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RESOURCE ALLOCATION POLICY FOR FISHERIES DEVELOPMENT VERSUS LAND DEVELOPMENT



APRP

Reform Design and Implementation Unit

Development Alternatives Inc. Group: Office for Studies & Finance, National Consulting Firm Development Associates, Cargill Technical Services, The Services Group, Training Resources Group, Purdue Universities, University of Maryland

A

Report No. 130

***RESOURCE ALLOCATION
POLICY FOR FISHERIES
DEVELOPMENT VERSUS
LAND DEVELOPMENT***

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Executive Summary

BACKGROUND:

The Agricultural Policy Reform Project (APRP) carried out previous studies on the policies and barriers to developing fish and land resources. This study was undertaken to review both agricultural and fishery projects to assess and compare projects of fisheries development and land reclamation development on lake resources. The study is confined to the ongoing activities in the northern lakes region and reviews both agricultural and fishery projects that were established on dried lake lands, taking into consideration that production policies used in the past may no longer apply. As a result of Egypt's increasing free-market economy, the team was assigned the task of assessing both of these projects to determine which is the more economically feasible alternative for the northern lakes' resources.

The lakes in the northern lakes regions—Borrolus, Manzalla, and Edko—provide a multitude of economic, environmental, and social benefits to the people of Egypt, and are the single largest source of fish in Egypt. The lakes also provide other valuable services, acting as buffers against seawater intrusion in the northern Delta and providing sanctuary for migratory birds. These lakes constitute 25% of the total Mediterranean wetlands.

The issue of agricultural land use versus fish farming use has been raised on many occasions. However, the government has not yet determined the policy issue on which is the better use of water and land resources. The lakes are managed by various authorities but primarily by the General Authority for Fish Resources Development (GAFRD). At present, Lake Manzalla represents by far the largest single fish source in Egypt, accounting for more than 14% of domestic supply and more than 40% of the regular private and government fish farm production in 1998.

The northern lakes are under severe pressure due to many factors. Land reclamation is among the most critical threats. Over the last 70 years, the lakes have lost nearly 60% of their surface area to agriculture, urban expansion, fish farming, and road construction, declining from 641,000 feddans in the 1930s to 280,000 feddans today.

Most of the reclamation has been part of a nationwide program to increase the amount of arable land available to meet the food and employment needs of the growing population. Other land reclamation projects have been associated with the construction of major highways and roads that pass directly through the lakes. The network of roads through Lakes Mariout and Manzalla has reduced water circulation with the Mediterranean Sea, as well as inside these water bodies, and led to the creation of small, independently functioning basins.

Approximately one million feddans were reclaimed from the 1950s to the 1980s, in addition to half a million feddans in the Five-year Development Plan of 1992-1997. During this period, reclamation programs included drying up some of the northern lakes areas that are adjacent to agricultural lands. Egypt, in its long-range reclamation program (1998-2017) plans to reclaim more than 3.4 million feddans in the desert regions in southern Egypt and the northern Sinai. Land reclamation programs rely on using the available land and water resources either from the Nile River or from drainage or ground waters. These reclamation programs focused on the northern Delta regions since they were the most overpopulated areas within the Delta. This focus led to decreasing the cultivated lands to meet the urban expansion caused by the rapid population increase. Therefore, agricultural horizontal expansion programs were launched to cope with the rapid increase in population, to secure food, and to create new job opportunities for the increasing number of people.

Expansion in the northern Delta region was considered necessary because the area was viewed as feasible for expansion through drying out the southern parts of the northern lakes. This action resulted not only in significantly reducing the water surface of these lakes, but also led to a shallow water depth in the parts of the lakes adjacent to land. These results in turn encouraged the drying out of a high proportion of the water surface of the lakes.

The reclaimed areas were estimated at 472,000 feddans including 209 feddans east of the Delta surrounding Lake Manzalla; 253,000 feddans in the middle Delta surrounding Lake Borrolus; and 10,000 feddans in the western Delta surrounding Lake Edko. Past evaluation of the reclamation programs in the northern lakes areas led policy makers to consider using drainage water mixed with fresh water for irrigation use as a

necessity for horizontal agricultural expansion and for reclaiming additional lands during the 1960s and 70s. This mixed water would supply the El Salam Canal, which would provide water needed to reclaim about 620,000 feddans in north Sinai. In the past, pumping of drainage water into the northern lakes kept the lakes from geological and biological changes. The lakes were also considered natural outlets for drainage water and treated sewage water.

The Government of Egypt made huge investments in reclaiming lands and preparing them for cultivation. Expenses for basic infrastructure reached LE 15,000 per feddan. Despite the investments, the lands did not achieve the anticipated marginal productivity until many years of improvement, effort, and use. The reclaimed lands proved unsuitable for agriculture because of high soil salinity, which repeated washing did not improve. The lands' unsuitability for agriculture became clear when the lands that were reclaimed in the 1960s did not reach their expected productivity. These circumstances led to great losses and accumulated debts for the beneficiaries. Conversely, fishing and fisheries brought the beneficiaries high revenues, despite the fact that using their lands as fisheries was illegal. For instance, many Mubarek graduates abandoned their lands south of El Hussania because they were unable to cultivate their lands. Some of them continued cultivating small areas of their land in addition to establishing fisheries to bring in high revenues to cover their cultivation expenses, and to prevent their lands from being taken away from them. Establishing fisheries is contrary the main purpose of land reclamation programs and with the money paid by the state to establish the infrastructure.

Evidence indicates that a possibility exists to increase the contribution of fish production from the northern lakes. If Egypt were to consider the fishing sector one of the components of agricultural activities, this would ensure the importance of the fish sector for the national economy in terms of production and increasing Egypt's fish products in the near future. This could occur if the fish sector is developed and provided with the needed finance and training in exportation. It is worth noting that APRP along with the Agricultural Commodity Council (ACC) are assisting in developing fish exports to European countries by determining standard specifications and encouraging the private sector to carry out export activities.

The study indicated that the main problem of the northern lakes regions is the new reclamation and land distribution laws that prevent holders from using their lands freely. According to Law No. 1138 of 1995 concerning land reclamation companies, landholders are forbidden to change their land use by switching to fishery; thus, they cannot choose the most profitable activities for themselves. The landholders who want to turn their lands into fisheries request that the government let them choose their production activities freely, especially since they initially came from fishing societies and were unaccustomed to farming.

Land reclamation activities through drying out or filling up the lake lands with earth is prohibited by Fishing Law No. 124 of 1983. Environment Law No. 4 of 1994 sets forth the environmental standards for developing natural resources. Concerning land reclamation, most the time the government did not abide by those laws. Therefore, the continued drying out and reclaiming parts of the northern lakes for land reclamation is considered an important issue for the fishermen and fishery owners in the lakes' reclaimed lands. In the past, comparing fishery revenues with agricultural revenues relied on incorrect data and information about production and revenues from these lakes. These were some of the factors that caused policy makers to dry out and reclaim the lake lands. The lakes' resources were not only affected by drying out the lakes for reclamation, but also by construction due to expansion, establishing roads, highways and power stations, and the resulting pollution from sewage waste. These factors negatively affect not only the fishing resources of the lakes, but also the environment and protecting the Delta's northern beaches from sea flooding and high salinity.

METHODOLOGY:

Deciding on the use of the northern lakes' natural resources relies primarily on financial and economic standards that reflect the profitability of these resources and what its use could add by increasing the "value added" on the national level. While social and environmental standards play roles in determining this use, financial and economic standards are vital. Through estimating both land and fishery use, we are

better able to choose the alternative that will lead to increased income, both individually and socially.

The Participatory Rapid Appraisal (PRA) method was used to obtain the current status of land reclamation projects in the northern lakes regions. This method identifies and compares the economic feasibility of agricultural use versus fishery use. The team conducted field visits to the reclaimed lake land areas, including major sites on the northern lakes. The team also visited private fish farms and reclaimed farms (i.e., those owned by fish farmers, land beneficiaries, and graduates) and talked with local authorities, government officials from GAFRD and the General Authority for Rehabilitation Projects and Agricultural Development (GARPAD), and land reclamation cooperatives.

Based on the above criteria, the team made field visits to land reclamation projects and fisheries to estimate annual net revenue for one feddan used either for agriculture or fisheries as a rapid indicator of the current status for these long-established projects.

The team also calculated the net present value (NPV) and the internal economic return rate (IERR) for the proposed projects to look at investing available resources in these areas. The analysis assumed that investments are made in three projects according to the main assumptions of each project. These projects included:

- i. An agricultural production project for crop production on five feddans granted to small holders or graduates.
- ii. An extensive fish farming project on five feddans of reclaimed lands that were previously used for agriculture.
- iii. A fishery project on five feddans leased from GAFRD.

Because there are no files containing data about expenses and income for any of the fisheries or agricultural projects (excluding the GAFRD fisheries), data were gathered from meetings with fishery owners. Twenty-four fisheries were randomly chosen as case studies to estimate the annual income of their projects and fisheries for the year 1999. A meeting took place with 14 fishery owners (3 were governmental and 10 were plant production farms in areas on Lakes Manzalla, Borrolus, and Edko). The goal of this rapid evaluation was to determine the main indicators in comparing the feasibility of using the lake lands in fishery projects or agricultural production in terms

of annual net revenue. In calculating the NPV and the IERR for the three suggested projects, the study team estimated the expected revenue for establishing future investment projects in these areas.

For projects that were established years ago, analysis results indicated that fisheries are more profitable than crop production, due to the soil's deterioration, its unsuitability for cultivation, and the relatively high expenses that lead to weak crop production when compared to fish production. The cost/revenue ratio is 1:2 (i.e., one earns double what one spends). That explains why beneficiaries of the reclaimed lands risk turning their lands into fisheries despite the fact that they are violating the law.

Regarding expected revenues on future investments, our analyses indicated the following:

- i. Crop production project: The NPV at discount factor (i.e., commercial interest banking rate) of 11% is approximately LE 8,700 for the rice and berseem rotation; approximately LE 1,400 for the cotton and wheat rotation, and approximately LE 5,200 for the cotton and berseem rotation. The IERR on the invested capital is 19% for the first rotation, 13% for the second rotation, and 17% for the third rotation.
- ii. Fisheries development project on reclaimed lands: The NPV at discount factor of 11% is LE 86,500. This value is 10 times the estimated value for the crop production project. The IERR on invested capital is 42%, more than double the rate of the crop production project.
- iii. Fishery development project leased from GAFRD: The NPV at discount factor of 11% is LE 85,000. This value is 10 times the estimated value in the crop production project. The IERR on invested capital is 45%, more than double the rate of the crop production project, and increases at approximately 3% of the rate of the fishery project on reclaimed land (Case No. 2).

Conclusions and Recommendations:

Based on the previous analyses, the study team makes the following recommendations to assist MALR decision makers—particularly GARPAD and GAFRD—in reforming their development policies on allocating, distributing, and using the available resources in the northern lakes regions:

1. The drying out of Egypt's fishing water bodies is a national issue that requires decisive policy measures to prevent its recurrence. Legal actions must be taken and national commitment must be made to prevent the drying out of the northern lakes. These lakes are of national interest and act as buffer zones for the entire Delta lands. Conservation and development of these lakes are vital for individuals and the country because the use of the lakes in fishery production is more profitable than in crop production.
2. In light of the free market economy and to encourage increasing private sector investment, net return on investment reflected by the IERR becomes the most important indicator for investment. Therefore, producers (i.e., investors, graduates, and land beneficiaries) should choose how they use the available resources, especially producers who possess newly reclaimed lands. They should be able to select the most appropriate type of production that would maximize their returns and profits. GARPAD's rules and regulations on land allocation in these regions should be reviewed to avoid the beneficiaries' (i.e. graduates, small farmers, and fishermen) emigration of their reclaimed lands.
3. Continuing to dry out or reclaim lake lands will lead to decreased water surface areas that are presently allocated for fishery activities. This action would result in overfishing and would sharply reduce the fishery stocks. Thus, fishery activities would not be sustainable.
4. Drying out the coastal zone areas will affect water depth level, as it already has in the El-Hagar Region of Manzalla Lake, and would have a negative impact on the region's fishery resources. Shallow water areas affect the locations of fish hatcheries and the incubation of fry, especially tilapia fry, which is the major production of the northern lakes.

5. Corrective actions must be taken on the legal status of existing fish farms in the northern lakes regions, especially those farms that are established on reclaimed lands. This reform could be achieved through agreement between GAFRD and GARPAD under the framework of MALR. The beneficiaries could then obtain licenses for their presently illegal fish farms on the newly reclaimed lands. This action would assist in settling the beneficiaries, increasing production, and encouraging more investment in their lands.
6. Maximize the water resources that are allocated for reclaiming huge areas in these regions by encouraging investment in establishing fish farm projects. The existing basic infrastructure constructed by the state for land reclamation projects could be used for fishery projects. This action would contribute positively to increasing the growth rate of the agricultural sector, generating more jobs, and maximizing income.
7. Apply appropriate scientific methods for managing the northern lakes. These methods should be based on an accurate database regarding fish stocks, fishery efforts, change in environmental factors, etc., to attain integrated management for rational use of the coastal resources. This could be achieved by unifying the licensing bodies under one organization and applying the “Integrated Coastal Zone Management (ICZM)” approach that was introduced by the Egyptian Environmental Affairs Agency (EEAA). This approach would secure a balanced and clean environment while also preserving the natural and biological resources of the northern lakes as buffer zones for Delta lands.
8. Intensify the efforts of the government and the private sector to solve production problems in the newly reclaimed lands. These lands have the potential to become more productive. To ensure success, reclamation and cultivation programs should focus on the regions that possess a fresh water supply. Additionally, this focus would avoid wasting scarce water resources through repeated land leaching in order to reduce the soil’s high salt content. Specifically, we recommend the following:

- i. Provide the appropriate basic infrastructure and services for the beneficiary communities.
- ii. Resolve the legal status of the land beneficiaries who have converted their reclaimed lands to fish farming.
- iii. Ration irrigation water by improving the land leaching process and drainage networks.
- iv. Provide the appropriate soft loans and credit that will assist land beneficiaries in keeping their lands and reaching marginal productivity, which takes longer in these regions than was originally expected.
- v. Expand agricultural mechanization by establishing specialized cooperative societies in these areas to provide such services.

1. Introduction:

Based on previous studies by the Agricultural Policy Reform Program/Reform Design and Implementation Unit (APRP/RDI) on the fishery sub-sector, the purpose of this study was to assess and compare projects of fisheries development and land reclamation development on lake resources. The issue of agricultural land use versus fish farming use has been raised on many occasions. Those who favor drying lake land for reclamation and those who favor using the lakes for fish farming each advocate their own view as the better, more efficient, use of available water and land resources. Each party strongly argues for what they believe in order to achieve their interests. However, the government has not yet decided the policy issue on which is the better use of water and land resources. Our study team's task was to assess both of these projects to determine which is the better alternative for using these resources. Our study is confined to the ongoing activities in the northern lakes region (i.e., land reclamation via drying lakes versus fish farming activities).

The northern lakes of the Nile Delta—Borrolus, Edko, Manzalla, and Marriout are managed by various authorities, but primarily by the General Authority for Fish Resources Development (GAFRD). These lakes provide a multitude of economic, environmental, and social benefits to the people of Egypt, and are the single largest source of fish in Egypt, contributing 28% of the country's total fish catch in 1998. At present, Lake Manzalla represents by far the largest single fish source in Egypt, accounting for more than 14% of domestic supply and more than 40% of the regular private and government fish farm production in 1998. The lakes also provide other valuable services, acting as buffers against seawater intrusion in the northern Delta and providing sanctuary for migratory birds. These lakes constitute 25% of the total Mediterranean wetlands.

The northern lakes are under severe pressure due to many factors. Land reclamation is among the most critical threats. Over the last 70 years, the lakes have lost nearly 60% of their surface area to agriculture, urban expansion, fish farming, and road construction, declining from 641,000 feddans in the 1930s to 280,000 feddans today. Most of the reclamation has been part of a nationwide program to increase the amount of arable land available to meet the food and employment needs of the growing population.

Other land reclamation projects have been associated with the construction of major highways and roads that pass directly through the lakes. The network of roads through Lakes Mariout and Manzalla has reduced water circulation with the Mediterranean Sea, as well as inside these water bodies, and led to the creation of small, independently functioning basins.

