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WATER QUALITY IMPROVEMENT AND CONSERVATION

PROJECT NUMBER 278-0288

JORDAN

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER SUPPLEMENT

June 1994

LIST OF ACRONYMS

ACE	Accociated Consulting Engineers
EA	Environmental Assessment
GOJ	Government of Jordan
JVA	Jordan Valley Authority
MMRAE	Ministry of Municipalities, Rural Affairs, and Environment
MOP	Ministry of Planning
MOTA	Ministry of Tourism and Antiquities
MWI	Ministry of Water and Irrigation
PPU	Policy and Planning Unit
USAID	United States Agency for International Development
WAJ	Water Authority of Jordan

Project Paper Supplement
Water Quality Improvement and Conservation

I. Project Supplement Summary

On March 3, 1993, a Project Grant Agreement was signed with the Government of Jordan (GOJ) to assist with efforts to improve water quality and conservation in the Zarqa river basin. The Grant Agreement provides $25 million in USAID funding for activities through the PACD which is currently September 30, 1997.

The potential improvement in relations with neighboring countries and the prospects for peace in the region have opened the door for improved economic growth in Jordan, including increased demands on Jordan's scarce water resources. The improved political and economic climate has led to a rethinking of the Water Quality Improvement and Conservation Project and a restructuring to include two additional components.

The first new component will provide a planning and pilot studies capability to the newly established Policy and Planning Unit (PPU) of the MWI. The second new component will provide a water supply and wastewater collection, treatment and reuse system for the tourist area of Petra.

This Project Paper Supplement increases the life of project costs from $30.86 million to $54.161 million and the USAID funded portion from $25 million to $42 million.

Both the USAID/Jordan mission and the Ministry of Water and Irrigation (MWI) and the Ministry of Planning (MOP) have recognized the need for the additional components and accordingly have cooperated closely to prepare this document.

II. Rationale and Detailed Description

A. Background and Overview of Project

Water is critical to the future economic development of Jordan and is central to the life and well-being of every Jordanian. Water resources in Jordan are critically limited. In 1990, Jordan used about 874 million cubic meters of water of which approximately 200 million cubic meters was from nonrenewable groundwater sources. Per capita water availability is 750 liters per capita per day, as compared to Egypt and Lebanon, which have 3,500 and 1,300 liters per capita per day respectively.

The threat of large-scale water shortages poses, if immediate actions are not taken, a potentially severe problem for the government and the people of Jordan. The dimensions of this

crisis are increasing and being exacerbated by continued deterioration of water quality, inefficient use of water and increasing demands for water by industry, agriculture and municipalities. In addition, frequent droughts and erratic recharge of both surface and groundwater resources bring added concern in meeting future water needs.

The total quantity of water available for use in Jordan is rapidly decreasing because of pumping of nonrenewable groundwater sources and overpumping of rechargeable sources. With full utilization of sustainable surface and groundwater sources and continuing growth and development in the municipal, industrial and agricultural sectors, the anticipated increased demand for water beyond the year 2000 reveals a large gap between supply and projected demands.

Therefore, the GOJ with USAID assistance initiated a program which addresses water conservation--using less water to do more--and enhancement of water quality to ensure availability for reuse. The original project design called for an investment of approximately $31 million ($25 million from USAID and $6 million from the GOJ) over a fifty-five month period to improve the quality and quantity of water from the Zarqa River Basin System and to improve the overall planning and management capabilities of the MWI.

The project components, are: (1) water resources monitoring and management, (2) water pollution prevention and cleanup, (3) irrigation water management and (4) water management education. Although focused on the Zarqa River Basin System, components (1) and (4) will strengthen programs which will serve national needs. Increasing the availability of water, through conservation and reuse by improving quality in the Zarqa River Basin System, will have a major impact on national development.

The End of Project Status (EOPS) is:

- More effective water monitoring and management program at the MWI.
- Improved water quality from the As-Samra wastewater treatment plant.
- Improved water delivery system and more effective irrigation water management in the Zarqa triangle of the Jordan Valley.
- Program in place to provide information and training on conservation and water resources management.
- Industrial and private sector active in water conservation and pollution prevention and control.

A USAID-funded national water management study analyzed the organizational structure and management of the MWI and concluded that there is a need for a unit within the MWI which can take a long-term view of what is happening, plan for future water resource development, work with other government and non-government agencies in addressing these problems, and link with donor agencies. The project has assisted the MWI to establish a Ministry-wide Policy and Planning Unit (PPU) which reports directly to the Secretary General of the Ministry and the Minister and is responsible for: (1) developing water use policies and strategic plans, (2) liaising with the MOP and international organizations and (3) strengthening human resources in the Ministry.

B. Perceived Problem

The changing political climate in the Middle East has resulted in a rethinking the Water Quality Improvement and Conservation Project. The potential improvement in relations with neighboring countries and the prospects for peace have opened the door for improved economic growth, including growth opportunities in the tourism sector. Consequently, even greater demands have been placed on Jordan's scarce water resources than previously perceived. Secondly, with the establishment of the PPU and the interest by other donors in restructuring the MWI, there is an opportunity to strengthen the strategic planning capability of the MWI through the new Policy Planning Unit while further contributing to improvements in conservation and water quality as called for in the Project Paper.

In most Middle Eastern countries, water is of high priority and water supply falls short of demand. Additionally, many of the major surface sources and groundwater aquifers cross international boundaries. Scarcity of water coupled with the requirement for meeting basic human needs result in strong competition among neighboring countries. This competition accelerates deterioration and depletion of water resources. If this phenomenon is not addressed, competition for water will ultimately hinder the peace process in the area. Addressing the water issues of Jordan will assist in reducing the pressure for water competition in the area.

