watershed cutting these stretches of the conduit was calculated as a function of the watershed area, average precipitation, the lithological units exposed and the height of the conduit above the local valley. The computations demonstrate that all watersheds in the northern part present high risks at open/near surface parts of the conduit, those in the central Arava Valley are mainly categorized as medium-low risk, and those in the southern part are classified as presenting a high risk to the RDC.

Three main aquifers are utilized along the Arava Valley by Jordan and Israel. The most exploited of these is the shallow Arava Fill Aquifer which includes the Hazeva Aquifer. The

two other deeper aquifers are the Judea Group Aquifer of Cenomanian – Turonian age; and the Lower Cretaceous Kurnub Group Aquifer. The water in the Arava Fill system is of low salinity and of prime importance both to agriculture and for the tourism industry. The water in this system derives from three sources: direct recharge from occasional flash floods, limited to the shallow unconfined sub-aquifers only; lateral subsurface leakage from the "fossil" Kurnub and Judea aquifers along the rift margins; and seasonal rainwater precipitated over the Moav and Edom mountain ranges which is conveyed to the aquifer system through the alluvial fans developed along its eastern rift margins.

The vulnerability of these groundwater resources to continuous leaks or sudden spillovers from the RDC is a major concern. The first to be affected would be the many shallow wells operating along the Arava Valley in Jordan in immediate proximity to the proposed alignment of the RDC. The heterogeneity in water quality of the Arava aquifers will make the detection of such leaks challenging and an array of monitoring wells will be required, mostly along the eastern margins of the Arava Valley. The monitoring system should comprise at least few tens of wells at depths of up to 200-300 m, and designed on the basis of a comprehensive hydrogeological database of all information available throughout the region and on additional new data in areas of information gaps.

The knowledge gathered on earthquakes occurrence, high values of Horizontal Peak Ground Acceleration (PGA) and recent surface displacements along the Arava Valley and the Dead Sea rift, demonstrate the complexity of the RDC project in relation to the seismic activity of the region. Since faults along the Arava Valley are presumably active faults, a laborious study of potentially active faults should be carried out using all available methodologies, and summarized in a catalogue similar to the one available for Israel. The presence of numerous intersection points of any alternative alignment of the RDC with potential active faults, extensive outcrops of sediments with high amplification potential, and the possibility of abrupt surface displacements of 1-2 meters, call for a thorough study of these aspects at an early stage of the planning phase.

A comprehensive GIS database has been established during this study in relation to the infrastructure and geo-environmental aspects of the Arava Valley, which can be used as an aid for future planning stages, and will be updated accordingly.

Annex III

An Environmental and Socioeconomic Cost Benefit Analysis and Pre-design Evaluation of the Proposed Red Sea / Dead Sea Conduit

"Marine Environment Component Study"

EXECUTIVE SUMMARY

The present report describes the physical, biological and chemical features and characteristics of the proposed site (including the intake area) for the Red Sea –Dead Sea Conduit project, which is located at the northern tip of the Gulf of Aqaba (at the Aqaba -Eilat border).

Seawater and sediments quality has been studied through generating records of seawater temperature, salinity, transparency, pH, alkalinity, dissolved oxygen, ammonia, nitrate, nitrite, phosphate, silicate and chlorophyll *a* as well as total nitrogen, total phosphorous, heavy metals and grain size analysis for bottom sediments. Seawater and sediment samples have been collected and analyzed at different times of the year.

By comparing the obtained data with previous records and offshore samples, taking into accounts the pronounced seasonality, most of the measured parameters reflect in general normal conditions specifically during the period of conducting the study. Phosphate, nitrite and nitrate concentrations did not show significant variation with depth. Although no significant variation in their concentrations among the six sampling station, phosphate concentrations were higher in deeper stations where nitrite and nitrate show higher concentrations in shallower stations.

The sediment in the study area is fine sands and moderately sorted (homogeneous) with low mud contents. Content of mud in the sediments tend to increase with water depth due to calm water conditions and decreasing water activity.

Color and odor of sediments both suggest that they are well oxygenated. The deviation from the white color may indicate localized accumulation of organic matter.

Concentrations of heavy metals in sediments were relatively higher than those recorded by other researches for the same area, but they are still within and close to most of the international environmental standards.

Total phosphorous and total nitrogen in sediments (i.e. 175-590 mg/kg for total nitrogen and 85-560 mg/kg for total phosphate) were relatively higher than some of the previous records.

The biodiversity survey has shown that the area is mainly covered by sea grass meadows and sandy bottoms, although some small colonies of hard corals can be seen at 10 m and 20 m depth. A number of organisms were observed include feather star, sea urchin, sea snails, sea

cucumber, various types of algae, sea grass, hard corals, soft corals, ascidians, sea anemone and various types of fishes. Further deep (beyond forty meters depth), the bottom habitat become different from the shallower depths, where more corals can be found.