On the other hand, the land reclamation program has opened up more than 2.5 million feddans of desert lands for agricultural purposes over the past four decades. Spearheaded by the General Authority for Rehabilitation Projects and Agricultural Development (GARPAD), the GOE's ambitious efforts have provided the basis for creating self-sufficient communities to ease the problem of overpopulation in the Delta and the Nile Valley, as well as to increase agricultural production and create new job opportunities. Land has been distributed to landless farmers and graduate families, as well as small, medium and large scale investors. At the present time, land reclamation continues to be an important component of overall development plans in Egypt. By the year 2017, GOE planners estimate that an additional 3.4 million feddans will be brought into production.

While the costs of land reclamation to fishery resources, bio-diversity, and other environmental services have been high, it is unclear whether the benefits of land reclamation for agriculture have materialized as originally planned. Anecdotal evidence suggests that several areas have encountered serious problems. Around Lake Manzalla, land tenure disputes and highly saline soils have prevented large tracts of reclaimed land from entering into agriculture. Some areas are completely vacant. Other areas have been converted to livestock production or fish farming. In other instances, the intended beneficiaries of these reclaimed lands, which include the Mubarak graduates, former government employees, and displaced fishermen, have not gained access or title to the land.

Fishermen are particularly concerned about land reclamation and predict that the lakes will be totally dry in the future. Not only have they been subject to large-scale government sponsored reclamation schemes in the past five decades, private reclamation have taken place. Pressure to reclaim the lakes remains high in several areas. The lakes' fertile alluvial soils are considered excellent for agriculture. Moreover, the lakes are located in areas that have large and expanding populations that need the space to grow. Future pressures for land may indeed lead to more widespread reclamation unless concrete and unequivocal steps are taken soon to stop this trend.

Decisions on land reclamation, however, must consider many factors, including soil fertility, costs of reclamation, access to markets, creating job opportunities, settlement of beneficiaries, and others. Environmental factors also must be taken into account. Wise and efficient use of the lake resources should ensure maximum yield, while balancing economic factors against environmental factors.

2. Study Objectives

The purpose of this study is to observe the relative returns for both fishery activities and cropping activities on the reclaimed lake land in the northern part of Egypt. This follows a previous APRP/RDI study, “Environmental Assessment to Promote the Sustainable Development of Fishery Resources in the Northern Delta Lakes of Egypt,” which recommended that APRP/RDI conduct an economic study to resolve policy issue in this area.

The objectives of the study as described in the Terms of Reference (TOR), (Annex 1), are as follows:

- Review relevant previous studies and research related to this issue. In addition, review all laws and regulations regarding the use of northern lakes for either cropping or fishery activities.
- Conduct interviews with stakeholders and beneficiaries who possess reclaimed agricultural land and have invested in fish farming and natural fisheries. Also interview officials in GARPAD and GAFRD regarding land reclamation and fishery development schemes in the northern lakes region.
- Conduct meetings with farmers on the reclaimed lake land as well as with fishermen to identify constraints and problems for developing the dried lands, and collect economic and financial data.
- Conduct a comparative economic assessment of agricultural lake land, fish farming and natural fishery activities in the northern region, and identify land use policy of the reclaimed lake lands.

3. Background and Literature Review

The topic of how to best use water and land resources in the northern lakes region has been tackled in various scientific conferences and symposia. The subject remains controversial and open to further discussion, since no conclusion has yet been reached.

There are two opposing viewpoints on this issue. The first is that exsiccation of the lakes for cultivable land seems feasible. The other view is that developing the lakes as a fish resource, job opportunity generator, and farm and national economy income-increasing factor is the better alternative.

The justifications for the first view are defined below.

Drying out some parts of the lakes could provide space for land reclamation efforts in the areas adjacent to populous zones. This action is expected to result in reducing the reclamation costs and increasing reclaimed areas for the landless and new graduates. Job opportunities and increased agricultural production are among the positive effects of partial exsiccation of the lakes.

A real increase in national income is an acceptable parameter to decide which view is more feasible. Additionally, value of the needed investments and their estimated returns are quite important as weighing factors.

A brief review of previous pertinent studies in this area is indicated below.

1. A study conducted by APRP/RDI, "*Environmental Assessment of Sustainable Development of Fish Resources in the Northern Lakes*," 2000, placed much emphasis on the biological, environmental and socioeconomic importance of the northern lakes for Egypt and the Mediterranean basin countries as well. The study stated that the lakes are the biggest fish supplier in addition to being huge reservoirs that accommodate agricultural, industrial, and sanitary drainage as well as treated wastewater. The lakes function as wastewater reservoirs and save money that would have been spent to construct treatment stations. Moreover, the lakes stand as natural sea wave breakers and protectors. The study made a concrete recommendation that Egypt not exsiccate the lakes due to their significant environmental and economic roles. The study also recommended developing the lakes through Integrated Coastal Zones Management (ICZM).
2. Another study conducted by APRP/RDI, "*Identification of Obstacles and Constraints Facing Fish Resources Development in Egypt*," 1999, indicated that fish

is a traditional staple food in the Egyptian diet, especially in the coastal zones. In 1996, the fish sector contributed 15.5% of the total animal production value. However, fish production is still insufficient in light of the pressing population growth and the reluctance of most Egyptians to consume imported frozen fish. The study also showed that Egypt could have a fair share in the world fish market, especially the European market.

The study pointed out that the lakes have been heavily polluted by wastewater. Additionally, several governmental agencies, including GAFRD, are in conflict over the fish resources development process; culminating in negative impacts on the whole process. The study recommended that the lakes not be exsiccated because of the critical increase of water salinity this action would cause. Fish farms in lakes and marine water, expansion in hatcheries, improving and rehabilitating fishing ports and fleets, and creating a conducive environment for private sector investment were the major recommendations presented by this study.

3. A jointly organized symposium by FAO, APRP/RDI and GAFRD, "*Improvement of Sustainable Development Policy of Fish Resources in A.R.E.*," was held in Cairo in 2000. The principal recommendations of this symposium were prohibiting the exsiccation of fish-producing water surfaces, encouraging coordination between the Ministries of Agriculture and Irrigation over use of irrigation water in fish farming, and adjusting the rental policy on fish farms to attract more investment to the fish sector.

4. A study conducted by APRP/RDI, "*A Study on the Allocation of New Lands Policy in Egypt*," 1999, included the laws and procedures applied by the GOE for handling the newly reclaimed lands. The study stressed the importance of adopting a specific mechanism for ownership of such lands by beneficiaries and graduates. Solving ownership problems and disputes in the new lands, especially in the northern zones and Nubaria, would help to create an efficient land market and better land use as well

5. A study was made by the Principal Bank for Development and Agricultural Credit (PBDAC) financed by the World Bank. Entitled "*Role of PBDAC in Fish Production, Marketing and Processing Development*," 1999, the study clarified and defined the role of the PBDAC in extending financing facilities to the fish sector as well as identifying the problems and constraints. The study focused on the importance of stopping all forms of pollution in the lakes, River Nile, and marine

fishing locations, and ignored any thoughts of exsiccating the lakes. The study also suggested that PBDAC should reconsider its credit policy to create a better environment for investors in the fish sector.

6. A study by Hunting Technical Services Ltd., "An Analytical Comparative Study on Land Reclamation Experiment: Study of the Integrated Agricultural Development in Suez Canal" (UNDP and Ministry of New Communities Development, A.R.E., 1980), indicated that wheat productivity in the Abis project (Marriout Lake) represented 66% of the national productivity average. This project, however, has deteriorated in recent years due to irrigation water shortage, drainage problems and a higher level of the underground water table. The same study also showed a remarkable disparity in yield and income of beneficiaries. The highest yield of beneficiary category (25% of the examined sample) showed L.E. 796 as gross individual income; 50% received L.E. 230; and the lowest yield growers received L.E. 25.

The same study on Lake Edko stated that by 1959, 2,700 feddans had been dried out. During 1959-1962, an area of 2,000 feddans was reclaimed and distributed to 699 beneficiaries at three feddans each, yielding L.E. 315 according to 1963-64 estimates. Since most of the beneficiaries were originally fishermen, 40% of their income was obtained from fishing, and 10% of those beneficiaries deserted the lands and returned to fishing.

Concerning Lake Borrolus, the same study indicated the problems facing development and reclamation projects in this area. In 1960, as many as 2,000 feddans were reclaimed in the Hamia district. Up to mid-1972 an area of 70,100 feddans was reclaimed: 30,800 feddans became governmental farms while 31,700 feddans were distributed to 7,518 beneficiaries. By 1979 an area of 70,000 feddans was distributed to 13,412 beneficiaries; 8,900 feddans were sold by open auction; and 48,500 feddans were leased to the Delta Sugar Company. Half of the reclaimed area reached marginal productivity by 1979. Also, average yield per feddan of rice represented 60% of that of the national level, and cotton was less by 4% than that of the national level. Part of the reclamation effort in the fallow land (formerly part of the lake), 30 km. away from Lake Borrolus, was unsuccessful. The experiment in Lake Borrolus revealed many constraints, such as the dominating sandy soil, high salinity and irrigation water shortage.

7. A study by Maclaren Engineering, Planners and Scientific Inc., “*Al Manzalla Lake Study*,” was published in 1981 and made recommendations as indicated below:

- The Internal Economic Return Rate (IERR) for crop use was estimated at 10%.
- Fish farming use achieved a slightly higher rate of IERR, estimated at 13%.
- Previous experiments indicated that crop use was technically feasible, but several soil-related difficulties should be solved (i.e., high rate of salinity, less permeability, and a high water table).
- Fundamental changes in any variable (e.g., yield or time needed for reclamation) could distort the results. Any such changes would necessitate reconsidering the feasibility of crop and fish use in the reclaimed area.

8. A study of Sahl Al Hussania District, “*An Analytical Study on North Al Hosainia Valley Development*” indicated that reclamation of the district for farm development was technically feasible. However, the following adverse impacts might occur:

- High probability for the emergence of the principal saline underground water current, which would require high treatment costs.
- High concentration of salinity would negatively affect productivity.
- Social and structural disturbances among beneficiaries might emerge.
- Implementing the project might cause problems in other neighboring projects (south and west of Mattariah).
- The economic analysis indicated the absence of economic justifications.
- Better alternative areas might exist.
- The study recommended against generalized farming being done over the entire project area.

9. A study prepared by Dr. Ahmed Barrania et al., “*Northern Lakes Between Crop and Fish Utilization*,” published in 1985 by the National Planning Institute, indicated the following:

- Official production statistics are tangibly less than the actual production (5%). In 1980 GAFRD estimated Lake Manzalla’s fish production at 25,000 tons, whereas Maclaren estimated 68,000 tons for that year.
- Fish that was produced was sold at compulsory fixed prices that were below free market prices.
- The applied management system allowed no room to maximize production from the lake’s fishing areas.

Calculating the IERR per feddan of crop use that was estimated by the previous study ignored water cost recovery and foregone production. **That is why crop utilization must be regarded as a new project, with taking the concept of with and without project into consideration, which enables calculating the Net Incremental Benefit per feddan in the case of crop utilization.** In the context of the previously shown considerations, the study concluded that the net incremental benefit per feddan of the reclaimed area for crop purposes was tangibly lower than that for fish use.

10. A study conducted by Dr. Othman Al Kholey, "*Cost-Return of Land Reclamation in Abis-Marriout Lake Project,*" published in Agricultural Science Magazine in 1966, indicated that land reclamation projects at Lake Marriout would require 64 years to recover the total costs.

4. Methodology

The methodology for this investigation is based on the techniques of Participatory Rapid Appraisal (PRA). A team was formed from GARPAD, GAFRD, and the Reform Design and Implementation Unit (RDI) of APRP. Team members met and interviewed stockholders representing fish farmers, fishermen and land beneficiaries (i.e., small farmers, graduates, and investors). The team conducted field visits to the reclaimed lake land areas, including major sites of the northern lakes (i.e. Borrolus, Edko and Manzalla). The team also visited private fish farms and reclaimed farms (e.g., fish farmers, land beneficiaries, and graduates) and talked with local authorities and government officials from GAFRD, GARPAD, and land reclamation cooperatives.

The PRA also included forming a working group to assist the study team in visiting project locations and sites in the northern region to discuss the problems facing the beneficiaries regarding use of resources. In addition to the team members, the working group included the chairman of GAFRD, his deputy director and his technical advisor; the head of Environmental Impact Assessment (EIA)/GARPAD and technicians from GARPAD; land settlers; and fishermen. Data collected during site visits were analyzed using the gross and net income method. The cost/benefit method was also used to determine and evaluate the most profitable use of available water and land resources.

Teams that use the PRA approach do not conduct surveys, but rather collect and analyze existing data, documents, reports, and studies related to the investigation.

Previous reports and studies are considered the key to the success of PRA and to reliable conclusions and recommendations. Thus, this detailed report reviews GARPAD and GAFRD planning documents and other reports that address the issues of land reclamation and allocation of the northern lakes. This method ensures that, not only will field data be collected directly from the fishermen and land beneficiaries, but also that they will share in the policy decisions regarding this problem.

Annex (3) shows a list of the officials, beneficiaries, and fishermen who were interviewed in the lake regions, while Annex (2) is a list of locations and sites visited during field trips.

5. Land Reclamation Programs: Current Status of Reclaimed Lands in the Northern Lakes Regions

5.1. Land Reclamation Programs in the Northern Lakes

During the 1960s, MALR's objectives for Egypt were to reclaim 150,000 feddans each year to meet the country's high population growth and to achieve the required food security for the increasing population. The reclamation plan at that time aimed at reconsidering the distribution and spread of the population all over Egypt. The reclamation process actually began at the end of the 1950s. At the same time, horizontal expansion started in the areas adjacent to agricultural land of the Delta governorates and in middle Egypt. These areas were considered the most overpopulated in the country. Approximately 74,500 feddans were reclaimed during this period. Reclamation of the desert land, however, started at the beginning of the 1960-1965 Five-year Development Plan. Under this plan, reclamation projects were implemented on desert lands that are located near Nubareya Canal, in addition to the reclamation that took place in Upper Egypt. The total reclaimed lands at the end of the 1970s reached nearly 912,000 feddans. After this period, however, the reclamation programs shrank considerably due to war. These programs regained great importance to Egypt at the beginning of the 1980s. Approximately one million feddans were reclaimed during this period, of which 50% were reclaimed during the 1992-1997 Five-year Development Plan. The reclamation programs during this period included reclaiming some parts of the northern lakes, especially those adjacent to agricultural lands. As part of its long-term development

objectives (1998-2017), Egypt plans to reclaim nearly 3.4 million feddans in the desert regions in southern Egypt and the northern Sinai.

Land reclamation programs were designed to facilitate using the limited available land and water resources, including underground and agricultural drainage waters. The reclaimed areas were distributed among seven geographical rehabilitation areas, including **the East, West, and Middle Delta; Sinai and East Suez Canal; Middle Egypt, Upper Egypt, and the New Valley. (I count 8.)** However, these reclamation programs focused on the northern Delta regions since they were considered the most overpopulated areas within the Delta. This focus in turn led to decreasing the cultivated lands to meet the urban expansion caused by the rapid population increase. Therefore, agricultural horizontal expansion programs were launched to cope with the rapid increase in population, to secure food, and to create new job opportunities for the increasing number of people. Expansion in the northern Delta region was considered necessary because the area was viewed as feasible for expansion through drying out the southern parts of the northern lakes (i.e., Manzalla, Borrolus, and Edko). This action resulted not only in significantly reducing the water surface of these lakes, but also led to a shallow water depth in the parts of the lakes adjacent to land. These results, in turn, encouraged the drying out of a high proportion of the water surface of the lakes.