The improved political and economic climate has led to a rethinking of the Project and a restructuring to include two additional components. The first component will provide to the newly established PPU a planning and pilot studies capability which will contribute substantially to MWI's ability to plan for future water resource development in a sound and sustainable manner. The second component will provide a water supply and wastewater collection, treatment and reuse system for the tourist area of Petra which is experiencing unprecedented growth and

consequent increased demands for water supply and wastewater services.

C. Goal and Purpose

The goal of the project remains unchanged, "To improve the overall management and conservation of Jordan's water resources".

The revised project purpose is: To increase the quality and the quantity of the water available on a sustainable basis in the Zarqa River Basin System and other critical areas in Jordan.

The revised project purpose, while incorporating the earlier project purpose, explicitly includes areas outside the Zarqa basin where critical water needs exist.

D. Detailed Description of Additional Components

D.1 Planning and Pilot Studies

The new component, Planning and Pilot Studies, is intended to provide the new PPU within the MWI with the resources to conduct planning and pilot studies related to improving the management of water resources in Jordan. These resources will allow the development of the PPU beyond the level originally envisaged in the Project Paper. Further, the studies will contribute to sustainable utilization of the country's scare water resources, enhance strategic planning capability of the MWI and lead to future investments in the water sector.

Planning and pilot studies will be selected according to established criterion in accordance with the goals and objectives of the project. A process will be established for reviewing and selecting proposals involving the MWI and other concerned agencies and USAID. The studies will contribute to the capability of the Ministry to conduct strategic planning in the water sector and to develop and manage water resources from renewable sources in a sustainable manner.

D.1.1 Justification

With greater prospects for a lasting peace in the Middle East, economic growth of the region has been stimulated. The tourist industry is attracting investment, the housing industry in Amman and throughout the country is booming, and investment overall in the economy is expected to grow at a relatively high rate. As the economy expands, greater demands are being placed on the country's limited water resources.

The addition of a planning and pilot studies component will allow the GOJ to better plan and prepare for demands for improved water and wastewater services. Given the extreme shortage of water,

these services need to be provided from sustainable sources and in an environmentally sound manner. Greater emphasis on conservation, demand management and water reuse is essential if Jordan is to continue to meet expanding demands, particularly for municipal and industrial water supplies and improved wastewater treatment which enables reuse. The planning and pilot studies component will provide the resources to support this work.

D.1.2 Criterion for Selection

Planning and pilot studies will be selected to fit within the overall goals and objectives of the project. The studies will, in general, emphasize sustainable use of water resources, water conservation and improved water quality. The studies are intended to contribute to the original project objectives in the Zarqa triangle as well as contribute to improved strategic planning by the MWI countrywide. The original PP laid out the responsibilities of the PPU to include policy development, strategic planning, international liaison, human resources development policies, and MWI information systems. The studies will contribute to improved strategic planning of water resource management, particularly in view of the potentially improved investment climate in Jordan and greater demands on the extremely limited water resources of the country.

Important selection criteria will be the linkage of the studies to improving water allocations and the high likelihood of funding by the GOJ, USAID or another donor due to their high priority. Small pilot projects will be considered. An example is the establishment of a small research and demonstration site at the As-Samra wastewater treatment plant where wastewater would be treated biologically utilizing ponds planted with duckweed or other crops. Additional description of possible studies to be considered for funding under this component is included as Annex 1.

D.1.3 Process of Selection

The GOJ will establish an advisory committee to review proposals. The committee will be chaired by the Project Coordinator in the PPU and consist of members from the Water Authority of Jordan (WAJ), Jordan Valley Authority (JVA), the MOP and other concerned agencies or parties. German Technical Assistance (GTZ) is also providing assistance to the MWI through the preparation of a water resources master plan and other initiatives. The committee will coordinate with GTZ to assure that any studies are coordinated with the master plan effort. The committee will meet to review proposals for studies as they are received and as funding is available. Studies will be reviewed on the basis of criteria as laid out in the previous section and in relation to the overall goals and objectives of the Water Quality Improvement and Conservation Project.

D.1.4 Strategic Planning

One element of the planning and pilot studies component will be to examine various approaches to strategic planning used in the U.S. and in other countries, and to develop and test an appropriate model for use by the PPU. This activity would involve reviewing several common models for strategic planning in business and government, working with the PPU to select one or more models which appear to be most appropriate for use by the PPU, testing and modifying the model(s) as appropriate, and using the modified model in selecting planning and pilot studies under this activity (as well as in general planning by the PPU).

D.1.5 Outputs

The outputs of this component will be completed planning and pilot studies and an improved capacity of the PPU to carry out strategic planning in the water sector in Jordan.

D.1.6 Inputs

The inputs for this component are technical assistance including the engineering design of Wadi Mousa component and funding for services and construction of pilot projects. Costs of these inputs are shown in Table 2.

D.2 Municipal Water/Wastewater Services for the Petra Region

D.2.1 Background

There is an urgent need for planning, design, and construction of water and wastewater systems in the area around the ancient city of Petra. Petra is drawing increasing numbers of tourists, both foreign and domestic. With the improved political climate in the region, the Ministry of Tourism and Antiquities (MOTA) expects the number of tourists served to increase significantly in the next two years, and the population of the surrounding communities (Wadi Mousa, Taiba, and Beida) is expected to rise with the increase in employment opportunities.

Thus far, no comprehensive planning for development of tourist facilities (accommodation, transportation, food provision, municipal services) has occurred. Nonetheless, nine new hotels, and two expansions to existing hotels, are under construction by the private sector.

At present, water supply and wastewater services are barely adequate to meet the needs of the local inhabitants and the existing hotels in the Wadi Mousa town, and the other villages in the areas surrounding the ancient city of Petra. Failure to plan, design, and construct facilities to meet projected needs will lead to serious environmental problems, because without

planning, the increased population (residents and tourists) will use resources and generate wastes in an unsustainable manner.