During the survey, a total of 2823 fishes have been counted representing 40 species that belong to 22 families. The number and diversity of fish species inhabiting the survey site are typical of sea grass beds sandy bottom habitats. The Heniochus diphreutus is the most abundant species, followed by Lethrinus variegates, Parupeneus forsskali and Dascyllus trimaculatus *Marin Environment Component Study / Proposed Red Sea/Dead Sea Conduit Project 9/95*

The bathymetry of the study area had a smooth gradient and relatively homogenous geometry .The bottom slope within 0-20 m depth range was around 0.097; no significant hills or valleys appeared at the bottom of the study area. The slope decreased with increasing depth and became around 0.045 (1:22) within the 20-60 m depth.

Sea level in the northern part of the gulf fluctuates during the year by up to one meter. The level is high from December through May and low during the period July through October depicting a clear yearly cycle. However, in the study area and reference to the Global mean sea level during the year 2004, the mean was about 16.4 cm, where the lowest value was1.5 cm, measured in August and the highest was 44.4 cm measured in November.

The maximum sea level range references to global mean sea level during the year 2004 was 142 cm, where the highest value was 94 cm observed on November 15th, and the lowest was -48 cm recorded on August 31st.

Studying temperature, salinity and density showed that the mixing conditions was dominating (on June 12th and 15th) in the upper 50 m, where the temperature, salinity and density were homogenous with mean values of 23.34 ± 0.07 °C, 40.726 ± 0.008 and 28.185 ± 0.020 _t respectively. The stratification conditions began dominating in the study area on July 3rd in the 0-50 m water column. The mean values of temperature, salinity and density were 24.39 ± 0.46 °C, 40.752 ± 0.039 and 27.885 ± 0.111 _t, respectively. It was clear that temperature was the determinative factor of mixing and stratification conditions.

However, there was a clear transition from mixing to stratification conditions within 20 days of the study period (June 12th to July 3rd, 2005), which reflected on the water masses characteristics particularly in the study area and generally in the northern Gulf of Aqaba.

Two current regimes were observed in the 2-32 m coastal water column. The first regime was observed in the surface waters at 2 m depth where a constant south-eastward current (157 ± 36°). The current below 2 m depth behaved in another pattern, where anticlockwise rotation in direction and increment of current speed with respect to depth were observed from 4 to 32 m water column. At each layer below 2 m depth there was multi-reverse of current direction between south-eastward and north-westward, i.e. parallel to the shoreline of the study area.

As known the potential impacts of any project/activity on the marine environment depend on the design and the type/nature of the construction and operation activities. Despite of the little available information on the project and its activities which are supposed to take place either during construction or operation, several impacts could be expected as major consequences.

With respect to the construction activities and the associated dredging. It is expected that the benthic habitat at the proposed conduit site will be destructed. The rate of sedimentation in the neighboring marine environment would increase as a result of dumping the dredging material. The water body is expected to carry more fine sediment particles, which takes longer time to settle at the sea bottom, leading to a turbid water body.

As for the physical conditions, it is expected water intake effect on sea level will not be localized and restricted in closed area, whereas the whole Gulf of Aqaba particularly and the Red Sea in general will be affected temporary until it reach stable conditions.

Marin Environment Component Study / Proposed Red Sea/Dead Sea Conduit Project 10/95

Changes in (increase) water velocity, water turbidity and sedimentation would affect the marine environment. Current velocity also affects the stability of sediments in the sea, water turbidity, light penetration, ability of organisms to capture prey and settlement of juveniles on hard substrates.

The water intake from the northern Gulf of Aqaba will be compensated by increase the inflow of waters from the Red Sea to the Gulf of Aqaba based on conservation of mass theory. It is likely that the surface water temperature will increase gradually and salinity will decrease gradually in the northern tip of the Gulf of Aqaba due to water intake up to reach a stable structure. The maximum expected increase of temperature and decrease of salinity will take one year to be of order +0.5 °C and -0.1 respectively.

However, such slight changes will not cause neither thermal pollution neither affect the natural cycle of mixing and stratification conditions, and consequently the thermohaline circulation will not be affected.
The direction of current will converge near the channel and will be parallel to the channel axis with speed reaches 3 ms-1 in case that the channel width and depth will be 10 m and 2 m, respectively.

It is assumed that the current pattern in the study area far more than 3 km in all directions from the channel will not be affected by the water intake in case that flow speed at the channel entrance will be 3 ms-1, while it will remain just as the existing circulation.

Annex IV

An Environmental and Socioeconomic Cost Benefit Analysis and Pre-design Evaluation of the Proposed Red Sea / Dead Sea Conduit

"Socio-Economic Condition"

EXECUTIVE SUMMARY

The Dead Sea is a unique location to the world. Its unique water composition attracts medicinal tourism, and the areas around the Dead Sea are of outstanding historical and environmental importance. The Dead Sea and it surrounding are facing a great challenge as the sea level has been dropping by nearly one meter per year due to water diversions upstream and to mineral extraction industries. Studies made so far reveal that one third of the Dead Sea natural surface area and much coast line have been lost.