The lakes' geographical features encouraged this trend. Because they are considered natural drainage for the agricultural drainage networks of the Delta regions (i.e., since the water drainage goes by gravity from south to north), the lakes' lower contour levels are in the north. Subsequently, the geographical nature of the lakes' bedrock was affected by creating swamps and wet clay soils with high salt content. **By that time the water had become shallow in the southern parts of the lakes. Additionally, the recent construction of Salam Canal passes through the southern region of Manzalla Lake, making it inevitable that these parts of the lake surrounding the Canal path not be dried out and starting the reclamation process in order to be utilized in agricultural production and creating new job opportunities to meet the requirements of the new communities. This action was similar to the reclamation process that also took place in the past (i.e., during the 1950s) in some parts of these regions.**

5.2. Current Status of Reclaimed Lands

5.2.1 East Delta Regions around Lake Manzalla

1. Sahel El-Hussania Region

The eastern Delta lands were once part of Manzalla Lake that dried out long ago in the lake's eastern and southern parts. The northern parts of the lake remain covered with water, except for some high lands over the land surface level that constitute islands. Given the overall government policy on rationing water resources and exploring the use of agricultural drainage water that runs by gravity to the northern Delta, the policy makers started to consider reusing a certain amount of this drainage water (about 3 billion m³) that would be mixed with fresh Nile water. The mixed water could then be pumped into an irrigation canal (i.e., Salam Canal) to irrigate about 620,000 feddans. Of these, 220,000 feddans are located in the West Suez Canal and 40,000 feddans are in the East Suez Canal (i.e., Sinai). The Canal path was designed to start from the Nile branch at Damatta, continue to the crossing point at Suez Canal (estimated length of 87 km.), then pass by the southern parts of Lake Manzalla. These parts of the lake contain many areas of shallow water lands and islands. The regions directly adjacent to the Salam Canal have dried out, as have parts of the lake that are near the canal. The land reclamation programs included reclaiming these regions for use as a surface irrigation system from the Nile. These regions are divided into reclamation projects as follows:

▪ North of Sahel El-Hussania	about 30,000 feddans
▪ North of Hussania	about 57,500 feddans
▪ South of Port Said	about 41,000 feddans
▪ Sahel South of Port Said	about 480,000 feddans
▪ Berket Om El-Rish	about 20,000 feddans
▪ El-Mattariah El-Salam	about 8,000 feddans
▪ El-Atawy	about 3,500 feddans

The reclamation process on these projects that began in the 1980s aimed to distribute the reclaimed lands to different types of land beneficiaries (i.e., small land owners, societies, early retirees from the public, government employees, military retired personnel, etc.).

The current status of these regions indicates the following:

- Mattariah Region (El-Salam, with about 8,000 feddans) is considered the most intensively cultivated region that relies on Salam Canal. The region is located within the geographical boundaries of Dakahleya Governorate south of Mattariah and from the east by Lake Manzalla. Many drainage networks pass through this region's areas; the Hadous drainage is the most important. This drainage leads to reducing the soil salt content in comparison with other areas surrounding the lake. Thus, the soil in

these areas responds positively to repeated water land leaching. On the contrary, similar soils in the Salam Canal areas do not respond to land leaching. The soils in the first area were successfully used for cultivating field crops because the soils reached the required marginal productivity within a reasonable period of time.

- Small areas of the dried reclaimed lands are cultivated south of Port Said, but the majority of these areas are still under cultivation despite the reclamation processes being complete. Significant areas of the reclaimed lands are used as fish farms (i.e., aquaculture). Two of the reasons for this are (1) the high soil salt content despite continuous land leaching with fresh water; and (2) because many of the beneficiaries in these regions are fishermen by nature and had not previously farmed agriculturally. This situation led to the following:

1. The land beneficiaries face technical, economical, and managerial difficulties in preparing the lands for cultivation.
2. Beneficiaries would not gain revenue for a long time due to very low land productivity, making it unsuitable for agriculture.
3. Despite the land beneficiaries having received the land officially for cultivation, most of them allocate parts of their lands for fish farming, since fish farming achieves fast and high financial return. In this way, they are able to cover their expenditures for cultivating the remaining land.
4. **The desire of the majority of land beneficiaries**

2. Damietta Governorate Regions

This governorate includes many reclaimed regions where reclamation processes started in the early 1960s in the El-Rahamna Region. About 5,000 feddans were reclaimed from Lake Manzalla, while more recent reclamation processes were in the El-Attawy Region (about 3,500 feddans on the Salam Canal). There is a 25-year difference in starting time between the two projects. The current situation in both regions indicates the following:

- i. Old reclamation project (El-Rahamna): Approximately 4,894 feddans were reclaimed in the early 1960s by Farskour Company and distributed to the small farmers late in the early 1960s.

Land beneficiaries in this region suffer from their land's low productivity. They are unable to develop their lands due to bad soil characteristics and because they must constantly add organic matter because the soil profiles contain residues of marine

organisms, a very high salt content, and bad soil permeability. Thus, the repeated water leaching of this land was not feasible and led to a high cultivation cost, which the beneficiaries could not handle with their low crop yields. Although some beneficiaries continued to leach and prepare their lands for cultivation, the net income per feddan has not exceeded LE 2,200 per year over the last 30 years.

ii. Recent Reclamation Project (El-Attawy): This project is located in the region between the El-Attawy agricultural drainage and Salam Canal. This area was part of Manzalla Lake before the reclamation. The lands were allocated to small beneficiaries, but the bad soil types were unsuitable for cultivation. The beneficiaries, therefore, must transfer sandy soil from the surrounding areas, add organic matter to it, and leach the lands repeatedly with fresh water to improve the physical condition of their reclaimed lands. To avoid financial losses caused by cultivating this land, some beneficiaries allocated parts of the dried reclaimed lands to establishing illegal fish farms. Others continued transferring sandy soil and adding organic matter to the reclaimed lands to improve the soil's physical characteristics and to reduce its salt content. Even then, they failed to achieve reasonable revenue when compared to fish farming revenue. Despite the continuing losses from cultivating such land, other beneficiaries were afraid to convert their lands to fish farms because they wanted to avoid possible legal actions taken by GAFRD. The following points are made from examining this project:

- 1) Agricultural water drainage reuse is justified, as rationing water resources was and still is an important goal for Egypt. To achieve such a goal requires reusing drainage water for reclamation programs, as well as feeding Salam Canal with available water resources. But changes in the nature of Manzalla Lake, due to its becoming a down stream for agricultural drainage networks and sewage water, contributed significantly to polluting the lake's water. This led to negative environmental impacts on the reclamation processes.
- 2) Egypt has invested heavily in reclamation programs and in preparing the reclaimed lands for cultivation. The average cost of reclamation was approximately LE 15,000 per feddan for constructing basic infrastructure. The lands were also unsuitable for cultivation because they were originally marine lands containing sediments of many marine organisms with high salt content. The leaching of the reclaimed lands by mixed or

fresh water to improve soil conditions was not successful. Using scarce water resources for repeatedly leaching out the high salt content from the reclaimed lands is not conducive to rationing water. In this regard, the experiences of the 1960s clearly showed that these reclaimed lands have not improved, even when the leaching process was repeatedly applied, nor was marginal productivity reached, until recently.

- 3) The beneficiaries living close to the lake achieved higher financial returns from fishery activity than from cultivation. Moreover, they faced many problems that forced them to convert their reclaimed lands to more profitable fish farms.
- 4) Emigration of the majority of small beneficiaries as well as of college graduates from their reclaimed lands was due to accumulating debts and the unsuitability of the land for cultivation.

Under these circumstances, one could question the usefulness and feasibility of the investment that was spent on land reclamation programs in these regions.

5.2.2 Middle Delta Regions around Lake Borrolus

The reclamation process started in the late 1950s in the northern and middle Delta regions surrounding Lake Borrolus. The reclamation programs were designed to utilize the wetlands that spread over and surrounded the lake. This reclamation started in two regions: El-Satamony Region (3,200 feddans) and Shalama Region (2,500 feddans). The dried reclaimed lands were distributed at the beginning of the 1960s. Then more reclaimed lands (about 12,400 feddans) were added in the Shalama Region in the Five-year Development Plan of 1960-1965, bringing the total to about 14,900 feddans in the Shalama Region. The reclamation programs continued in the Borrolus Lake Region by reclaiming more areas (about 55,000 feddans) in Hafer Shehab Eldin in the Five-year Development Plan of 1987-1992, while the plan of 1992-1997 added another 32,000 reclaimed feddans. The total reclaimed areas in Hafer Shehab Eldin reached approximately 87,000 feddans.

In the El-Mansour Region, about 37,600 feddans were reclaimed within the El-Hamoul district. More reclaimed lands (about 22,000 feddans) were added during the Five-year Development Plan of 1965-1970. The total reclaimed lands in this region were 59,600 feddans.

In the El-Zawya Region, about 21,000 feddans were reclaimed under the development plan of 1968-69/1970-71. More reclaimed lands were added in the plan of 1987-92. Total reclaimed areas reached about 31,085 feddans.

The reclamation programs continued during 1982-1997 in the regions of Hafer Shehab Eldin Extension, Balteem, El-Kalabsha, Koom Doshmi, and North Motobus. Total reclaimed areas in these regions surrounding Borrolus Lake reached about 75,000 feddans. The reclamation programs, which depend on drying out parts of the lake, are ongoing.

The above analysis indicates the following:

- Reclamation projects started in the 1960s in 85 villages that covered all the reclaimed regions. The soil characteristics of the majority of reclaimed lands were unsuitable for cultivation; thus, lands did not provide reasonable revenues, especially those located close to the canal terminals and near the lake's boundaries.
- Despite some beneficiaries having shown interest in cultivating their reclaimed lands and putting a lot of effort towards doing so, they failed to improve the lands because of high soil salinity and deteriorating soil characteristics. Thus, the lands did not reach the anticipated marginal productivity until after many years of improvement, effort, and use. Also, continuous land leaching did not succeed in reducing soil salinity or improving land productivity. These circumstances led to great losses for the beneficiaries and their debts accumulated. Therefore, they converted the reclaimed lands to more profitable fish farms, despite being subject to legal actions in violation of GARPAD's rules and regulations for the newly reclaimed land use. However, they were prepared to take the risk because they felt the high profits from the fish farms justified their actions.
- Some reclaimed lands that were provided with basic infrastructure did not achieve the anticipated production goals over all the years of use. The cost of basic infrastructure reached about LE 14,500 per feddan, according to a survey carried out on some of the reclamation projects (e.g., North Motobus Region). Reclamation processes of drying out lake lands are ongoing in projects located close to Borrolus Lake (e.g., Balteem project at around 3,000 feddans; Koom El-Akhder at around 15,500 feddans; and Koom Doshmi west of Borrolus Lake and north of Motobus at around 14,000 feddans).

All indicators and past experiences reveal that a high percentage of the expected dried reclaimed lands will face the same technical, financial, and economic problems in the future. This is quite obvious in the region of El-Mansour sector and in other regions that are close to the lake. Under these circumstances, the question remains: how feasible is reclamation of the dried lake lands?

5.2.3. Regions of West Delta around Lake Edko

Lake Edko is considered one of the two natural depressions that are located in the northern coastal area of the Delta. The geographical and biological features of this lake have changed over time due to many reasons. The most important reason is construction of the agricultural drainage networks (i.e., including the principle drainage) which serve about 300,000 feddans representing the cultivated lands of Behera Governorate. This led to an increase in the lake's salinity and to shallow water areas in many parts of the lake. This situation thus encouraged the policy makers to reclaim these shallow parts and convert the swamps to agricultural lands.

Drying out the lake for reclamation started before 1952, when around 2,000 feddans in the Nareman Region were reclaimed. By the mid-1950s, around 3,000 additional feddans were reclaimed in the Edko Region and distributed to small beneficiaries (i.e., fishermen). Allocating reclaimed lands to fishermen was an exception to the land distribution rules of GAFRD, whose rules were mainly restricted to farmers cultivating agricultural lands. The dried reclaimed lands allocated three to five feddans for each fisherman. An additional 5,100 feddans were reclaimed during the five-year plan of 1960-1965, and 2,600 feddans were reclaimed in 1968-69. Thus the dried reclaimed areas at the end of the five-year plan of 1965-1970 totaled approximately 10,400 feddans. A brief review of reclamation efforts in the Lake Edko region reveals the following:

- The beneficiaries faced many difficulties in cultivating their lands: high soil salinity, high water table levels, failure to improve land productivity by continuous land leaching, adding organic matter, and planting crops that would tolerate salinity. The efforts made over the last 30 years did not succeed in improving land productivity or reaching the anticipated marginal productivity of these lands.

- Lack of irrigation water was one of the serious problems in these regions because the irrigation source (i.e., Fazara Canal) is located far from these regions (approximately 37 km.). Thus, irrigation inevitably came from the lake's water—the only available water source close to these regions. In addition, the agricultural drainage networks in the regions were inefficient and led to unsuccessful land leaching processes—even when used repeatedly—to remove the salt.
- The beneficiaries were forced to transfer sandy soil each year to the low-level reclaimed lands to raise the land surface level above the water table level. This process is extremely costly, estimated at approximately LE 25,000 per feddan.

6. Fishery Activities and Fish Production of the Northern Lakes

The four northern lakes—Manzalla, Borrolus, Edko, and Marriout—on the Mediterranean coast of the Delta, covered an area of nearly 285,000 feddans in 1998. These lakes are considered very important water bodies because they are used as fishing grounds, water reservoirs, sites for drainage, and waste water disposal. They are also used for various types of aquaculture. One of their important roles is standing as barriers to prevent the Mediterranean Sea water from invading the fertile agricultural Delta land and destroying the cultivated area.

The lakes are generally shallow with a rich aquatic life. Considerable parts of the lakes are overgrown with emergent aquatic vegetation. The first three lakes are connected with the sea by passes (i.e., boogases), while Lake Marriout is closed and discharges its water into the sea through a discharge station in El-Max.

After the construction of the High Dam, the environment of the lakes changed substantially. The fresh water that previously flowed through the Northern Delta lakes, flushing out saline water and wastes accumulated since the last flooding period, had been replaced by drainage water that flowed through the lakes into the sea. Consequently, this brought about a change in the species composition in the lakes, from one with significant marine fish and crustacean components, to one largely dominated by fresh water species, especially tilapia and typical brackish water species (mainly mullet). The altered water regime encouraged this species change, which in turn increased the **amount of aquatic regulation in the lakes, providing protected areas for spawning and nurseries, as well as by a high production of fish food organisms.** Since 1953, widespread public and private reclamation efforts have reduced the open lake areas by more than 30%.

Fish resources of the northern lakes consist of two types: open fisheries system (i.e., capture) and closed fisheries system (i.e., aquaculture and Hoshas). Around 100,000 feddans surrounding the lake borders are used for brackish fish farming. In addition, many thousand feddans along the coastal strip of the lakes are used for marine aquaculture, which represents a huge investment in this activity and provides about 183,000 tons of fish per year. Approximately 50,500 feddans that are being used as fish farms are actually dried reclaimed lands, mainly from Lakes Manzalla and Borrolus. These areas produce more than 154,000 tons of fish, which represent 84% of the total aquaculture production of the lakes' regions. Hoshas, due to their special natures, represent a unique but extensive form of land use on the lakes, especially on Manzalla and Borrolus, since Hoshas use is different from the open and closed forms of fishery. A Hoshas is basically a water surface area cut off from the lake's wide water surface area by bonds. Lake water passes into the Hoshas through narrow passages, along with fry and/or fish. The fish are kept in the Hoshas and grown for a certain period of time. The Hoshas then dries out. Using this method, fish can be harvested many times during the year. No official published data exist regarding the Hoshas areas or their production, but the study team estimates the area of Hoshas at 40,000-50,000 feddans producing 20,000-25,000 tons of fish per year. The Hoshas and fish farms in the dried reclaimed lands are considered illegal production activities according to GARPAD's rules and regulations. These regulations should be reformed by giving legal status to Hoshas and fish farms to solve the land beneficiaries' major problem in these regions.

The northern lakes have considerable fish production potential. The present capture fisheries' yields could be substantially increased by implementing an efficient weed control program that would diminish water evaporation losses, which are substantially higher from a vegetarian-covered surface than from a clear one. The northern lakes also have great potential for developing semi-intensive in-lake aquaculture. The currently used Hoshas type of culture activities can produce more fish once they are declared legal by converting Hoshas away from a harvesting system towards a culture system. Furthermore, well-managed legal Hoshas will also play a positive role in keeping the lakes' borders fixed. However, a new fisheries management regime must respect the rights of traditional fishermen by seeking an equitable solution to their conflicts with the encroaching Hoshas operators. Conversely, agricultural, industrial and sewage pollution is a major constraint for fisheries development in the northern lakes. Prohibiting both

governmental and private land reclamation activities is crucial to maintain the water surface of the lakes.