For reasons discussed in Section D.2.3, provision of water/wastewater services to the Petra area communities and to the new hotel developments is an exceptionally challenging problem. Thus a phased approach is suggested, as described in Section D.2.4.

D.2.1.a Petra: A Unique Cultural Resource

Petra is the ancient capital of the Nabataeans, an Arab tribe that controlled the trade routes between the Mediterranean Sea and the interior from 312 B.C. to 106 A.D. It is a stunning area, with over 800 municipal buildings, tombs, dwellings, water supply structures, and monuments many of which are carved directly into the living rock. In addition to the ancient city itself, the Petra region offers an extraordinary array of monuments that span the last 9,000 years of human civilization.

To preserve this remarkable world heritage site, the GOJ has suspended granting of construction permits for new hotels until a Petra area master plan is developed; it is considering establishing a National Park site at Petra; and it is considering establishing a Petra Authority, to ensure optimum coordination of planning, and control of development.

Several donor agencies and non-governmental organizations are currently working to restore and preserve the site. USAID is funding archaeological excavation and restoration of a byzantine period church near the main monuments. USAID is also developing a new project which will contribute to the preservation and sustainable development of the unique cultural and environmental resources of Petra, while improving tourist services and community participation. In 1992, UNESCO, at the request of H.M. Queen Noor al-Hussein, initiated a detailed study of Petra, in preparation for a master plan; a draft report was recently updated and released. The Petra National Trust, a PVO, is active in preserving the site, and in conducting studies relating to the site and to social issues regarding further development.

D.2.1.b Tourisitic Potential of Petra Area

Available accommodation near Petra falls far short of current demand. At present, significant development of new accommodation is underway, with four new hotels under construction on the road to the adjacent village of Taiba, another hotel complex in Taiba, four in the town of Wadi Mousa, and a major expansion of existing hotels. The development underway will increase the hotel capacity almost ten-fold, from 310 beds to about 3000 beds (see Annex 8).

According to the MOTA, revenue generated by tourism in Jordan was U.S. $570 million in 1993, and a 20% increase is expected by 1995. Because 95% of all tourists visit Petra, a large proportion of this revenue can be assumed to be from visits to Petra. Revenues are expected to increase both because more tourists are expected to visit Jordan in general (and Petra in particular), and because facilities to meet the demand for longer stays will be available upon completion of the new hotels. The impact of increasing the number of days spent at Petra is significant from a foreign exchange perspective, because presently, many tourists spend an average of five days in Jordan, usually as one segment of a tour of the Levant region.

D.2.1.c Villages in the Wadi Mousa Region

To make the rest of this section of the report easier to understand, the following is a brief discussion of Wadi Mousa town, and the villages surrounding it.

Wadi Mousa, with a population of 12,000 according to municipal records, is the largest town near Petra. There is a housing project (Um-Sayhum), population 1,400 is located just west of Wadi Mousa town. The village of Beida, population 350, is to the north of Wadi Mousa. Finally, the village of Taiba is approximately 7 km south on the road to Ma'an from Wadi Mousa; the population is estimated to be 4,000.

Existing facilities include a limited water supply system, which is inadequate to meet the increasing demand. There is no central system for wastewater collection, treatment and reuse for the Wadi Mousa town and surrounding villages.

D.2.2 Water Supply/Wastewater Planning

In 1990, the WAJ contracted with Associated Consulting Engineers (ACE), an Amman engineering firm, to design a wastewater collection and treatment/reuse system for Wadi Mousa town. The preliminary design report was submitted in November 1990. WAJ had numerous significant comments and concerns about the preliminary report. ACE addressed some of these, and submitted an updated preliminary design report in February 1991. WAJ subsequently asked ACE to prepare a design for an upgraded water supply system for Wadi Mousa town. The final design report for the water supply system, and for the wastewater collection, treatment, and reuse system, was submitted in March 1992.

Planning has largely focussed on Wadi Mousa town. The new hotels on the Taiba road, and in Taiba, are explicitly excluded from the plans. Water supply planning is limited to improvements in the distribution system and the storage capacity; no plans for increased pumping capacity at the well field, or increased trunk line transmission capacity, were made.

The information presented in this section (Section D.2.2) is drawn from the three ACE reports (November 1990, February 1991, and March 1992), and from discussions with WAJ engineers, hotel managers, and municipal government officials.

D.2.2.a Water Supply Provision: Current Status

Currently, the towns of Wadi Mousa and Taiba, and the B'doul village, are supplied with piped water from four wells in the Ma'an area, about 17 kilometers from Wadi Mousa town. The well water is pumped to two separate reservoirs, one of which supplies most of Wadi Mousa town and the B'doul village, the other supplies Taiba and the southern part of Wadi Mousa town. The water is delivered via 150 mm galvanized steel pipe, much of which is exposed, resulting in breaks.

The distribution system is approximately 20 years old; losses are thought to be considerable. The water is metered, and unit costs increase with usage rate. Bills are collected every three months.

According to the ACE preliminary report (November 1990), there is insufficient water to supply current needs, particularly in the summertime. The deficit is alleviated by water from water tankers, roof tanks, and local springs.

A survey done by ACE estimated water consumption to be 68 liters per capita per day. The survey was very limited, based on four representative homes. Both the shortage of municipal water in the summer, and the cost of emptying cesspits, keeps current water use rates low.

D.2.2.b WAJ Plans for Expanded Water Service

In March 1992, ACE completed the "final design report" for expanded municipal water service, and for a wastewater collection, treatment, and reuse system for Wadi Mousa town. The new hotel developments in Wadi Mousa town, on the Taiba road, and in Taiba, were not considered.

The water system design includes a new 4000 m3 storage reservoir to replace the existing 300 m3 reservoir, as well as additional pressure regulation (elevation difference between the existing reservoir and the town is 340 meters, but there is only one pressure reducing valve). A buried distribution network will replace the current above-ground network.