In order to stop the Dead Sea water level from dropping and bring it back to the earlier level, a study is being carried out to investigate the possibility of conducting a conduit from the Red Sea to the Dead Sea. The project is anticipated to include an intake canal at the northern tip of Gulf of Aqaba, where water would then be pumped through either an open canal or a pipeline to the southern part of the Dead Sea. In addition to building a desalination plant with annual capacity of 850 million cubic meter (MCM) or more, and a hydropower generator depending on the head deference between the Red Sea and the Dead Sea. The estimated water to be conveyed to the Dead Sea is about 2.6 MCM per day.

An agreement was signed between the Royal Scientific Society (RSS) and Friends of Earth Middle East (FoEME) to research and evaluate the long-term socio-economic issues related to the proposed Red Sea - Dead Sea Conduit (RDC), and to examine the impact of water flow disruption on the marine environment in the Gulf of Aqaba. The study is funded by USAID – MERC program.

In order to achieve the socio-economic study objectives, the study team surveyed the target area which extends from southern part of the Dead Sea to the northern part of Gulf of Aqaba. This area combines large important industries for Jordan, hotels, protected areas, archeological sites, residential areas and agricultural lands.

RSS developed questionnaires for the different concerned sectors in the target area (local community sector, tourism sector, industrial sector, and hotel sector). Questionnaires were filled by a representative sample from each of the sector. The questionnaires aimed at collecting the views, perceptions, and issues of concern related to the project.

Results showed that the majority of the surveyed sectors supported the project idea, they have stressed however on several issues and concerns that must be considered before the establishment of the project and during the design phase such as: acquisition of private land, change of the Dead Sea water characteristics, medical value and negative effect of project activity on the protected areas and archeological sites along the proposed route of the conduit.

Annex V:

Socio-Economic Study in Israel and Palestine

Executive Summary

This report covers the socio-economic component study that was carried out by the Water and Environmental Development Organization (WEDO) in cooperation with Friends of the Earth Middle East (FoEME) during the project period of July 1st 2005 to May 1st 2007 with regard to the project titled "An Environmental and Socioeconomic Cost Benefit Analysis and Pre-design Evaluation of the Proposed Red Sea / Dead Sea Canal". The Red Sea / Dead Sea Canal will in this report be referred to by the abbreviation RDC.

The target group of this socio-economic impact study extends along the western side of the Dead Sea Rift Valley, from the northern part of the Dead Sea to the northern head of the Gulf of Aqaba. The area combines large important industries for Palestine and Israel, hotels, protected areas, archaeological sites, residential areas and agricultural lands. Palestinian proposals have existed since the Oslo period to establish Palestinian hotels on the north western shores of the Dead Sea, create a Palestinian mineral extraction industry and develop the many archaeological sites such as Qumrun on the West Bank areas of the Dead Sea. Jericho is the largest city in the Dead Sea area, located near the north western tip of the Dead Sea. Jericho has a large agriculture and tourism economic base and prior to Israeli military closures was the gateway for tourism to the north western shores of the Dead Sea. Ein Gedi and Ein Boqeq are the main tourism sites on the Israeli shores of the Dead Sea, with small mostly agricultural communities scattered along the whole length of the Arava Valley, with the Israeli port city of Eilat at the head of the Gulf of Aqaba. The socio-economic impact study was carried out largely via questionnaires for different sectors in the concerned area, local resident, tourist, industry and hotel. In Israel surveys were completed in its Dead Sea, Arava and Eilat areas. For Palestine only Jericho residents could be surveyed.

The results showed that the majority of the Israeli and Palestinian populations surveyed in the concerned area were in favor of the project idea. However they also expressed real concern as to any change in Dead Sea water characteristics affecting tourism and any impact on the marine environment in Eilat. A deeper analysis revealed that those that had actually read about the RDC details were those that expressed greater concerns. The vast majority be they Israeli or Palestinian were interested in all options being studied and not just the RDC, reflecting possibly the interest of the public to have all relevant information before it prior to making decisions.

www.foeme.org

Amman Office:
EcoPeace / Friends of the Earth Middle East (FoEME)
P.O. Box 9341 Amman 11191, Jordan
Tel: + 962-6-586-6602/3
Fax: +962-6-586-6604
Email: info@foeme.org

Tel Aviv Office:
EcoPeace / Friends of the Earth Middle East (FoEME)
85 Nehalat Benyamin St., Tel Aviv 66102, Israel
Tel: + 972-3-560-5383
Fax: + 972-3-560-4693
Email: info@foeme.org

Bethlehem Office:
EcoPeace / Friends of the Earth Middle East (FoEME), C/O WEDO
P.O. Box 421, Bethlehem, Palestine
Tel: + 972-2-274-7948
Fax: + 972-2-274-5968
Email: wedo@p-ol.com