Many different types of fishing gear and methods are employed on the northern lakes. The main methods are as follows:

- Seine nets: Encircling or moving gear, usually small mesh (2-5 cm stretch mesh or less); especially effective for mullet.
- Trammel nets: Low (less than 1 cm) three-layered nets fished in stationary manner, mesh size of inner net usually 2.6 - 5.2 cm stretch measure; most effective for tilapia.
- Hand fishing: Sometimes carried out in association with seine nets pulled behind the boat; catches are exclusively tilapia.
- El Berba: Trawling with a triangular frame net fastened over the side of the boat; used in fall and winter during periods of high winds; catches are mostly tilapia with some other species.
- Tara: Surrounding water hyacinth patches with fine mesh nets; net is pulled under patch and vegetation removed; used in late summer and fall; catches are primarily tilapia and catfish.
- Cawabi: Small wire traps used in shallow water for small tilapia and other species.
- Tahawet and Dora: Large fish traps (100 - 400 m long) built by staking a fine mesh net (usually less than 2.5 cm stretch) in an upright position with a spiral box at either end; used mainly for mullet and other marine species but marine catch component is tilapia.

6.1. Lake Manzalla

Lake Manzalla lies at the northeastern-most extremity of the Nile Delta, between the Damatta branch of the Nile and Port Said. The sea connection (i.e., boogase) is at El-Gaml, about 10 km. west of Port Said. Most of the water inflow is agricultural drainage water and urban wastewater. The many islands that have effectively divided the lake into distinct areas impede flow-through of water. The total surface area of the lake is about 150,000 feddans (GAFRD, 1998), making it the largest and most productive lake in the Delta.

The northern part of Lake Manzalla, between the Port Said-Damatta Road and the Mediterranean Sea, is now a pure marine lagoon of about 13,000 feddans (El Dibba Triangle). However, the water quality is expected to improve after the completion of the boogase El Dibba that will connect the Triangle to the sea.

Open water production of the lake amounted to 65,000 tons in 1999, or 21% of the total inland fish catch. Twenty-seven species (24 fish and 3 crustacean) have been identified in the Lake Manzalla open-fishery catch. Tilapia accounts for about 34,000 tons or 52% of the total annual catch. A total of 3,000 tons of mullet were caught, amounting to 5% of the total catch.

The number of licensed boats was 3,109 in 1999. This number almost certainly underestimates the actual number of fishing boats. It was reported to the study team that unlicensed boats amount to roughly 50% percent of the total number of licensed vessels. Hence, 4,663 is our adjusted figure of fishing boats for 1999. The number of fishermen in 1999 was 14,000.

6.2. Lake Borrolus

Lake Borrolus is in the mid-Delta region between the Rosetta and Damatta branches of the Nile. All the canals and drains flowing into the lake enter along the southern shore. Six agricultural drains provide most of the water flow.

The lake has a surface area of 103,000 feddans (GAFRD, 1998). Open-water production of the lake was 55,300 tons in 1999, or 12% of the total inland fish catch. Tilapia accounted for 33,000 tons, or 60% of the total annual catch. A total of 11,000 tons of mullet were caught, amounting to 20% of the total catch.

The number of licensed boats was 6,924 in 1999. As with the case for Lake Manzalla, the adjusted estimate of fishing boats for 1999 is 10,386. There were approximately 31,000 fishermen on Lake Borrolus in 1999.

6.3. Lake Edko

Lake Edko is located between the Rosetta branch of the River Nile and Alexandria. Water flow-through is generally from east to west, with water coming from two main agricultural drains. The total surface area of the lake is about 17,000 feddans (GAFRD, 1998). Open-water production was 9,500 tons in 1999, or 2% of the total inland fish catch. Tilapia accounted for 8,000 tons, or 80% of the total annual catch, followed by mullet at 500 tons, or 5% of the total catch.

As in the case of Lakes Manzalla and Borrolus, the number of fishing boats operating on Lake Edko was adjusted to 1,797 boats in 1999. There were 5,400 fishermen on the lake in 1999.

7. Assessing the Current Status of the Reclaimed Lands and Fishery Activities in the Northern Lakes Regions

The study team visited several locations and sites on Lakes Edko, Manzalla, and Borrolus at Port Said (south and north of the Hussania regions). These visits were not only to identify problems facing the land beneficiaries and fishermen, but also to interview the stakeholders, beneficiaries, and fishermen who possess the reclaimed lands as well as the investors who own fish farms in the same locations. The following are the study team's observations, which are based on interviewing land beneficiaries, fishermen, and investors:

7.1. Edko Lake Regions

- The Chairman of the Central Administration for Fishery Development in the Western Region, which includes Lakes Edko, Manzalla, and Marriout, pointed out that the land value for fish farming activities increased from LE 50 per feddan in the 1960s to about LE 15,000 per feddan at present. Agricultural land increased by only double its value during the same time frame. The Chairman considers the disparity of these increases an indicator for the importance of fish farming compared to crop farming. He revealed that fish production from the lake increased from 4,000 tons in 1974 to about 10,000 tons in 1999, with a total value of LE 60 million and a net value of about LE 30 million. Although approximately 4,000 fishermen depend on the lake for their incomes, only about 1,920 licenses are provided by GAFRD. He calculated the average income per individual at about LE 7,000 per year. He added that over a short period of time, fish production has increased dramatically, but the area has yet to reach its full potential. Higher levels of fish production could be reached if the fisheries authorities are able to overcome the current constraints that prevent fuller exploitation, he said.
- Since 1959, about 3,000 feddans from the shallow water of Lake Edko were reclaimed and distributed (i.e., five feddans of dried land for each beneficiary). The reclaimed land increased later to 10,400 feddans. The main purpose for drying parts of Lake Edko was to focus on allocating newly reclaimed lands to the landless or to small beneficiaries and not for crop production, which would be achieved anyway.
- The land beneficiaries interviewed said that they must transfer land (i.e., sandy soil) to increase the land level by 1-1.5 meters above the water table level. (Note that this

region is considered the lowest land level in the Delta.) The process is very costly, but without transferring sand and increasing the land level, the beneficiaries are not able to cultivate their land. The average cost of increasing land level is LE 20,000 per feddan, and after three years they must then add more soil (25 cm. each year with an average cost of LE 5,000 per feddan). The dried land is irrigated from the Edko agricultural drainage, which serves Behera Governorate (about 300,000 feddans). This is an extremely high reclamation cost. According to the land distribution law, all beneficiaries of reclaimed land should be farmers, with the exception of the beneficiaries in the Edko Lake region, who are fishermen. Since they were unable to cultivate land with poor fertility, a high water table and high salt content, most of them favor fish farming activities. The beneficiaries who invested in land development prefer to continue in land cropping, because it would be impossible to change their farms to fisheries.

- One land beneficiary who owned five feddans of dried land pointed out that his land had low productivity. The high water table level, poor land characteristics, and high salt content are the main causes for low productivity. Thus, most of the beneficiaries left their land and work as fishermen. Some of the beneficiaries use their land as fish farms, despite violating the law. Therefore, the Agrarian Reform Society, according to the director of this society, reclaimed the land for a second time by transferring sand to increase the land level and removing or reducing the salt content to keep the farmers on their land. The lands that were reclaimed a second time and that have good farming practices cultivate palm trees, guavas, berseem, winter tomatoes, vegetables, and beans. The owner of this land invested about LE 20,000 for transferring sandy soil to his low-level land. The estimated average income of such land is LE 3,000-4,000 per feddan per year for crops, and LE 6,000-7,000 per feddan per year for winter tomatoes, green peppers, or guavas.
- The region's main problem is that reclamation and distribution laws prevent the beneficiaries from changing the reclaimed land to fish farms. Thus, the beneficiaries cannot choose the more profitable activity, even if fish farming were more profitable for them. Beneficiaries who want to change to fish farming activities want the government to allow them free choice for what they produce, especially since this community was initially a fishery community, and the beneficiaries are unaccustomed to agricultural farming. Fishery Law No. 124 of 1983 prohibits drying or dumping

any part of the northern lakes, but this law is not applied in many instances. Also, Environmental Law No. 4 of 1994 addressed the criteria that should be taken into account when dealing with coastal natural resources—including the northern lakes—in order to protect these resources from pollution and dumping.

- One team member visited Perseeq Fish Farm/GAFRD. The area of the farm is about 2,000 feddans located on Edko Lake and is operated and managed by GAFRD. The farm is divided into seven independent sectors (each includes bonds of about 15 feddans in area) with a total water area of 1,400 feddans in addition to 150 feddans used as hatcheries. Each sector is under separate supervision. The fish farm also includes a feed plant. A natural, or traditional, production system is primarily used at the farm, with only 30 feddans under a semi-intensive production system. The productivity is about 1.3 tons per feddan under the traditional system. Production could reach 7 tons per feddan under a semi-intensive production system. Costs and revenues of the farm's activities are located in Annexes (4) and (5).
- The team also visited Arab Fisheries Co., an Arab League affiliate, which was established in 1997 as a fish farm on 74 feddans, of which 50 feddans are water. The farm is located adjacent to Perseeq Farm of GAFRD and is leased from GAFRD at a rate of LE 200 per feddan per year for five years, renewable. This farm includes six bonds for fries, each with an average area of 450 m², 22 bonds for a nursery with a total water area of 1700 m²; and 22 bonds for production with an average water area of 7000 m². A semi-intensive technique is used. Farm productivity was 300 tons for the farm's first season in 1999, with an average of 6 tons per feddan at the rate of one-and-one-half production cycles per year. This company is a foreign investor (i.e., Arab Gulf States capital) in fishery activities in Egypt. The estimated investment is LE 8 million for construction of bonds, buildings, and equipment.
- The team looked at another private fish farm operated by a large investor. The farm is about 130 feddans and was leased three years ago from GAFRD on an annual basis at a rate of LE 100 per feddan per year. A traditional production system is used, and productivity is about 2 tons per feddan. The investor indicates that he will improve and integrate his production cycle, since he owns the hatchery and will raise his own fingerlings and fry, but he still needs extension guidance from GAFRD.
- Continuing to dry out parts of the northern lakes for reclamation programs is considered a vital national issue that should be discussed to solve the serious

problems of the fishery communities and to protect the lakes' resources. Inaccurate information in the past on the lakes' productivity, in addition to insufficient knowledge on returns of fishery resources compared with returns from agricultural land, contributed to the decision to reclaim lake lands.

- Land reclamation activities in the northern lakes are in direct contravention to Fishery Law No. 124 of 1983, which states that the northern lakes are not to be dried. Additionally, Environmental Law No. 4 of 1994 defined the criteria that should be taken into account when dealing with natural resources, including the northern lakes, in order to protect these resources from pollution.
- In addition to the land reclamation program for agricultural development, the lake is being dried out and affected by urban expansion, road construction, power plants, garbage, and sewage. As a result, the lakes, which have provided flood control and environmental balance, may not be able to do so in the future.
- Edko Lake is considered the primary source of livelihood for about 4,000 fishing families. Around 1,600 boats operate on the lake. Thus, drying out the lake by continuing land reclamation programs will have a great negative impact on the fishery community. This is especially obvious when one notes that investors operate on approximately 10,000 acres of fish farms bordering the lake to protect it from drying out and to retain job opportunities for fishermen. The lake has a development committee that includes 11 members representing all of the concerned parties, including government officials. This committee manages and supervises all of the lake's activities. The committee meets once a month and makes proposals to improve the fish production and water quality and deals with other developmental issues.

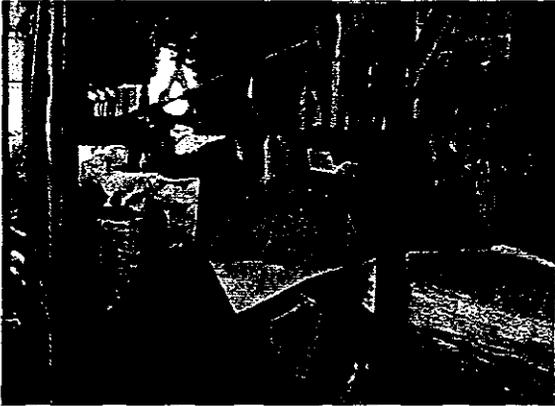
7.2. Manzalla Lake Regions

The team visited the Integrated Fish Farm of GAFRD at Manzalla Lake near Port Said, private fish farms at Bahr El-Bakar area north of Hussania plain, and the newly reclaimed areas that are distributed to the graduates at Khaled Ben Walid Village, adjacent to south of Hussania Drainage and Salam Canal. (Salam Canal, West of Suez Canal Region, totals 220,000 feddans of reclaimed areas). The team's observations are summarized as follows:

- El-Manzalla Fish Farm of GAFRD/MALR was established in 1965. Its area is about 1,000 feddans, of which 650 feddans are fresh water surfaces (i.e., agricultural

drainage water) allocated for fishing pond activities. The farm includes 13 traditional fishponds (one feddan each) and seven semi-intensive fishponds (one feddan each). There are also two nursery ponds (with an area of three feddans) for producing fry and fingerlings, as well as a fish feeding plant and hatchery. This farm is an integrated fish farm. (See attached photos.)

- The commercial semi-intensive fish farming technique was started at GAFRD's Manzalla farm as an experiment in 1997 and included one ongoing cycle of 165 days. Based on the results of this experiment, a second experiment was carried out in 1998. Production reached 6 tons per feddan compared with 2.25 tons per feddan using the traditional fish farming technique. (Note: Yield per feddan for the traditional farming in the past was 0.3 tons per feddan). The team was informed that production for the 1999-2000 season increased to 8 tons per feddan. The production value of Manzalla farm during this season was estimated at LE 7.5 million, and the gross profit was LE 3.5 million. Details of the accounts are shown in Annex (4). The farm produces tilapia, mullet, and carp. The feed plant produces supplementary pelleted feed (i.e., 17% and 25% total protein). **Production is available to the farm and private sector.** The applied feeding rates and the feeding frequency used resulted in a good feed conversion ratio of 1.5:1 to 1.6:1. The farm includes four nursery ponds with a total area of 15 feddans for producing tilapia fry and fingerling, in addition to a specialized tilapia hatchery that produces 4-6 million. The semi-intensive technique used by GAFRD is more productive per unit of water surface area. Based on the Minister's instructions, GAFRD is going to expand this technique into the surrounding areas and will provide the required services for expanding this technique to the private sector.



Fish Feeding Plant at Manzalla Fish Farm, GAFRD



Fish Nursery ponds for producing fry and fingerlings at Manzalla Farm, GAFRD



Fish Pond for collecting the production at Manzalla Farm, GAFRD

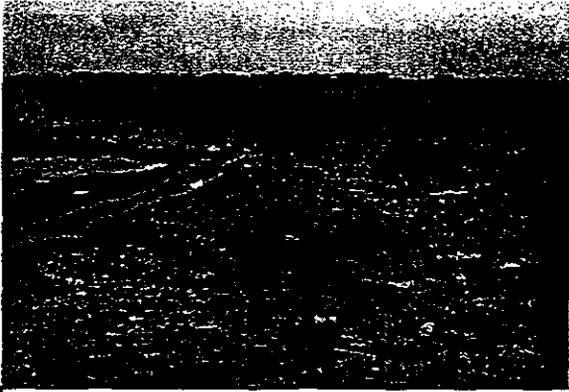


Fish Ponds for production at Manzalla Fish Farm, GAFRD



Fish Hatchery at Manzalla Fish Farm, GAFRD

- During a visit to the newly reclaimed areas north of Sahl El-Hussania (i.e., areas located north of Salam Canal), the team noted that the entire area (about 10,000 feddans) was engaged in fish farming activities and not in crop farming as it should have been. One beneficiary, who with his family owns 600 feddans of reclaimed lands, indicated that his family has long used this land for fish farming activities, despite GAFRD's regulations that crops should cultivate the land. His reason was simple, he said, for the land never being reclaimed. He inherited the land as a fish farm long ago. He revealed that his family's fish farming activities are more profitable than crop farming. The profit from fishing is more than eight-fold of profits from crop farming. Therefore, most of the investors established fish farms long ago, even before GAFRD allocated these areas for land reclamation and development. He also indicated that he must sign a land allocation contract with GARPAD to receive legal status for his land, which was not reclaimed and has been used as a fish farm for many years.
- During another visit to the university graduates' region (i.e., Khaled Ben-Walid Village, south of Sahl El-Hussania), the team noted that graduates practice fish farming and ignore crop farming or cultivating their lands as part of GARPAD's plan for land reclamation. They indicated that crop farming is not profitable since the type of land is unsuitable for cultivation because of the soil's high salt content even after the leaching process. (See attached photos.) Thus, the graduates prefer to convert their reclaimed land to fish farms to achieve revenues that will cover the expenses of cultivating the land. The team collected financial data to be analyzed and compared it with other farming practices. The reclaimed lands adjacent to Salam Canal (south of Sahl El-Hussania) that are allocated to the graduates are not suitable for cultivation. The graduates therefore converted their farms to fish farms to survive and to repay their debts. (See attached photos.)