According to a WAJ engineer, there are currently no firm plans to increase the pumping capacity of the well field, drill new wells, or increase the capacity of the trunk line from the reservoir to the service area. WAJ has, however, identified potential sites for 2 new wells. WAJ estimates that the pumping and trunk line

capacity will be adequate to meet the needs of Wadi Mousa town and Taiba (not considering the new hotel developments) until the year 2000. Currently, three wells have a pumping capacity of 150 cubic meters/hour. WAJ records show that the limestone aquifer where the wells are located has good potential for additional production, without substantial long-term drawdown effects.

D.2.2.c Wastewater System: Current Status

Wastewater in Wadi Mousa is currently discharged into cesspits. There is no central wastewater collection system. Most of the cesspits are concrete block, with no bottom slab, to allow for seepage. The soil is highly permeable, resulting in groundwater contamination, thus contamination of local springs (this has been confirmed by WAJ bacteriological sampling). Some newly constructed cesspits do not allow for seepage, and must be emptied frequently. Most of the cesspits that allow for seepage have never been emptied, according to the ACE November 1990 report.

One of the hotels (Petra Forum Hotel) has its own wastewater treatment system. The treated wastewater is used for irrigation purposes on the hotel grounds. No water quality monitoring is conducted. The system is nearing capacity, and will not be able to accommodate increased flows when the hotel addition is completed in 1995. Hotel management has attempted to work with the original engineering contractor to expand the system, but the contractor has not been responsive.

D.2.2.d WAJ Plans for Expanded Wastewater Service

The ACE design provides for sewer connections to most houses in Wadi Mousa, gravity flow to a pumping plant located adjacent to the wadi, pumping the sewage to waste stabilization ponds located 6 kms from the pumping plant (85 meters of lift), and reuse of the treated water for irrigation at the site. The proposed location for the treatment plant is in a different drainage basin (Seil Wadi Mousa), thus avoiding the possibility of effluent draining into Petra. The design takes a phased approach, with Phase I meeting needs until the year 2000, Phase II meeting needs until the year 2010.

There are provisions for odor control at both the pumping station and at the treatment plant. The design includes two holding tanks at the pumping station, providing two days storage in the event of problems, as well as a standby generator. It also includes provisions to protect the pumping station against a 50-year flood.

D.2.3 Issues Regarding Design of Water and Wastewater System

Based on a cursory review of the three ACE reports, and on a visit to Wadi Mousa, it is clear that providing wastewater collection and treatment for the Wadi Mousa area is a very challenging problem. The geography and town planning is such that the lowest point in the town is very near (about 1 km) from the entrance to the sig (the narrow natural entrance of Petra) that leads to the ruins. Until 1963, the wadi discharged into the sig. In the same year, a dam was constructed at the mouth of the sig, re-routing the water through an ancient Nabataean tunnel; nonetheless, water running into the sig during floods is always a possibility. The town itself is built on moderately steep hillsides, with no significant flat land to accommodate wastewater facilities. The hotels on the Taiba road are built on the steep slopes of the wadi. The area is largely one of rock cliffs and steep canyons; there is flat land to the north of the area, but pumping wastewater here for treatment would require considerable lifting, and would result in wastewater treatment/reuse facilities overlying the limestone aquifer currently used for municipal water supply.

As discussed below, the ACE design of the wastewater system appears to have selected a very undesirable alternative. It is possible, however, that the least undesirable alternative has been selected, and that there is no better solution to the problem. However, this must be reviewed and analyzed very carefully, before proceeding with the proposed design. Additionally, there are some areas where the ACE analysis/design clearly must be modified or expanded. These areas include estimates of water needs and wastewater generated, planning for hotel development outside of Wadi Mousa itself, environmental impact assessment, including the environmental impacts of the alternative locations of the proposed pumping station and treatment plant and consideration of operation and maintenance costs.

The following discussion details the major concerns regarding the current plans for water/wastewater service in the Wadi Mousa area. This project paper supplement provides for detailed examination of these issues, modification and expansion of the plans wherever necessary, and careful analysis of all aspects of the proposed WAJ/ACE project.

D.2.3.a Water System

The population estimates and water use estimates appear to be extremely low. The ACE report (January 1991) estimated population in the year 2010 by using a growth rate of 3.6 percent per year for 20 years, and adding to this a population figure for tourists expressed as "equivalent residents". The "equivalent residents" figure took into account an estimate of the number of

tourists, and the high water use rate of tourists. Based on these calculations, ACE estimates the population needing water and wastewater services in the year 2010 to be 21,200 people (residents and "equivalent residents", i.e. tourists, after accounting for the high relative water use rate of tourists vis a vis residents).

However, the population estimates did not take into account the new hotels in Wadi Mousa, Taiba, and on the Taiba road, nor the expansions to hotels in Wadi Mousa. The estimates assumed hotel accommodation of 310 beds. However, the MOTA estimates that there will be about 3000 beds in the area by the year 1995. Additionally, the tourist water use rate was calculated by an averaging process which included lower priced accommodation, thus lowering the average use rate.

A re-calculation of "equivalent residents", based on 3000 beds (not 300 beds) and on water use rates typical of the first class hotels, results in an estimated population of 24,000 persons (residents and "equivalent residents") by the year 1995 -- approximately double the ACE estimate. While WAJ does not plan to provide the new hotels outside of Wadi Mousa with water, the increased demand will certainly impact the well field, as well as necessary storage and transmission capacity. As discussed above, preliminary examination of WAJ data suggests that the aquifer is sufficiently productive to satisfy demand.

D.2.3.b Issues Regarding Wastewater Collection and Treatment System

Issues regarding the current design of the wastewater collection and treatment system fall into six categories:

- o wastewater generation estimates;
- o location of key facilities;
- o planning for hotels outside of Wadi Mousa;
- o selection of wastewater treatment process;
- o operation and maintenance cost considerations;
- o environmental impact assessment.