Salt efflorescence at the soil surface of the new lands in Khaled Ben Waleed village, South of Sahl el Heseneya



Traditional fish farms on the new lands at Bahr El Bakar region



Old reclaimed lands at Edko region. The Beneficiaries have to add sand soil to increase the land level in order to be cultivated.

Most of the small investors and beneficiaries of the reclaimed lands that were allocated north and south of Sahl El-Hussania request licenses for their fish farms, but Ministerial Decree No. 1338 of 1992, allocating reclaimed land through the reclamation companies, does not allow them to have such licenses. This issue could be resolved, for both the beneficiaries' interest and the national interest, if GARPAD and GAFRD together would review the policy of using these regions' resources—particularly since both agencies are under MALR. GARPAD and GAFRD could then coordinate their rules and regulations.

- The team visited many areas that were cut off from Lake Manzalla in Damatta Governorate. These include Sayala, Zarara, El Enaniya and Dibba sub-regions. Many fish landing sites along the lakeshore were also visited. Both crop and fish farm operators were interviewed. Discussions were held and information on cost and benefits in crop and fish farms was obtained. This information is included in detail in the study report. We interviewed many fishermen who operate on the lake to assess the economic aspects of their fishing activities on the lake. That information is also contained in the study report.
- In the Zarara sub-region (8 km. west of Damatta on El Salam Canal), land is mainly used for agriculture. Insignificant areas were converted to fish farms. It was reported to the team that most of the crop farmers in this sub-region prefer to produce fish rather than crops. Their reasons were poor quality of soil and the high cost of land reclamation. **However, beneficiaries are threatening by destroying their fish farms, if they use the land for agriculture.**
- In the Enaniya sub-region both crop and fish farming take place. It was reported that the beneficiaries who already invested in land they possessed from long ago prefer to continue crop farming, despite the fact that fish farming is preferable in the newly reclaimed areas.
- In the Dibba Triangle sub-region (33,000 feddans) as well as in fish farms along Port Said-Damatta Road, fish farming proved to be a very efficient and profitable method of resource use. Fish farm productivity is expected to increase due to the improved water quality resulting from construction of the El Dibba Boogase at Ezbat El Borg City. The boogase will connect the lake with the sea and permit water exchange. However, it is important that other outlets connecting the lake to the sea remain open to ensure water circulation.

- In the El Sayala sub-region the fish farms are greatly affected by water pollution from the El Sayala sewage station. Poor water quality in this area increases operating costs and decreases the quality of fish produced in the region's existing fish farms. The fishermen showed that they obtain reasonable revenues from fishing operations. Expenditures for an average family (e.g., six people) are about LE 600 per month; average savings are about L.E. 200 monthly. Fishermen mainly use traps and standing trap nets (i.e., Tahawet), which seem efficient. About 6,000 fishermen operate on Lake Manzalla, most of them unlicensed. They produced about 6,000 tons of fish in 1999.
- The team met the chairman of the largest fishermen's cooperative (about 150,000 members) for Lake Manzalla and also met with a group of fish farmers. Neither supports any reclamation programs for the lakes. Conversely, they say their requests to some members of the People's Assembly to change the reclamation policy of drying out Lake Manzalla have gone unheeded.
- A key issue raised by the chairman of the fisheries cooperative is that the crop farmers with land adjacent to the land being reclaimed would end up being the beneficiaries, not the newly resettled people or the graduates. Fish farmers confirmed the higher profits from fish farming than from crop farming; they thus converted the dried reclaimed land to traditional fishponds, although it is illegal to do so. Some said they hid the ponds among cultivated crops. The crop farming was not productive and discouraged them from continuing to cultivate the land. Farmers also complained that the reclaimed land requires repeated land leaching over many years before becoming suitable for cultivation.
- One of the land reclamation associations in the lake's area had a total of 1,200 feddans. Of these, 800 feddans were unused, 200 feddans were used for agricultural crops, and 200 feddans were used for fishponds. The association's preference, according to their chairman, was also for fish farming.
- Open-water fishing is also very productive, fishermen said. The catchments that fishermen put up around areas of reeds—small areas of approximately 10-15 meters in diameter—could produce half a ton of fish in one month. Half of this harvest is split with the farmer who owns the land adjacent to the catchment site.
- GARPAD officials on the site visits on January 10th said that it would be seen as a scandal if all reclamation were to stop, because the investment to date in canals and

other infrastructure has been high. People noted, however, that the canals do in fact support the flow and supply of water for the fishponds.

- Egypt has 25% of the wetland area in the Mediterranean basin, most of which is in the coastal area. Egypt has signed international treaties to protect these wetland areas. It is not clear which ministry is responsible for managing and protecting the Egyptian wetlands; someone thought it was the Ministry of the Environment's Coastal Areas Department. If so, this department should be contacted as a "stakeholder" in any future workshop.

7.3. Borrolus Lake Regions

The study team visited many dried reclaimed areas that were part of Lake Borrolus in addition to the lake's main fishing center (i.e., Borg El-Borrolus). The team also visited beneficiaries' farms as well as fishery farms. Many related issues were discussed and information was obtained on their operating costs and benefits, either for growing field crops and/or for fish farming in reclaimed areas of the lake. The study team made the following observations:

- During the visit to the reclaimed areas in Mansour, El-Hamoul and El-Zawya, it was evident that a considerable number of fish farms exist in the reclaimed lands and that their numbers are increasing. We also noted that Kafr El-Shikh Governorate produced the bulk of the national production of cultivated fish (about 143,000 tons in 1999). A considerable number of fish farms use developed techniques and the semi-intensive system prevails. More than 85 private hatcheries operate in addition to the one GAFRD hatchery.
- Many fish farmers interviewed were land beneficiaries (i.e., farmers) who have long cultivated their reclaimed lands. They reported that fish farming is much more profitable than crop farming, due mainly to poor soil quality and the relatively high cost of crop production compared to fish production. The owner of a private semi-intensive fish farm mentioned that the cost/revenue ratio is about 1:2 (i.e., one can get double what one spends). This may explain why fish farmers risk converting their lands from legal use (i.e., crop farming) to illegal use (i.e., fish farming).
- The team visited El-Zawya Fish Farm of GAFRD. The farm was established in 1987 with an area of about 1,000 feddans, of which 790 feddans are water surface area. The farm includes 57 rearing ponds (730 feddans) and 16 nursery ponds (60 feddans). The main fish produced are mullet, tilapia and carp. The average yield per feddan was about 1.658 tons in 1998, which might be considered low compared with many private fish farms in the region.
- About 16,000 fishermen operate on Lake Borrolus and produced about 55,000 tons of fish in 1999. The fishermen interviewed reported that they receive reasonable incomes from fishing on the lake. However, the income varied according to fishing method and size of boat. Significant parts of dried and reclaimed lands are converted to fish farms. Thus, the beneficiaries of the reclaimed lands request that MALR change the land allocation law to give them freedom to select how they use their resources. They

also requested that GAFRD coordinate with GARPAD to issue licenses allowing them to operate their fish farms instead of growing field crops.

8. Estimating Net Income of Fishery and Land Development Activities

Selecting a method for using available natural resources depends on many criteria. Financial and economic criteria are considered the most important, because they reflect the earning power of these resources on one hand, and on the other, how the use of these resources could increase the value at the national level.

The study relied on official data and records of the lakes that were published in 1998 in estimating net income per feddan of natural fishing, with respect to the lakes' areas, production, productivity, and prices. The depreciation estimate of the used assets is based on the data collected by the team from fishermen during field visits. The following illustrates the estimates of yearly income of each productive activity of current operating projects located on the three main northern lakes. These estimates are based on data collected from land beneficiaries, fishermen, investors, and fish farm owners.

Manzalla Lake Projects

The estimated return (i.e., net profit/(losses)) generated from project samples in Manzalla Lake Regions are illustrated in the following. The estimates are based on the detailed data shown in Annex (4) and in Tables (8/1) and (8/2).

1. Aquaculture Projects

These estimates include five case studies that the team analyzed and are illustrated in the following table:

Region	Annex (4) Case Study Number	Profit/(Losses) of Feddan per LE/Yr.	Remarks
North of Sahel El- Hussania	1	3,968	Private farm (extensive tech.)
Manzalla	2	4,726	GAFRD fish farm
El-Dibba Triangle	3	(207)	Productivity could be increased
El- Sayala	4	936	Affected by sewage water
El-Dibba	5	7,117	Private leased farm/marine fish

2. Agricultural Projects

These estimates include five case studies that the team analyzed and are illustrated in the following table:

Region	Annex (4) Case Study No.	Profit/(Losses) of Feddan per LE/Yr.	Remarks
South of Sahel El-Hussania: Graduate Project/Khaled Ben Walid Village, Site (a)	6	(500)	Salty lands reclaimed 10 years ago; not always cultivated; low productivity
Graduate Project, Site (b)	7	(117)	Same soil type; cult. with rice
Graduate project, Site (c)	8	(916)	High investment, land prep. took 14 months; high yield
El-Rahamna/Damatta	9	(164)	Five-year trials for cultivation
El-Ataynaa/Damatta	10	2,208	Land in use for 30 years

3. Natural Fisheries Projects

The estimates in the following table are based on team interviews with officials and on Tables (8/1) and (8/2):

I T E M S	Unit	Value / Area
Area of the Lake	Feddan	15,000
Total Production of the Lake	Ton	65,000
Value of Production	000' LE	351,284
Total Cost (including depreciation)	000' LE	23,320
Total Net Income	000' LE	327,964
Average Net Income	000' LE	2,186
Average Productivity per Feddan	Kilograms	433

Notes on the above tables:

- Net income per feddan for fish farming (aquaculture) ranges between LE 3,968-7,120. This figure is for private sector farms that produce under normal environmental conditions.
- Net income per feddan of the GAFRD farms is estimated at LE 4,726.

- Environmental factors, especially pollution, greatly affect net return. Net income per feddan decreased to LE 936 in the Sayala region due to water sewage pollution, compared with LE 3,968 in North Sahel El-Hussania. In the Dibba Triangle Region, loss per feddan was LE 207 due to increased salinity. After the Dibba water passage project is completed, the situation may improve for these regions, due to improved water quality resulting in increased productivity and income.
- Regarding the newly reclaimed lands, net income per feddan generated from the agricultural projects shows losses ranging from LE 117 to LE 916 (as in all of the graduates' farms of Khaled Ben Walid Village), and in the Rahamna Region, where the losses are estimated at LE 164 per feddan.
- The old reclaimed lands in the Damatta Region, which have been cultivated for 30 years, generated net income of about LE 2,208 per feddan. This is less than what could be generated by fish farming in the same region.
- The average net income of the natural fisheries type of production is estimated at LE 2,186 per feddan per year. This amount is greater than what could be generated from agricultural production or from some aquaculture production.

Edko Lake Projects

Estimated return (i.e., net profit/(losses)) generated from project samples in the Lake Edko regions are illustrated in the following. Estimates are based on detailed data in Annex (4) and in Tables (8/1) and (8/2).

1. Aquaculture Projects

These estimates include four case studies that the team analyzed and are illustrated in the following table:

Region	Annex (4) Case Study Number	Profit/(Losses) of Feddan per LE/Yr.	Remarks
El- Masraf El-Khayri	11	10,000	Semi-intensive fish farm, using modern tech. and concentrates
El-Dahra / Perseeq	12	2,500	Farm under development
El- Masraf El-Khayri	13	140	Low income due to lack of finance and staff skill level
Perseeq	14	1,880	GAFRD's fish farm

2. Agricultural Projects

These estimates include four case studies that the team analyzed and are illustrated in the following table:

Region	Annex (4) Case Study Number	Profit/(Losses) of Feddan per LE/Yr.	Remarks
Agrarian Reform Society	15	1,725	Sandy soil, cultivate palm, vegetables, and horticulture
Agrarian Reform Society	16	231	Sandy soils; cultiv. rice and beans
Agrarian Reform Society	17	283	Cultivate rice and berseem
Agrarian Reform Society	18	804	Cultivate cotton and berseem

3. Natural Fisheries Projects

Estimates in the following table are based on team interviews with officials and on Tables (8/1) and (8/2).

I T E M	Unit	Value/Area
Area of the Lake	Feddan	17,000
Total Production of the Lake	Ton	9,494
Value of Production	000' LE	55,128
Total Costs (including depreciation)	000' LE	8,985
Total Net Income	000' LE	46,143
Average Net Income	000' LE	2,714
Average Productivity per Feddan	Kilograms	558

Notes:

- Net income per feddan for fish farming (aquaculture under semi-intensive type of production with feeding concentrates) is estimated at LE 10,000 per production cycle. This is considered a very high return by all standards.
- Average net income per feddan of the prevailing traditional fish farming method ranges between LE 2,500 for private sector farms and LE 1,880 for public sector farms.
- Average net income per feddan of the farms, which do not have enough financial resources or good management, is estimated at LE 140 per production cycle.
- For the newly reclaimed lands, data indicate that the estimate of net income per feddan of the vegetable or horticultural rotation is LE 1,725, which is higher than could be achieved from traditional crop rotation. Net income for traditional crops ranges from LE 231 to LE 804 per feddan/year.
- Average income generated from fish farming is higher in all cases than that generated from crop or vegetable production.
- Average net income of the natural fisheries type of production is estimated at LE 2,734 per feddan/year. This amount is greater than what could be generated from agricultural production or from some aquaculture production

Borrolus Lake Projects

Estimated return (i.e., net profit/(losses)) generated from project samples in the Borrolus Lake regions are illustrated in the following. Estimates are based on detailed data in Annex (4) and in Tables (8/1) and (8/2).

1. Aquaculture Projects

These estimates include five case studies that the team analyzed and are illustrated in the following table:

Region	Annex (4) Case Study Number	Profit/(Losses) of Feddan per LE/Yr.	Remarks
El-Zawya	18	3,147	Natural dried area; semi-intensive farm using modern technique
El-Mansour Sector, Policy Society	19	5,025	Reclaimed area; unsuitable for cultivation
El-Mansour Sector, Policy Society	20	6,179	Crop farm converted to fish farm
El-Zawya	21	1,295	GAFRD's farm
El-Hamoul	22	2,585	Reclaimed area

2. Agricultural Projects

These estimates include four case studies that the team analyzed and are illustrated in the following table:

Region	Annex (4) Case Study Number	Profit/(Losses) of Feddan per LE/Yr.	Remarks
El-Mansour Sector, Policy Society	23	(300)	Many efforts to cultivate the reclaimed land; all failed.
El-Hamoul	24	(421)	Rice and berseem cultivated
El-Hamoul	25	(385)	Cotton and wheat cultivated
El-Hamoul	26	(148)	Cotton and s.beet cultivated

3. Natural Fisheries Projects

The estimates in the following table are based on interviews with officials and on Tables (8/1) and (8/2):

I T E M S	Unit	Value / Area
Area of the Lake	Feddan	103,000
Total Production of the Lake	Ton	55,300
Value of Production	000' LE	379,273
Total Costs (including depreciation)	000' LE	51,930
Total Net Income	000' LE	327,343
Average Net Income	000' LE	3,178
Average Productivity per Feddan	Kilograms	536

Notes:

- Net income per feddan for fish farming (aquaculture) ranges from about LE 3,147 to LE 6,179 per production cycle.
- The reclaimed lands that were cultivated with crops do not generate any income. Therefore, the beneficiaries converted their crop farms to fish farms (as in case nos. 19 and 20). The estimated income from the converted farms ranges from LE 5,025 to LE 6,179 per feddan as in case nos. 19 and 20, respectively.
- The reclaimed lands that are cultivated with crops had losses ranging from LE 148 to LE 421 per feddan.
- The average net income of natural fisheries production is estimated at LE 3,178 per feddan/year. This figure is greater than what could be generated from agricultural production or by some aquaculture production.

**Table (8/1): Value and Quantity of Production for 1999
from Lakes Manzalla, Borrolus, and Edko**

Types	Price LE/Kg	Manzalla		Borrolus		Edko	
		Ton	000'LE	Ton	000'LE	Ton	000'LE
Tilapia	6	33,929	203,574	33,382	200,292	7,449	3,075
Catfish	3	5,893	17,679	2,315	6,945	652	1,653
Jack	11	535	5,885	1,144	12,584		
Shelled Jack	11	219	2,409	955	10,505		
European Eel	30	202	6,060	152	4,560	16	480
Crabs	11	70	770	17	187		
Basarya	2	122	244				
Mabrouk	4	330	1,320	236	944	22	88
Mullet	11	3,083	33,913	10,719	117,909	481	5,291
Shrimp	10	411	4,110	449	440		
Sea Bream	23	328	7,544	3	69		
Spotted Sea Bass	7	146	1,022	247	1,729		
Sole	16	62	992	210	3,360		
European Sea Bass	27	248	6,696	81	2,187		
Lout	23	40	920	9	207		
Other Varieties	3	19,382	58,146	5,785	17,355	873	2,619
TOTAL		65,000	351,284	55,704	379,273	9,493	13,206

Source: Fish Production Statistics, 1999, GAFRD.

**Table (8/2): Number of Fishing Boats in 1999
(Registered & Unregistered Boats)**

Lake	Number of Registered Boats(1)	Estimated Number of Unregistered Boats(2)	Total No. of Boats	Average Operating Costs LE /Year
Manzalla	3,109	1,555	4,664) 5,000
Borrolus	6,924	3,462	10,386	
Edko	1,198	599	1,797	

(1) Source: Fish Production Statistics, 1999, GAFRD.

(2) Study Team estimates on the basis of 50% of the registered boats.

9. Comparing Internal Rate of Return on Fishery and Land Development Projects

Utilizing the available resources in the northern lakes regions relies on the feasibility studies of the proposed development projects. These studies should indicate the anticipated financial and economic returns (IRR) on investing in the available productive activities in these regions (i.e., land development projects and/or fish farming or aquaculture projects). Thus, this section includes calculating the IRR on investment in three proposed development projects that could technically be established in these regions. These proposed projects are similar to the projects that already exist in these regions or that have great potential to be established in the near future. The proposed development projects include the following:

- 1) A land development project for reclaiming and cultivating new lands for field crop production. Land would be allocated to graduates or land beneficiaries at five feddans each. This is the usual size of land holding allocated to these types of beneficiaries.
- 2) A fishery development project (i.e., aquaculture) using an extensive fish farming production system. The project area is also five feddans that were converted from crop production to fish farming production.
- 3) A fishery development project on five feddans that are allocated from the lake and leased annually from GAFRD.

The technical design, operating production systems, productivity rates, and management of the ongoing projects that already exist in these regions were used as guidance for the technical design of the proposed projects. Costs, including investment, working capital, and operating costs, were estimated for each of the proposed projects on the current market prices prevailing at the time of calculating the returns on investment. Annex (5) illustrates detailed calculations on which the expected Net Present Value (NPV) and Internal Rates of Return (IRR) are estimated for each project. A summary of the main assumptions for these estimates follows.

1) **Land Development and Crop Production Project**

The newly reclaimed lands that dried out from the northern lakes are usually allocated and distributed to the beneficiaries (i.e. small farmers, graduates, and fishermen) according to GARPAD's distribution rules. These rules and regulations prevent beneficiaries from using the newly reclaimed land for anything but crop cultivation. Thus, the return on capital invested in this kind of production for five feddans is calculated under the following assumptions:

- GARPAD undertakes construction of the basic infrastructure (e.g., main canals and drainage, main roads, power networks, services buildings, etc.) through the reclamation companies.
- GARPAD allocates the usual five feddans along with a house for each beneficiary and also undertakes the on-farm reclamation process (e.g., land leveling, feeding irrigation canals and drainage, farm roads, etc.). The beneficiary will repay the costs in equal installments over 30 years without interest.
- GARPAD and the reclamation companies estimate the reclamation costs per feddan (i.e., on-farm construction including the house and the farmer's share in the basic infrastructure). These costs range from LE 9,200 in North Sahel El-Hussania regions; LE 15,200 in south of Sahel Port Said; to LE 14,500 in Kafr El-Shikh regions. The last estimate (of which LE 9,000 is for on-farm reclamation and LE 5,500 is for the beneficiary's share in basic infrastructure costs) was used for this calculation under the assumption that the beneficiary will repay half the cost in equal installments over 30 years.

- The beneficiary will purchase the farm's assets (e.g., irrigation networks and pumps, farm equipment, etc.) in addition to his investment in the reclamation process.
- The life horizon of the project is assumed to be 30 years, since marginal productivity of the reclaimed lands requires more time than other development projects.
- Operating costs are estimated on the basis of proposed cropping patterns that include field crops already grown in the region (e.g., rice and berseem rotation, cotton and wheat rotation, cotton and berseem rotation). The calculation took into account the production values of these proposed rotations as feasibly technical alternative rotations.
- Cultivating the land is assumed possible after two years of reclamation, through which the land will be reclaimed from excess salt using surface water and after the soil physical characteristics have improved. Productivity will then be gradually improved from the first year of grown crops until reaching marginal productivity by the sixth year of cultivation.
- Estimating the working capital was also considered as a percentage of the annual operating costs. This estimate assumes that the working capital will be recovered in the last year of the project's lifetime and will be considered revenue.
- For farm asset values (i.e., salvage value) we assumed that 25% of the farm asset values will be recovered in the last year of the project's lifetime and will be considered revenue.

Based on the above assumptions, the NPV and IRR were calculated using the methodology of the Economic Development Institute of the World Bank (EDI/WB). The results of this analysis show the following:

- The NPV at discount factor (i.e., commercial interest banking rate) of 11% is LE 8,700 for the rice and berseem rotation, LE 1,400 for the cotton and wheat rotation, and LE 5,200 for the cotton and berseem rotation.
- The IRR on the invested capital is 19% for the first rotation, 13% for the second, and 17% for the third rotation.

2) Fishery Development Project Using Extensive Fish Farming System

The basic assumption in this case is that the beneficiary of the reclaimed land wants to convert the production pattern from crops to fish by establishing an aquaculture farm on five feddans of reclaimed land. The beneficiary was encouraged to do so because he faced many problems in cultivating his land because of crop production losses on one hand, and the expected profit from the alternative land use (i.e., aquaculture) on the other. The calculation of the NPV and IRR on invested capital for a fish farm of five feddans is detailed in Annex (5). This calculation is based on the following assumptions:

- The project's land is allocated to the beneficiary according to GARPAD rules and regulations in addition to the payment terms mentioned in the previous case. The beneficiary will take the risk in converting his agricultural land to a fish farm.
- The beneficiary will invest in establishing a fish farm and will cover the costs of the reclaimed land as part of his investment.
- Since the capital cycle of this type of project is relatively short when compared to reclamation projects, the life horizon of the fishery project is assumed to be 15 years in addition to one year for construction.
- Operating costs are based on one production cycle according to the indicators of similar projects in the same region. Productivity and production are based on one feddan of the surface area, different types of fish, production norms in the area, and length of the production cycle.
- The NPV and IRR are determined by using the same methodology as in the previous case.

The results of the analysis showed the following:

- The NPV at discount factor (i.e., commercial interest banking rate) of 11% is LE 86,600. This value is more than 10 times the estimated value of the crop production project (Case No. 1).
- The IRR on the invested capital is 42%. This rate is more than double the rate of the previous project (Case No. 1).

3. Fishery Development Project On the Lake Leased from GAFRD

This case assumes that the investor will lease water surface area on the lake to establish an aquaculture farm using the traditional production system. Five feddans will

be allocated and leased from GAFRD. Annex (5) details the calculating of NPV and IRR for the proposed project. The following are the basic assumptions made to determine the anticipated return on invested capital:

- The water surface area will be leased from GAFRD at an average rental value of LE 150 per year, renewable for five years.
- Investment costs include construction of fish ponds, water feeding canals and drainage, water pumping, cleaning the weeds, purchasing the equipment, etc. The depreciation and salvage values of these assets are the same as in the previous cases.
- Operating costs are based on one production cycle according to the indicators of such projects in the same region. Productivity and production are based on one feddan of the surface area, different types of fish, production norms in the area, and length of the production cycle. Working capital is determined on the basis of the annual operating costs and will be recovered in the project's last year as in the previous cases.
- The life horizon of the project is assumed to be 15 years in addition to one year for construction.

Based on the above assumptions, the NPV and IRR were calculated using the methodology of the Economic Development Institute of the World Bank (EDI/WB). The results of this analysis show the following:

- The NPV at discount factor (i.e., commercial interest banking rate) of 11% is LE 85,000. This value is more than 10 times the value anticipated from the crop production project (Case No. 1).
- The IRR on the invested capital is 45%. This rate is more than double the rate of the crop production project and increases at approximately 3% of the rate of the fishery project on reclaimed land (Case No. 2).

10. Conclusion and Recommendations

Based on the previous analyses, the study team makes the following recommendations to assist decision makers in the MALR—particularly GARPAD and GAFRD—in reforming their development policies on allocating, distributing, and using the available resources in the northern lakes regions:

1. The drying out of Egypt's fishing water bodies is a national issue that requires decisive policy measures to prevent its recurrence. Legal actions must be taken and national commitment must be made to prevent the drying out of the northern lakes. These lakes are of national interest and act as buffer zones for the entire Delta lands. Conservation and development of these lakes are vital for individuals and the country because the use of the lakes in fishery production is more profitable than crop production.
2. In light of the free market economy and to encourage increasing private sector investment in productive activities, net return on investment reflected by the IRR becomes the most important indicator for investment. Therefore, producers (i.e., investors, graduates, and land beneficiaries) should have free choice for using the available resources, especially producers who possess newly reclaimed lands. They should be able to select the most appropriate type of production that would maximize their returns and profits. This could be achieved by reviewing GARPAD's rules and regulations on the land allocation system in these regions to avoid the beneficiaries' (i.e. graduates, small farmers, and fishermen) emigration of their reclaimed lands.
3. Continuing to dry out or reclaim lake lands will lead to decreased water surface areas that are allocated for fishery activities. This action would result in increased overfishing and would sharply reduce the fishery stocks. Thus, fishery activities would not be sustainable.
4. Drying out the coastal zone areas will affect water depth level, as it already has in the El-Hagar Region of Manzalla Lake, and would have a negative impact on the region's fishery resources. Shallow water areas affect the locations of fish hatcheries and the incubation of fry, especially tilapia fry, which constitutes the major production of the northern lakes.
5. Corrective actions must be taken on the legal status of existing fish farms in the northern lakes regions, especially those farms that are established on reclaimed lands. This reform could be achieved through agreement between GAFRD and GARPAD under the framework of MALR. The beneficiaries could then obtain licenses for their presently illegal fish farms on the newly reclaimed lands. This action would assist in settling the beneficiaries, increasing production, and encouraging more investment in their lands.
6. Maximize the water resources that are allocated for reclaiming huge areas in these regions by encouraging investment in establishing fish farm projects. The existing

basic infrastructure that was constructed by the state for land reclamation projects could be used in fishery projects. This action would contribute positively to increasing the growth rate of the agricultural sector, generating more jobs, and maximizing income.

7. Apply appropriate scientific methods for managing the northern lakes. These methods should be based on an accurate database regarding fish stocks, fishery efforts, change in environmental factors, etc., to attain integrated management for rational use of the coastal resources. This could be achieved by unifying the licensing bodies under one organization and applying the “Integrated Coastal Zone Management (ICZM)” approach that was introduced by the Egyptian Environmental Affairs Agency (EEAA). This approach would secure a balanced and clean environment while also preserving the natural and biological resources of the northern lakes as buffer zones for Delta lands.
8. Intensify the efforts of the government and the private sector to solve production problems in the newly reclaimed lands. These lands have the potential to become more productive. To ensure success, reclamation and cultivation programs should focus on the regions that possess a fresh water supply. Additionally, this focus would avoid wasting scarce water resources through repeated land leaching in order to reduce the soil’s high salt content. Specifically, we recommend the following:
 - i. Provide the appropriate basic infrastructure and services for the beneficiary communities.
 - ii. Resolve the legal status of the land beneficiaries who have converted their reclaimed lands to fish farming.
 - iii. Ration irrigation water by improving the land leaching process and drainage networks.
 - iv. Provide the appropriate soft loans and credit that will assist the land beneficiaries in keeping their lands and reaching marginal productivity, which takes longer in these regions than was originally expected.
 - v. Expand agricultural mechanization by establishing specialized cooperative societies in these areas to provide such services.

Annex (1)

Proposed Terms of Reference

A Case Study on Fisheries Development Versus Land Development

Justification

The four northern lakes of the Nile Delta—Borrolus, Edko, Manzalla, and Marriout—provide a multitude of economic, environmental, and social benefits to the people of Egypt. They are the single largest source of fish in Egypt, contributing 28% of the country's total fish catch in 1998. At present Lake Manzalla represents by far the largest single fish source in Egypt, accounting for more than 14% of domestic supply and more than 40% of the regular private and government fish farm production (1998). The lakes provide other valuable services. They act as buffers against seawater intrusion in the northern Delta and provide sanctuary for migratory birds. They constitute 25% of the total Mediterranean wetlands.

The northern lakes are under severe pressure due to many factors. Land reclamation is among the most critical threats. Over the last 70 years, the lakes have lost nearly 60% of their surface area to agriculture, urban expansion, fish farming, and road construction, declining from 641,000 feddans in the 1930s to 280,000 feddans today. Most of the reclamation has been part of a nationwide program to increase the amount of arable land available to meet the food and employment needs of the growing population. Other land reclamation projects have been associated with the construction of major highways and roads that pass directly through the lakes. The network of roads through Lakes Marriout and Manzalla has reduced water circulation with the Mediterranean Sea, as well as inside these water bodies, and led to the creation of small independently functioning basins.

While the costs of land reclamation to fishery resources, biodiversity, and other environmental services have been high, it is unclear whether the benefits of land reclamation for agriculture have materialized as originally planned. Anecdotal evidence suggests that several areas have encountered serious problems. Around Lake Manzalla,

land tenure disputes and highly saline soils have prevented large tracts of reclaimed land from entering into agriculture. Some areas are completely vacant. Other areas have been converted to livestock production or fish farming. In other instances, the intended beneficiaries of these reclaimed lands, which include the Mubarak graduates, former government employees, and displaced fishermen, have not gained access or title to the land.

Fishermen are particularly concerned about land reclamation and predict that the lakes will be totally dry in the future. Not only have they been subject to large-scale government sponsored reclamation schemes in the past five decades, private reclamation have taken place. Pressure to reclaim the lakes remains high in several areas. The lakes' fertile alluvial soils are considered excellent for agriculture. Moreover, the lakes are located in areas that have large and expanding populations that need the space to grow. Future pressures for land may indeed lead to more widespread reclamation unless concrete and unequivocal steps are taken soon to stop this trend.

Decisions on land reclamation must consider many factors, including soil fertility, the costs of reclamation, access to markets, and others. Environmental factors also must be taken into account. Wise and efficient use of the lake resources should ensure maximum yield, while balancing economic factors against environmental factors.

The purpose of these terms of reference is to propose a study to look at the relative returns to fishing in the northern lakes and agriculture on reclaimed lake land. This follows a previous RDI study, Environmental Assessment to Promote the Sustainable Development of Fishery Resources in the Northern Delta Lakes of Egypt, which recommended that RDI conduct such an economic study.

Objectives

1. To identify land use policy for Lake Manzalla.
2. To conduct a comparative economic study of land use on Lake Manzalla (i.e., fishery use versus agricultural land use).

Outputs

- An analytical report on the use of lakes for fish production versus crop production.
- Workshop to present the study's results and recommendations.
- Justify the proposed benchmark for T5, if possible.

Timing

September – October 2000

Team and Resources

- Dr. Mohamed El-Shenawi, GAFRD Advisor (retired) 20 working days.
- Dr. Ahmed Barrania, Economist (retired INP staff) 20 working days.
- Eng. Nadya El-Sayed, Engineering Planner, GARPAD, 15 working days (one working day per week).
- Mr. Mostafa El-Sherif, Accountant, GAFRD (retired), 15 working days.

RDI Unit Responsibility

Resource Economics, Dr. Jane Gleason, Dr. Sayed Hussein

Tasks

- Review previous studies and research on reclamation programs.
- Review all laws and regulations regarding the use of northern lakes.
- Interview and meet with officials in GARPAD and GAFRD regarding land reclamation schemes and fishery development in the northern lakes.
- Conduct meetings with farmers in the reclaimed lands to identify constraints and problems for developing the dried reclaimed lands and to collect economic and financial data.
- Conduct meetings with fishermen and fish farmers to identify constraints and problems for development and to collect economic and financial data.
- Prepare a draft report of the study.