A re-examination of the proposed design, from the perspective of the above issues, is likely to result in significantly increased costs, as well as raise additional issues not yet considered, because of the lack of an environmental impact assessment. The initial estimate of cost, based on the brief review conducted in preparing this project paper supplement, is $12.3 million (ACE/WAJ estimate is $6.9 million).

D.2.3.b.1 Wastewater Generation Estimates

The amount of wastewater needing treatment was estimated by the same procedure described in Section D.2.2.b above.

Additionally, the water use by local residents may have been underestimated. Local resident use rate in the year 2010 was projected to be 70 liters/capita/day. The projection was based on a current use rate of 40 liters/capita/day (derived from a survey of four representative homes in Wadi Mousa), and an assumed incremental increase in water use rate of 1.5 liters/capita/day in the years 1990 - 2010. This assumed incremental increase in use rate is probably quite low. Current constraints on water use/wastewater generation include costs of emptying septic tanks (15 to 20 JD, very costly for most residents), and reduced availability of water supply in summer months. As water becomes more readily available, as septic tanks are no longer used, and as income and standard of living increase, water use rate (thus wastewater generation rate) for Wadi Mousa residents is expected to become similar to that of comparable towns which do have adequate water supply and wastewater collection/treatment systems.

If the increase in hotel beds in Wadi Mousa, and the probable higher water use rate of the Wadi Mousa full-time residents, is considered, the wastewater generated, thus the size of facilities and the treatment cost, would increase, possibly substantially.

D.2.3.b.2 Location of Key Facilities

The proposed locations for the pumping station, and for the wastewater treatment, plant are problematic. It is entirely possible that the proposed locations are the least undesirable alternatives; however, given the sensitivity and visibility of the project, this must be confirmed by a careful analysis.

The proposed location for the pumping station is immediately adjacent to the wadi bed, approximately 100 meters from a luxury hotel currently under construction. The proposed station would be mostly underground, with a concrete flood protection wall (200 meters long, 3.5 to 6 meters high) around it. Odor control consists of removing gas via a 200 meter long pipe to a "relatively high unpopulated area" (March 1992 ACE report).

The proposed location is the lowest place in Wadi Mousa town which is not on the immediate route into the Petra siq. Thus it is the only feasible location for a completely gravity-fed system. However, the site has several serious drawbacks. It is in the immediate flood plain of the wadi, which is subject to violent floods. Effective flood protection is critical, because flood damage to the pumping station could allow sewage to flow into Petra itself. Additionally, the site may create odor problems if the odor control system does not operate optimally. The view from all hotel rooms facing the site would also be affected.

The proposed location of the wastewater treatment plant is also problematic (though it also may be the least undesirable alternative). The site is 6 km from the pumping plant, in a wide, cliff-ringed canyon of spectacular natural beauty, which has its own touristic potential. The site may result in odor problems at Petra and in the surrounding areas if the treatment process is not functioning optimally. Additionally, 85 meters of lift is required to pump the sewage from the pumping station to the wastewater treatment plant; this will be costly. Pumping costs (and other operation and maintenance costs) have not been adequately addressed.

D.2.3.b.3 Planning for Hotel and Village Development outside of Wadi Mousa

Three large new hotels are currently under construction on the road between Wadi Mousa and Taiba; another hotel is planned; a large hotel is under construction in Taiba. The total number of beds in these hotels will be over 1000 by 1995.

Presently, there are no plans to provide wastewater services (nor water services) to these hotels. According to the Mayor of Wadi Mousa, the hotel owners have signed agreements with the Ministry of Municipalities, Rural Affairs, and Environment (MMRAE) to provide their own on-site wastewater treatment plants. Upon casual inspection of the construction sites, however, it does not appear that there is room for such systems. Several individuals involved in local development indicated that they believe the hotels plan to install septic tanks; there is currently no place in the area to bring septage for treatment, nor are there plans to treat the septage at the new wastewater treatment plant.

Even if the new hotels do install small treatment plants, the least cost effluent disposal area will be the wadi.

D.2.3.b.4 Selection of Wastewater Treatment Process

The proposed wastewater treatment technology is waste stabilization ponds. WAJ experience in other small communities in Jordan suggests that this technology, while it has distinct advantages of simplicity and low cost, has drawbacks that may make it inappropriate for use at Wadi Mousa. High strength wastewater (BOD > 700) is typical in Jordan and enhances the potential odor problems. The possibility of treating septage from the hotels not connected to the wastewater collection system (i.e. hotels in Taiba and on the Taiba road), and septage from other surrounding communities, should be considered. Appropriate technology selection is particularly important in this project, due to the reuse potential of the treated wastewater, and because of the odor potential of an unsuitable plant. Waste stabilization ponds should not be ruled out as appropriate at

this point; however, the advantages and disadvantages must be examined closely.

D.2.3.b.5 Operation and Maintenance Considerations

The ACE reports contain little discussion of Operation and Maintenance considerations and costs. Such information is critical to the decision of the most feasible alternative for the wastewater system. The pumping costs for the current design (85 meters of lift) are expected to be high, and could even necessitate additional electrical power delivery to the area (this issue has not yet been examined).

D.2.3.c Environmental Impact Assessment

No environmental impact assessment for the proposed project (nor for the hotel development) has been done. Given the rich archeological history of the area, the social and environmental impact of intensive development, the environmentally sensitive location of the pumping station and the treatment plant, the economic policy issues associated with providing costly municipal services to the private sector, and other such issues, an environmental impact assessment is essential, and should be done immediately. An Environmental Assessment (EA) is likely to uncover critical issues that have not yet been identified, as well as potential solutions.