Annex (2)
List of Government Staff,
Beneficiaries and Investors Interviewed

Name	Position	Organization
Eng. Serag Abdel Hafiz	Chairman	GAFRD
Eng. Mohamed Kamoun	Chairman of the Central Administration for Western Region Affairs	GAFRD
Eng. Mostafa Munir	G. Director of Production, Western Region Director of Madeya Ports, and Chairman of Lake Edko Committee	GAFRD
Eng. Esaam El-Alamy,	Director of Fish Farms at Manzalla	GAFRD
Eng. Ahmed El-Gamal	Ex. Director of Manzalla Fish Farm	GAFRD
Eng. Hassan El-Raghy	Director of Port Said and Damatta Region	GAFRD
Eng. Afifi	Extension Officer at Lake Edko	GAFRD
Eng. Mohamed R. El-Hamamsy	Director of Lake Manzalla	GAFRD
Mr. Mohamed M. El-Tar	Private owner, fish farm, on dried land	Lake Manzalla
Mr. Khaled El-Tar & Mr. Amin	Private owners, fish farm, on dried land	Lake Manzalla
Mr. Mosaad Amin	Private owner, crop farm, 20 feddans	8 km west Damatta, Zarara sub-region
Mr. El-Saied M. El-Degnauey	Private owner, fish farm, 90 feddans	Sayala sub-region
Owner	Golden Fish Company, 130 feddans	El Dibba Triangle
Mr. Hassan Dawood	Private owner, fish farm, 6 feddans	Dibba Region, Port Said-Damatta Road
Mr. El Sayala	El Dibba fishing	Sites on Lake Manzalla
Mr. Said Sabaa	Director of Lake Marriout, and Chairman of Lake Marriout Committee	GAFRD
Mr. Gamal Mohamed	Director of Operations, Lake Marriout	GAFRD
Mr. Hassan Radwan	Private investor and owner, 130 feddans, fish farm	Edko Lake Region
Director	Arab Fisheries Co., affiliate of Arab League, big investor company in fish farming	Perseeq Region
Eng. A. Hassan El-Regal	Director, Agrarian Reform Society	Edko Lake Region

Name	Position	Organization
Mr. Mohamed El-Hemeda	Land Beneficiary, 5 feddans, since 1960s	Edko Lake Region
Mr. Mohamed Belal	Land Beneficiary, 7 feddans	Edko Lake Region
Eng. Mohamed M. El-Bawab	Director, West Delta Region	GAFRD
Mr. El-Hadad	Investor in semi-intensive fish farm	Private sector
Director & Tec. Staff.	Borrolus Aquaculture Center	Borrolus Lake Region
Eng. Fawzi El-Shenawi	Director of Lake Borrolus	GAFRD
Eng. Fouad Ibrahim	Director of Cooperative and Development	Mansour Sector, MALR
Eng. Adel Abdalla	Director of El-Zawya Farm, Borrolus Lake	GAFRD
Mr. Shaker Sebahy	Land Beneficiary, Borrolus Lake Region	Lake Borrolus
Mr. Ahmed Samra	Land Beneficiary, Borrolus Lake Region	Lake Borrolus
Mr. Salah El-din Yehya	Land Beneficiary at Borrolus Lake region	Lake Borrolus
Mr. Ismail Radwan	Land Beneficiary at Borrolus Lake region	Lake Borrolus
Group of Land beneficiaries	Agr. crop producers, owns new lands	Around the lakes

Annex (3)

List of Locations and Sites Visited

- The Integrated Fish Farm of GAFRD at Manzalla Lake, near Port Said and Dammatta.
- The dried reclaimed lands that were allocated to the beneficiaries (i.e., small farmers and collage graduates) at regions of Baher El-Bakr, north and south Sahel El-Hussania, Khaled Ben Walid Villages, Baher El-Bakr Drainage, and on Salam Canal (about 220,000 feddans).
- Lake Edko near Alexandria, and the dried reclaimed areas and fish farms in the regions of Koom Bellal, Dibba, El-Sayala, and on Port Said-Damatta Road.
- Fish Harbor at Lake Edko.
- The Integrated Fish Farm at Manzalla Lake/GAFRD, the dried reclaimed lands adjacent to the lake, and fish farms in the region.
- Fish farm (aquaculture) of Golden Fish Company, located in Dibba Triangle (about 130 feddans).
- Perseeq Fish Farm /GAFRD on an area of 2,000 feddans on Lake Edko.
- The Arab Fish Farm Company/Arab League on an area of 70 feddans, near Perseeq Fish Farm on Edko Lake (Arab Investment Fund).
- Borrolus Lake and the Integrated Fish Farm of GAFRD, dried reclaimed land on Lake Borrolus/Kafr El-Shikh Governorate.
- Newly dried reclaimed areas (about 90,000 feddans) in the regions of Hamoul and El-Mansour.
- Fish farm at El-Zawya in Hamoul Region (about 1,000 feddans)/GAFRD.
- Fish farm at Burg El-Borrolus on Lake Borrolus, Kafr El-Shikh Governorate.

Annex (4)

Statistical and Financial Data Collected during Field Visits

The study team collected these data from 24 fish and crop farms during their visit of the northern lakes regions (i.e., Manzalla, Borrolus, and Edko). The data show the calculations for net income for the last year (1999) only.

Case No. (1)

1. Region of Manzalla Lake

North of Sahel El-Hessanya

Private Sector Fish Farm

Total farm area: 600 feddans
 Utilization: Fish farm (aquaculture)
 Owner's Name: Mohamed Salem El-Tar and partners
 Production System: Extensive fish farming
 Water Source: Bahr El-Bakr Drainage, water rich with organic matter, from sewage drainage
 Date Established: 30 years ago

Annual Costs and Revenue (1999):

Operating Costs		Production & Revenues	
Items	LE	Items	LE
Fries	25,000	Tilapia (100 tons)	500,000
Labor	14,400	Mullet (40 tons)	360,000
Casual Labor	3,000	Toubar (150 tons)	1,200,000
Fuel, Oil & Repair	1,500	Mabouk (60 tons)	240,000
Cleaning the farm	2,000	Catfish (30 tons)	150,000
Bonds maintenance	600		
Depreciation	2,500		
Tax and Duties	20,000		
Total	69,000		2,450,000

Estimated total net revenue of the farm is LE 2,381,000 per year, and net income per feddan is LE 3,968 per year.

Case No. (2)

Manzalla Integrated Fish Farm/GAFRD

Public Sector Fish Farm

Farm area: 1,000 feddans, of which 600 feddans are water surface area.

Remarks:

- The farm is a public farm on Lake Manzalla and is operated by GAFRD. Only direct costs are recorded at the farm; indirect and other costs are recorded at GAFRD's headquarters.
- Cost and revenue data were extracted from the financial statements of costs that were prepared by General Department of Budgeting & Planning at GAFRD's Headquarters for the year ending 30/6/2000.
- Data collected are aggregate data that include direct and indirect costs divided into four main categories: labor, physical inputs, service inputs, and current transfer payments. The following shows the aggregate costs and revenues:

i. Costs:

Direct Costs		Indirect Costs	Total Costs
Items	(LE)	(LE)	(LE)
Wages	697,976	243,611	
Physical Inputs	1,899,517	26,343	
Service Inputs	97,319	7,398	
Current Transfer Payments	1,442	230,095	
Total	2,696,254	507,447	3,203,701 (*)

Source: GAFRD records at Manzalla Farm and GAFRD Headquarters for 1999/2000.

(*) Includes estimated interest (LE 80,389) and depreciation (LE 149,295).

b. Production and Revenue:

Estimated production is as follows:

About 1,276 tons: Mullet - 169 tons, Tilapia - 687 tons, Carp - 276 tons, and catfish 117 tons. Estimated revenues are approximately LE 7,929,535.

Net return is estimated at LE 4,725,834; net return per feddan is LE 4,725.

Case No. (3)

Manzalla Lake, Damatta Region

Private Sector Fish Farm

Location:	Dibba Triangle
Farm area:	140 feddans
Owner Name:	Ragaie Ghanm (registered investment co.)
Utilization:	Marine fish farm
Water Source:	Mixed water from Manzalla Lake and Mediterranean Sea.
Production System:	Extensive fish farming
Date Established:	1991/1992.

Remarks:

- Dibba Triangle region is not suitable for crop cultivation and not included in the reclamation program.
- The region's total area is 33,000 feddans, of which 1,300 feddans are fish farms. The water surface area for free open fishing is about 20,000 feddans. The productivity of the free open fishing is very low (about 3 kg/feddan). This led to the emigration of all fishermen from the region to the Mediterranean coastal zone to establish aquaculture fish farms.
- The estimated salinity of the triangle is 18-PPM, increasing in the winter to 70 PPM.
- The company is owned by many partners and is registered in the General Authority for Investment.
- Elevation of the company farm is 60 cm. above sea level. The increase of farm salinity is due to inefficiency of the water pipes that connect the triangle to Manzalla Lake and the triangle to the sea, because these pipes are always blocked.
- To reduce salinity, the Dibba Sea waters inlet (Boogase) is under construction at El-Bourg village. The connected water pipes should also be changed to wider pipes.
- The fish types at the farm are mullet (35%), sea bream (50%), and sea bass (15%).

Estimated Costs and Revenue:

1. <u>Investment cost:</u>	LE
Constructing fish bonds	160,000
Two water pumps	30,000
Water gates (in and out)	10,000
Buildings	15,000
Transportation (cars)	110,000
Fishing boats and nets	2,000
<hr/> Total	<hr/> 327,000
2. <u>Current operating costs:</u>	LE
Drying fish bonds	5,000
Fries	150,000

Fish fodder (20% protein)	150,000
Chemical fertilizers	15,000
Cleaning the bonds	3,000
Fuel, oil, and repairs	25,000
Labor	43,200
Harvesting	10,000
Rent for 3 years	67,200
Depreciation	72,450
Total	540,850

3. Production and Revenue:

<u>Production (tons)</u>	<u>Revenue (LE)</u>
Mullet (7.35 ton x LE1,200)	88,200
Sea Bream (10.5 ton X LE 25000)	262,500
Sea Bass (3.15 ton X LE 27000)	85,050
Total Revenue	435,750

This farm showed losses (for this production cycle) estimated at LE 87,100. Annual losses are estimated at LE 29,033 (i.e., LE 207 per feddan).

The farm could possibly achieve profit by increasing productivity with the Dibba Sea water inlet in operation and if the farm water source is improved.

Case No. (4)

Manzalla Lake, Damatta Region

Private Sector Fish Farm

Location: Sayala region, about one km. from Sayala sewage drainage station
Farm area: 89 feddans
Owner Name: Mohamed El-Degnawy and others
Utilization: Fish farm on Manzalla Lake
Water Source: Mixed water from Manzalla Lake
Production System: Extensive fish farming
Date Established: 15 years ago

Remarks:

- The farm is established on water surface area from Manzalla Lake.
- About 50% of the fries that are provided to the farm are tilapia fry from the lake; 50% are other types of fries (i.e., mullet, mabrouk, and catfish) and are provided from outside the lake.
- Polluted water from the sewage drainage station affects the farm.

- The production cycle is for two years.
- Average productivity per feddan was about five tons/year before the Sayala sewage drainage station was established.. But after the construction of Damatta-Port Said Road, the water inlet from the sea became blocked and contributed to decline in productivity. After the construction of the road, the seawater is now pumping.
- The region includes about 14 fish farms with a total area of 400 feddans. The polluted water from the sewage drainage affects this farm.

Estimates of Costs and Revenue:

a. <u>Investment cost:</u>	LE
Construction of fish bonds	100,000
Equipment (pipes and water pumps)	110,000
Ditches and digging	200,000
Construction of water gates	44,000
Buildings	35,000
Fish boats and nets	11,200
Total	500,200

b. <u>Current operating costs (for two years):</u>	LE
Cleaning fish bonds	24,000
Fries	80,000
Fish fodder	60,000
Labor	11,000
Fuel, oil, and repairs	16,000
Transporting	5,000
Rent (for 2 years)	16,910
Depreciation (for 2 years)	90,780
Total	303,690

c. Production and Revenue:

<u>Production (tons)</u>	<u>Revenue (LE)</u>
Mullet (18.69 ton x LE 12,000)	224,280
Tilapia (31.15 tons x LE 6,000)	186,900
Catfish (9.345 tons x LE 5,000)	46,725
Carp (3.115 tons x LE 4,000)	12,460
Total Revenue	470,365

Revenue:

Net revenue from two years' production cycle is LE 166,675

Net revenue for one year is LE 83,337.

Net return per feddan is LE 936.

Case No. (5)

Manzalla Lake, Damatta Region

Small Private Sector Fish Farm

Location: El-Dibba Region, Port Said-Damatta Road
Farm area: 6 feddans leased from GAFRD
Owner Name: Hassan El-Said Dawood
Utilization: Fish farm on Manzalla Lake
Water Source: Mixed water from Manzalla Lake
Production System: Extensive fish farming
Operation date: Leased from GAFRD 8 years ago

Remarks:

- Manzalla Lake is the source of irrigation and drainage.
- The production cycle is for 1.5 years.
- Fish types produced are sea bass, sea bream, eel, and lout.

Estimated Costs and Revenue:

a. <u>Current operating costs (for 1.5 years):</u>	LE
Fries	42,000
Fish fodder	45,000
Production Labor and Guard Labor	3,540
Fuel, Oil, and Repairs	4,200
Rent (for 1.5 years)	855
Depreciation (for 1.5 years)	2,350
<u>Total</u>	<u>97,945</u>

b. Production Value and Net Revenue:

The estimated value of production on a 1.5-year production cycle is LE 162,000.
Average production value per feddan is LE 27,000.

Net return for the farm's production cycle is LE 64,055.

Net return for farm per year is LE 42,703

Net return per feddan is LE 7,117 per year.

Case No. (6)

South of Sahel El-Hessanya

Crop production farm

Location: Khaled Ben Walid Village, Graduates' Reclamation Project (2000 feddans)

Farm area: 5 feddans allocated from GARPAD
 Owner Name: Sabry Abdel Azeem Mohamed
 Utilization: Field crop cultivation (barley)
 Water Source: Salam Canal
 Operation date: Allocated by GARPAD in 1989

Remarks:

- The farm was delivered without land leveling (i.e., reclamation processes not completed). The cost of land leveling is estimated at LE 12,000 over 10 years.
- Preparation of the reclaimed land for cultivation continued for 10 years, during which time soil salinity was continuously leached by fresh water from Salam Canal every four days for the last 10 years. The soil salinity reached about 8 PPM; it should be only 1 PPM.
- The area suitable for cultivation up to the present is about 700 feddans of the village's total area (i.e., about 2,000 feddans).
- The farm's water consumption is estimated at about 10 times the water used in fish farming.

Estimated Costs and Revenue:

a. <u>Current operating costs for 5 feddans of barley:</u>	LE
Land leveling by laser	1,200
Water pump	360
Seed	300
Fertilizer	780
Land Preparation	100
Labor	140
Fuel & Oil	100
Harvesting	500
Total	3,480

b. Revenue:

Production: 5 feddan x 3 ardeb x LE 60/ardeb = LE 900
 Thus, the loss is LE 2,500. Loss per feddan was LE 500 in 1999 after 10 years of cultivating the reclaimed land.

Case No. (7)

South of Sahel El-Hessanya

Crop production farm

Location: Khaled Ben Walid Village, Graduates' Reclamation Project (2000 feddans)
 Farm area: 5 feddan allocated from GARPAD

Owner Name: Adel Fathy Metwaly
 Utilization: Field crop cultivation (rice)
 Water Source: Salam Canal
 Operation date: Allocated by GARPAD in 1989

Estimated Costs and Revenue:

a. <u>Current operating costs for 5 feddans of rice:</u>	LE
Land leveling	150
Rice nursery	400
Fertilizer	400
Land Preparation	100
Pesticides	175
Fuel & Oil	500
Harvesting	500
Loan	50
Total	2,275

b. Revenue:

Production: 5.5 tons of rice x LE 380/ton is LE 2,090.
 Thus, the loss is LE 585; loss per feddan is LE 117.