D.2.4 Implementation Approach

Two problems are encountered in approaching the Wadi Mousa water/wastewater project:

1. Unplanned development is already under way; an urgent need for water/wastewater facilities will exist in 1995 (when most of the hotels under construction are scheduled to open), making the need for a thorough environmental assessment and an engineering review of the existing design immediate and critical;

2. The initial assessment of potential problems with the proposed design of the wastewater treatment system (described above), and the lack of consideration of the likely need to expand the pumping and storage capacity of the water supply system for areas outside of Wadi Mousa town, make estimation of cost of the project difficult. The ACE report estimates a total cost of $6.9 million for the entire project (water storage and distribution, wastewater collection and treatment). These figures are probably low, but until a thorough design review and an environmental impact assessment is done, it is difficult to estimate just how low they are. A best estimate of actual costs is shown in Annex 9.

To accommodate the urgency of the project, the GOJ, utilizing its own funds, is planning to award a contract to a local engineering firm jointly with an international firm to conduct a detailed engineering review of the ACE/WAJ proposal, including a feasibility-level analysis and recommendations for design changes, a thorough environmental impact assessment and an engineering design.

However, upon GOJ request, USAID would consider financing the engineering review and environmental assessment, from funds available under the existing Technical Services and Feasibility Studies Project (278-0266). The final engineering design and the engineering supervision services will be funded from the project supplement funds. USAID has agreed with the GOJ that the construction cost of this project will be co-financed, with cost sharing.

D.2.5 Cost Recovery

The Wadi Mousa water/wastewater project is a good candidate for maximum cost recovery. The need for the project is based almost entirely on increased tourism in the area, and on the associated activities of the private sector to serve the tourists. The hypothesis on which this Project Paper Supplement is based is that the area has substantial income-generating potential; some of this income should be used to recover the costs to the GOJ of providing municipal services to the tourists. This is consistent with USAID policy, and with basic principles of sustainability.

Therefore, an important element of the USAID project will be to examine the mechanisms by which project costs could be recovered, and recommend the best alternative(s). This could provide a good opportunity for the MWI to build up the capabilities of the PPU in designing financial systems to recover water and wastewater costs. The study would examine cost recovery for touristic development and apply what is learned to other development in other touristic areas (e.g. the Dead Sea). Thus a cost recovery study for the Wadi Mousa water/wastewater development is included in Annex 1, as an example of the type of study which might be done under the planning/pilot studies component of this Project Paper Supplement.

D.2.6 Outputs

The outputs of this component are the completed, environmentally and economically sound water and wastewater systems serving Wadi Mousa and surrounding areas, a wastewater reuse system for the treated effluent, and a cost recovery plan.

D.2.7 Inputs

The inputs for this component are funding for construction services and supervision of construction. Costs of these inputs are shown in Table 2.

III. Cost Estimate and Financial Plan

The Project budget is increased to a total of $54.161 million, consisting of an additional $17 million USAID contribution plus an additional GOJ contribution of $6.3 million. The revised Host Country Contribution is calculated as 22.45%. Table 1 provides a summary of the Revised Life of Project (LOP) budget by component.

Table 1: Summary Revised LOP Budget by Component (U.S. $000s)

Component	Original Project		Supplement		TOTAL LOP
	USAID	GOJ	USAID	GOJ	
1. Water Resources Monitoring & Management	5,941.8	2,021.6	- 0 -	- 0 -	7,963.4
2. Water Pollution Prevention and Cleanup	11,504.8	1,500.0	- 0 -	- 0 -	13,004.8
3. Irrigation Water Management	3,109.0	474.8	- 0 -	- 0 -	3,583.8
4. Water Management Education	2,118.4	1,864.5	- 0 -	- 0 -	3,982.9
5. Planning and Pilot Studies	- 0 -	- 0 -	8,456.0	- 0 -	8,456.0
6. Petra Water and Wastewater	- 0 -	- 0 -	7,000.0	6,300.0	13,300.0
7. Evaluation	150.0	- 0 -	92.0	- 0 -	242.0
8. Audit	150.0	- 0 -	92.0	- 0 -	242.0
9. Contingency	2,026.0	0.1	1,360.0	- 0 -	3,386.1
Total	25,000.0	5,861.0	17,000.0	6,300.0	54,161.0

* Exchange rate: JD 1 = $1,50

The estimated costs and scheduled disbursement of the supplement project funds are summarized in Table 2.

Table 2: Illustrative Summary Budget and Projected Disbursement Schedule (U.S. $000)

Element	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Grant Total
USAID (FX)							
- Studies	605.3	1,513.2	1,810.5	2,415.8	1,661.2	8,006.0	
- Design (Wadi Mousa)	180.0	270.0				450.0	
- Construction Supervision			420.0	460.0	120.0	1,000.0	
- Construction			2,700.0	2,700.0	600.0	6,000.0	
- Eval.		46.0			46.0	92.0	
- Audit		23.0	23.0	23.0	23.0	92.0	
- Contingency	68.0	340.0	272.0	340.0	340.0	1,360.0	
USAID Total (FX)	**853.3**	**2,192.2**	**5,225.5**	**5,938.8**	**2,790.2**		**17,000.0**
GOJ Total (LC-US$)							
- Construction			2,835.0	2,835.0	630.0		6,300.0
GRAND TOTAL	**853.3**	**2,192.0**	**8,060.5**	**8,773.8**	**3,420.2**		**23,300.0**

USAID will fund 100% of planning and pilot studies and Wadi Mousa engineering design work. USAID has budgeted $7.0 million for Wadi Mousa, including funding 100% of the engineering supervision, while cost sharing the construction costs of water and wastewater systems. For purposes of this project paper, the construction cost to USAID is estimated to be $6.0 million; the GOJ contribution is estimated at $6.3 million and the total cost at $12.3 million. Costs beyond those budgeted will be the responsibility of the GOJ. Construction will be carried out under host country contracting procedures. Payment will be on the basis of progress vouchers submitted by contractors, certifications by the construction supervisor and regular inspections by USAID engineering staff.

IV. Implementation Plan

To provide sufficient time for the completion of the planned activities under the project supplement. The PACD for the project will be extended by two years to September 30, 1999.

The additional two components will be implemented in close coordination with the other components of the project. The studies component relates closely to the first component dealing

with water resources management and the establishment of PPU. The work in Wadi Mousa will need to coordinate closely with the public awareness efforts under the fourth component. The work in As-Samra will be supplemented by further analysis under the new studies component.

The studies portion of the project will be the responsibility of the PPU which will develop the studies Scope's of Work working in cooperation with other units of the MWI and MOP. Depending on the size and complexity of the studies, USAID will award these studies contracts to U.S. and/or Jordanian consulting firms. Contracts with U.S. firms will be conducted through buy-ins with USAID/W centrally funded projects, IQC contracts, or through competitive procurement under USAID Direct Contracts.

The PPU will be the central coordination point for the project. The PPU will need to closely coordinate the activities of the studies contractors with the recently fielded main technical assistance Contractor as well as with activities of other donors. Regular coordination meetings will be scheduled to coordinate activities. Work under the planning and pilot studies component will be with PPU whereas work under the Wadi Mousa component will be the responsibility of WAJ.

In order to move ahead with the Wadi Mousa project in a timely manner, an engineering review and environmental analysis and final design of the proposed Wadi Mousa water and wastewater project is required. The engineering and environmental study is intended to be a thorough engineering and environmental review of the existing design, with recommendations for changes as appropriate. The study will include an analysis of the current situation and a thorough analysis of the alternatives, including the "no action" alternative, for improving water supply as well as providing wastewater services. The study will result in recommendations for the final design of the Wadi Mousa Project, including safe yield of the Al Ga'a aquifer, or other nearby water resources, inclusion of inhabited areas and hotels in the Petra area, location of major structures and method of wastewater treatment.

The GOJ seems to be prepared to proceed forward with the engineering review and the environmental assessment and the final design. This work will be carried out by a local engineering firm in joint venture with an international engineering firm; funding of this activity will be provided from GOJ own resources.

However, upon GOJ request, USAID would consider financing the engineering review and environmental analysis of the proposed Wadi Mousa water and wastewater project from the TSFS Project, 278-0266. In this case, the work will be conducted by an IQC firm contracted directly by USAID. The Supplement Grant Agreement will provide a condition precedent for financing the

construction of Wadi Mousa project, that the environmental assessment should be acceptable to USAID. A draft scope of work for the study is included as Annex 2. With the acceptance of the results of the Engineering Review and the environmental assessment, the project will then proceed with final design of the Wadi Mousa Project.

A USAID Direct Contract will be awarded to a U.S. consulting firm to prepare the final design, tender documents, assist WAJ in contracting for the construction services; and supervise construction of the Wadi Mousa water and wastewater systems. The U.S. consulting firm will be expected to work in partnership and subcontract part of the work to a local consulting firm.

Construction at Wadi Mousa will be contracted through a Host Country Contract between WAJ and a U.S. and / or Jordanian firm. The WAJ has extensive experience in contracting under USAID regulations. Currently the WAJ is contracting with a U.S. firm to rehabilitate and upgrade the facilities at As Samra Wastewater Treatment Plant under the Water Quality Improvement and Conservation Project. Over the past ten years the WAJ has had extensive experience in USAID financed host country contracting actions.

Procurement of goods and services will conform to USAID regulations for full and open competition. The procurement plan has been developed with full consideration for maximum involvement of Gray Amendment entities in the provision of required goods and services, and elements of the project supplement are appropriate for Gray Amendment entities. The following is the proposed schedule for the procurement of goods and services assuming approval of the Project Paper Supplement by August, 1994:

Wadi Mousa Component

Engineering Review and EA	July-November, 1994
Feasibility Study & EA completed	November, 1994
Selection of an A&E firm	January, 1994
Completion of Final Designs	July, 1995
Issue Preq. Questionnaire	July, 1995
Preparation of Short List	September, 1995
Issue IFB	October, 1995
Receipt of Bids	November, 1995
Bid Evaluation	December, 1995
Contract Award	February, 1996
Contractor Mobilization	March, 1996

Project Implementation Schedule

The following two tables are an illustrative implementation plan for the two new project components:

Table 3. Planning and Pilot Studies Illustrative Implementation Schedule

Activities	Year 1	Year 2	Year 3	Year 4	Year 5
Conduct Study #1	xxx	xxxxx			
Conduct Study #2		xxx	xxxx		
Conduct Study #3			xxx	xxxx	
Conduct Study #4				xxxxxxxx	xxx
Conduct Study #5				xxxxxxxx	xxxxxxx

Table 4. Wadi Mousa Component Implementation Schedule

Activity	Year 1	Year 2	Year 3	Year 4	Year 5
Engineering Review and Environmental Analysis	xxx				
Final Design	xxx	x			
Construction Contracting		xxxxx			
Construction			xxxxx	xxxxxx	x
Operation and Maintenance					xxxxx
Reuse					xxxxx
Implement Conservation Plan					xxxxx

The following table provides an illustrative list of the services to be provided by the Studies and A & E Contractors:

Table 5. Services by Studies and A & E Contractors (Man-Months)

Activity	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
1. Long Term Expatriate			12	12		24
2. Short Term Expatriate	32	70	72	92	66	332
3. Jordanian		10	40	40	8	98

V. Project Monitoring

The Project Supplement contains two independent components. The MWI, through its Policy and Planning Unit, will be the official Project counterpart unit implementing the Planning and Pilot Studies component of the Project. Meanwhile, WAJ will be the official counterpart unit implementing the Wadi Mousa Water and Wastewater component of the Project. Due to the size and complexity of the project, in addition to the full time FSN Project Officer assigned to implement the four components contained in the original project, the monitoring and implementation responsibilities of the two components contained in the Project Supplement will be carried out by another FSN project officer in the Office of Water, Environment and Agribusiness (WEA). Both FSN Project Officers in charge of the original project and the supplement will report directly to the WEA Office Director or his designee. Additionally, Senior Mission management will monitor the project in the context of the overall portfolio review process. The project implementation reviews (PIR's) focus on pipeline issues, progress towards attainment of project outputs.

VI. Conditions and Covenants

A. Condition Precedent to Initial Disbursement:

Prior to the first disbursement under this Grant Amendment of additional funds authorized by this Project Authorization Amendment No. 1, or to the issuance by A.I.D. of documentation pursuant to which such disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. :

(1) An opinion of counsel acceptable to A.I.D. that the Project Agreement Supplement has been duly authorized and/or ratified by, and executed on behalf of the Grantee, and that it constitutes a legally binding obligation of the Grantee in accordance with all its term.

B. Condition Precedent to Disbursement for the Wadi Mousa Water and Wastewater Systems:

Prior to any disbursement under the Grant Agreement Amendment (including the initial disbursement) for the Wadi-Mousa Water and Wastewater Systems, or to the issuance of documentation pursuant to which such disbursement will be made, the Grantee will, except as the parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D.:

(1) A Project environmental assessment on Wadi Mousa town and the surrounding areas, acceptable to USAID.

C. Covenants:

The GOJ shall covenant for the additional funds authorized under the Project Amendment No. 1 to the bi-lateral Project Grant Agreement to:

(1) Provide the electricity, civil works, and operations and maintenance required for the Wadi Mousa Water and Wastewater Systems.

(2) Take actions to secure the necessary funding for the execution of projects which have been studied under the Planning and Pilot Studies component of the Grant Amendment.

(3) Adopt an efficient institutional mechanism to ensure that there is proper coordination of development activities in the Wadi Mousa area.

VII. Evaluation and Audit

The Project budget includes obligation of funding to finance two planned external evaluations of the Project. These resources will be used to evaluate the new components added to the original Project. The two evaluations will be performed with the participation of USAID, GOJ and the implementing agencies with the support of a U.S. short term consultant. The first evaluation will be conducted in FY 1996 and the final evaluation will be conducted in FY 1999.

The first evaluation will assess the course of the project and compare actual project accomplishments to statements of anticipated achievements contained in the PP supplement and the project work plan. The evaluation will recommend revisions of emphasis in the Project and future orientation of project efforts. It will also make recommendations as to how overcome obstacles to effective implementation.

The final evaluation will sum up what the Project has accomplished over its lifetime in improving the PPU capabilities in policy planning and strategic development in water sector in Jordan, and will provide the GOJ and USAID with information and recommendations to assist in decisions about future activities in the water sector. Also, the evaluation will determine the progress achieved in connections to the completed water and wastewater systems serving Wadi Mousa town and the surrounding areas in an environmentally sound basis.

The Project budget includes funding for annual audits of project finance. The USAID Controller's Office will supervise and use the audits to unsure conformity with sound fiscal management practice.

VIII. Summaries of Analysis

A. Technical

The Technical Analysis of the Project Paper remains unchanged. The technical description of the Wadi Mousa and the intended project interventions are described in Section II.D.2. USAID/Jordan intends to conduct an Engineering Review and Environmental Assessment which will provide additional information concerning the engineering and environmental issues relating to Wadi Mousa component. However, based on the current information, it is felt that the cost estimate which has been prepared (Annex 9) represents a reasonable estimate upon which USAID may proceed to obligate funds.

B. Financial and Economic

The financial and economic analyses of the original Project Paper remain unchanged. For the studies and pilot studies component it is not possible to determine a meaningful rate of return. It is expected, however, that through planning and pilot studies this will result in improved allocations of water in the country.

The consultants report for Wadi Mousa prepared by Associated Consulting Engineers did not include such an analysis. The report did, however, analyze from an economic viewpoint the costs of alternate wastewater treatment processes. Also, the report provided financial cost/benefits analysis of the wastewater reuse system considering costs of reuse versus benefits of reuse. This analysis showed positive returns after the fifth year.

For the Wadi Mousa component, an economic analysis will be prepared as part of the Engineering Review and Environmental Analysis. It is expected that the rate of return for the entire system will not exceed 10% if the methodology is based on the current low prices of water and wastewater services in Jordan. A methodology based on alternative sources of clean water and hauling of septage by tank truck is expected to show a higher return.

C. Social Soundness

The social soundness analysis remains as in the original Project Paper. In addition to the beneficiaries identified in the Project Paper, the project will directly benefit the residents of Wadi Mousa and surrounding communities through the provision of

an improved water supply and a piped sanitation system and residents of other critical water short areas of the country where studies will be conducted leading to water supply and wastewater improvements. It will also benefit the tourist industry in Jordan overall as improved facilities are provided to tourists visiting Petra, the premier tourist destination in Jordan.

D. Institutional

The institutional analysis remains as in the original Project Paper. The PP Supplement provides additional resources for planning and pilot studies to be coordinated by the newly established PPU. These resources together with technical assistance to be provided under the project are expected to provide strengthening of the capability of this unit and of the MWI to undertake strategic planning.

E. Environmental Considerations

The Initial Environmental Examination (IEE) for the activities planned under the Project Paper Supplement is included as Annex 6. The IEE has been approved by the Bureau Environmental Coordinator. Studies related to planning and preliminary analysis will be granted categorical exclusions. Other studies which more directly lead to construction activities, such as final design studies, may require environmental assessments. Pilot studies will be considered on a case by case basis.

For the Wadi Mousa water and wastewater project an Environmental Assessment will be conducted. Annex 2 is a draft scope of work for an Engineering Review and Environmental Assessment.