Case No. (8)

South of Sahel El-Hussania

Crop production farm

Location: Khaled Ben Walid Village, Graduates' Reclamation Project (2000 feddans)
 Farm area: 5 feddans allocated from GARPAD
 Owner Name: Rafat Taha El-Aaser
 Utilization: Field crop cultivation (rice)
 Water Source: Salam Canal
 Operation date: Allocated by GARPAD in 1994

Remarks:

- The farm was delivered to the graduate without land leveling (i.e. reclamation processes not completed). About LE 600 spent on land leveling.
- The land was divided into two parts: saline soil and alkaline saline soil.
- This farm is considered the best farm in the village, and all graduates do not reach the productivity of this farm, which is considered ideal for them.
- Preparation of the land for cultivation took about 14 months; cultivation started in 1996.

Estimated Costs and Revenue:

a. <u>Investment costs:</u>	LE
Land leveling	6,400
Irrigation & drainage networks	3,600
Chemicals	3,200
Land improving processes	10,000
Total	23,200

b. <u>Current operating costs for 5 feddans of rice:</u>	LE
Land leveling	140
Rice nursery	500
Fertilizer	455
Land leveling	140
Pesticides	415
Labor	2,400
Irrigation	400
Cleaning weeds	880
Harvesting	760
Transportation	110
Depreciation	4,640
Total	10,840

c. Revenue:

Production: 16 tons rice x LE 400/ton = LE 6,400
Thus, the loss is LE 4,580; loss per feddan is LE 916.

Case No. (9)

Manzalla Lake, Damatta Governorate

Field crop farm, newly reclaimed land:

Location: El-Rahamna Region, about 8 km. west of Damatta on Salam Canal
Farm area: 20 feddans reclaimed by the private sector
Owner Name: Mousad Amin El-Seiady
Utilization: Field crop cultivation (rice and berseem)
Water Source: Salam Canal
Operation date: 1987

Remarks:

- The land was purchased in 1987 at LE 300 per feddan, and the owner paid LE 8,000 per feddan for obtaining legal status from GARPAD.

- The area purchased is 120 feddans, but 100 feddans were sold to raise funds to invest on the remaining area (i.e., 20 feddans).
- Reclamation of the 20 feddans started in 1990 and continued until 1995. Cost of reclamation was estimated at LE 5,000 per feddan and included construction of drainage networks for drying out the land, construction of bonds, land cleaning, and land leveling. The land was then cultivated with rice and berseem. Other parts of the land were leased at LE 1,300 per feddan.
- After five years of trying to cultivate the land, the cultivation failed due to high soil salinity. Therefore, two feddans were converted to fish farming but this was not successful because GARPAD won't allow that.

Estimated Costs and Revenue:

a. Current operating costs:

Rice Crop		Berseem Crop	
Costs	LE	Costs	LE
Land leveling & preparation	50	Land leveling & preparation	50
Seed	72	Seed	125
Chemical fertilizers	300	Chemical fertilizers	148
Organic fertilizers	400	Pesticides	22
Labor	2,070	Harvesting	120
Pesticides	25	Labor	1,800
Harvesting	180		
Packing	30		
Total	3,127	Total	2,265

b. Production and Revenue:

Rice production: 3 tons x LE 600/ton = LE 1,800/feddan

Berseem production: 4 cuts = LE 320/feddan

Thus, total production values for the two crops were LE 2,110.

Estimated losses for 20 feddans = LE 3,282, and LE 164 per feddan.

Case No. (10)

Manzalla Lake, Damatta Governorate:

Field crop farm, newly reclaimed land

Location: El-Anayina Region, Damatta Governorate
Farm area: 13 feddans
Owner Name: Rabie Refaiy
Utilization: Field crop cultivation (rice and berseem).
Water Source: Salam Canal.
Operation date: 30 years ago

Remarks:

- The farm produces rice and berseem. The owner cultivates rice and leased the berseem at LE 1,000 per feddan.
- The farm is equipped with a set of irrigation and drainage equipment.

Estimated Costs and Revenue:

i. <u>Current operating costs per feddan:</u>	LE
Land preparation	240
Irrigation	80
Seed	120
Fertilizer	75
Pesticides	50
Labor	150
Harvesting & packing	185
Total	900

b. Production and Revenues:

Rice production: 3 tons/feddan x LE 650 x 10 feddans = LE 19,500

Leased land for berseem: LE 13,000.

Thus, total revenues = LE 32,500.

Estimated net returns from the farm = LE 29,100 (LE 2,238 per feddan).

Case No. (11)

Lake Edko, Behera Governorate

Private Sector Semi-intensive Fish Farm

Location:	Water surface area on Edko Lake, on El- Khairy drainage
Farm area:	15 feddans leased from GAFRD
Owner Name:	Eng. Abdel Maniam El-Sheekh
Utilization:	Fish farm on Edko Lake
Water Source:	Mixed water from the Lake and from drainage
Production System:	Semi-intensive fish farming
Operation date:	Leased from GAFRD since 1996

Remarks:

- The farm was established over three years with a total investment of about LE 70,000 (LE 30,000 for constructing fish bonds in 1996; LE 20,000 for drying out the bonds and cleaning the weeds in 1997; and LE 20,000 for preparing the farm for production in 1998).
- Farm productivity during the period of establishment in 1996, was about 800 kg per feddan, production value was about LE 60,000, and net revenue was estimated at about LE 15,000 after deducting the construction costs of that year (1996).
- Productivity per feddan increased in 1997 to about 1,100 kg; production value reached about LE 120,000; and net revenue was estimated at LE 20,000. By 1998 productivity reached about 2,100 kg; production value was estimated at LE 200,000; and the net revenue at LE 100,000.
- The farm used improved fish fodder, and four air pumps (LE 14,000) were attached to the bonds, besides improving the quality of the soil's bonds. This led to almost double the productivity in 1999, when it was estimated at about 4,200 kg per feddan and the feed conversion factor was 2:1.

Estimated Costs and Revenue:

- Details of cost of production were not available during the visit. However, aggregate data was obtained on the farm regarding average productivity, gross value of production, total costs, and net profit.
- Investment costs spent each year have been deducted from the gross revenue of the same year. Thus, no annual depreciation of the assets was considered.
- Cost of production distributed on the cost items as follows: 70% for fries, 10% for labor, 15% for fuel and oils, and 5% for maintenance and repairs.
- Thus, the average productivity was 4.2 tons/feddan per year; the total value of production was estimated at about LE 300,000; and the total costs reached about LE 150,000. Therefore the estimated return per feddan equals LE 10,000.

Case No. (12)

Lake Edko, Behera Governorate

Private Sector Fish Farm

Location: El-Dahra Water Drainage of Perseeq
Farm area: 14 feddans leased from GAFRD
Owner Name: Abdel Maniam Ahmed Abu Senaa
Utilization: Fish farm on Edko Lake
Water Source: Mixed water from the Lake and from drainage
Production System: Traditional fish farming
Operation date: Leased from GAFRD since 1996

Estimated Costs and Revenue:

i. Investment Cost:

	LE
Construction of fish bonds and round roads	25,000
Cleaning and preparing the farm site	8,000
Purchasing of pumps	5,000

ii. Operating Costs:

Data on operating costs were unavailable.

iii. Revenue:

The owner estimates the net return of one productive year at about LE 35,000 and the net return per feddan at about LE 2,500.

Case No. (13)

Lake Edko, Behera Governorate

Private Sector Traditional Fish Farm

Location: Water surface area on Edko Lake, on El- Khairy drainage
Farm area: 50 feddans leased from GAFRD
Owner Name: Ahmed Mostafa Premo
Utilization: Fish Farm on Edko Lake
Water Source: Mixed water from Lake and drainage
Production System: Low productivity fish farm
Operation date: Leased from GAFRD since 1987

Estimated Costs and Revenue:

a. Investment Cost:

	LE
Constructing fish ponds.	16,000
Cleaning and preparing the farm site	3,000
Purchasing of pumps	7,000

ii. Operating Costs:

Data on operating costs were unavailable.

iii. Revenue:

The average productivity is 300 kg/year. Low productivity is due to lack of funds and experience in addition to environmental factors. The net annual return estimated by the owner is about LE 700 per year for the farm and about LE 140 per feddan /year.

Case No. (14)

Lake Edko, Behera Governorate

Perseeq Farm, Public fish farming/GAFRD

Location: Integrated fish farm at Perseeq, Edko Lake
Area: 2,000 feddans on Edko Lake

Remarks:

- The farm is a public farm on Edko Lake operated by GAFRD. Only direct costs are recorded at the farm; indirect and other costs are recorded at GAFRD's Headquarters..
- Data on costs and revenues were extracted from the financial statements of costs that were prepared by General Department of Budgeting & Planning at GAFRD's Headquarters. for the year ending 30/6/2000.
- Data collected are aggregate data that include the direct and indirect costs divided into four main items: labor, physical inputs, service inputs, and current transfer payments. The following shows aggregate costs and revenues:

a. Costs:

Direct Costs		Indirect Costs	Total Costs
Items	(LE)	(LE)	(LE)
Wages	836,863	292,086	
Physical Inputs	2,343,007	32,493	
Service Inputs	137,548	10,456	
Current Transfer Payments	1,154	313,345	
Total	3,318,572	648,380	3,966,952 (*)

Source: GAFRD records at Perseeq Farm and Headquarters for year 1999/2000.

(*) Includes estimated interests (LE 109,556) and depreciation (LE 203,460).

b. Production and Revenue:

Estimated production is as follows:

About 1,396 tons (mullet - 227 tons, tilapia - 635 tons, carp - 498 tons, and catfish - 36 tons). Thus, estimated revenues are LE 7,728,474.

The net return was estimated at LE 3,761,523. Net return per feddan is LE 1,881.

Case No. (15)

Lake Edko, Behera Governorate

Field crop farm, dried reclaimed land

Location: Dried reclaimed lands from Edko Lake
Farm area: 5 feddans within the area of Agrarian Reform Society of Edko
Owner Name: Salem Abdelhamed Tailon
Utilization: Field crop cultivation
Operation date: 1959

Remarks:

- The government dried and reclaimed 3,000 feddans that were distributed to the beneficiaries from the fishermen. Additionally, about 10,000 feddans have been reclaimed naturally due to the appearance of shallow areas on the Lake's boundaries.
- This land is under the level of the agricultural drainage as well as the sea level by about 1.7 meters, and is also affected by the high water table. The soil also contains high levels of salinity and alkaline.

- The fishermen who possessed the reclaimed lands did not give up fishing; they cover the cultivation expenses from their fishery activity revenues.
- The beneficiaries transfer sand for raising the land level above the sea level. The annual cost of transferring sand is about LE 5,000 per feddan.
- Land problems started to improve only after 1975, when the beneficiaries transferred the sand to their reclaimed lands.
- The land cultivates field crops and vegetables.

Estimated Costs and Revenue:

1. <u>Investment cost:</u>	LE/feddan
Increasing land level by transferring sand	20,000
Improving land level every 3 years	15,000
2. <u>Operating costs (horticulture, palm, vegetables):</u>	
Manure	500
Chemical fertilizer	300
Pesticides	60
Labor	1,360
Palm nursery & planting (300/feddan)	400
Fuel & Oil	80
Depreciation	60
Tax	15
Total	2,775

3. Production & Revenue:

Production values: palm (LE 2,000); horticulture (LE 2,000); vegetables (LE 500).

Estimated net revenue per feddan = LE 1,725.

Case No. (16)

Lake Edko, Behera Governorate

Field crop farm, dried reclaimed land

Location: Dried reclaimed lands from Edko Lake
 Farm area: 5 feddans within the area of the Agrarian Reform Society of Edko
 Owner Name: Salem Abdelhamed Tailon
 Utilization: Field crop cultivation
 Operation date: Since 1959

Estimated Costs and Revenue:

a. Operating costs LE/feddan:

Items	Berseem	Fava Bean	Rice
Land preparation	20	30	40
Seed	120	150	190
Chemical fertilizer	57	89	170
Labor	450	200	230
Harvesting		150	180
Transports		20	30
Other Expenses & Taxes	15	15	15
Total	662	654	855

b. Production and Revenue:

Items	Berseem	F. Bean	Rice
Production Value (LE/feddan)	960	900	840
Net Revenue (LE/ feddan)	298	246	(15)

Thus the net return per feddan in the case of beans and rice equals LE 231.

Net return for rice and berseem equals LE 283.

Case No. (17)

Lake Edko, Behera Governorate

Field crop farm, dried reclaimed land

Location: Dried reclaimed lands from Edko Lake
Farm area: 5 feddans within the area of the Agrarian Reform Society of Edko
Owner Name: Saied Darwesh Tailon
Utilization: Field crop cultivation
Operation date: Since 1959

Estimated Costs and Revenue:

a. Operating costs LE/feddan:

Items	Cotton and Berseem
Land preparation	60
Seed	30
Chemical fertilizer	118
Labor	270
Pesticides	300
Harvesting	500
Transports	41
Other Expenses & Tax	15
Total	1,334

b. Production & Revenue:

The production value is estimated at LE 1840 for cotton. Net return for both crops is estimated at LE 804 per year.

Case No. (18)

Borrolus Lake, Kafr El-Shikh Governorate

Semi-intensive fish farm, El Hadad Farm:

Location: El-Zawya Region, swamp areas, Lake Borrolus
Farm area: 30 feddan purchased at LE 250 per feddan in 1978
Owner Name: Dr. Ismail Radwan
Utilization: Highly productive fish farm using modern technology
Operation date: 1982

Estimated Costs and Revenue:

1. <u>Investment Cost:</u>	LE
Purchase of Land (40 feddans x LE 250)	10,000
Construction	185,519
Fishing equipment	18,034
Laboratory equipment	2,932
Furniture	8,332
Total	224,817

2. <u>Operating costs:</u>	LE
Maintenance of fish bonds	1,200
Fries	42,551
Chemicals	705
Fertilizers	12,203
Maintenance of equipment	6,027
Fuel, electricity, and telephone	17,117
Labor	41,836
Other expenses	16,425
Transport	1,700
Advertising	156,345
Depreciation	28,729
Total	324,838

3. Production and Revenue:

The farm produced 60 tons of tilapia x LE 7,000/ton = LE 420,000.

The net revenue is estimated by LE 94,412 for the farm, and by LE 3,147 per feddan.

Case No. (19)

Borrolus Lake, Kafr El-Shikh Governorate

Traditional fish farm

Location: El-Mansour Sector, El-Shorta Society, Lake Borrolus
 Farm area: 30 feddan dried reclaimed lands, purchased at LE 15,000 per feddan from the Society in 1994.
 Owner Name: Abdel Razik Abdel Razik
 Utilization: Traditional fish farm
 Operation date: 1994.

Estimated Costs and Revenue:

1. <u>Investment Cost:</u>	LE
Purchase of Land	450,000
Construction of bonds and roads	10,000
Irrigation equipment	10,000
Buildings	2,000
Total	472,000

2. Operating costs:

	LE
Fries	12,600
Organic matter	800

Irrigation and maintenance	4,000
Farm Guard	6,000
Casual labor	600
Loan interest	2,800
Depreciation	1,540
Tax	900
Total	29,240

3. Production and Revenue:

The owner estimates farm production at LE 180,000 and net revenue at LE 150,760. Thus, net revenue per feddan equals LE 5,025.

Case No. (20)

Borrolus Lake, Kafr El-Shikh Governorate

Field crop farm converted to fish farm

Location: El-Mansour Sector, El-Shorta Society, Lake Borrolus
 Farm area: 20 feddans of dried reclaimed lands
 Owner Name: Shaker Kluony
 Utilization: Semi-intensive fish farm
 Operation date: 1999

Remarks:

- The land was purchased from El-Shorta Society for land reclamation in 1987 at LE 3,000 per feddan.
- The land was cultivated with field crops until 1999, when it was converted to a fish farm for 1999/2000 season.
- The owner tried to cultivate the land and invested about LE 16,200 . Since the farm did not produce, he converted it to a fish farm.

Estimated Costs and Revenue of fish farming:

1. Investment cost:

	LE
Purchase of land	60,000
Constructing fish bonds and roads	20,000
Gates	5,000
Irrigation pumps	3,600
Fodder equipment	2,500
Buildings	4,000
Total	95,100

2. Operating Costs:

	LE
Fries	35,500
Fodder	126,000
Labor	46,800
Casual Labor	200
Depreciation	3,920
Total	212,420

3. Production and Revenue:

The average farm productivity was estimated at 2.8 tons per feddan, and the total production value of the farm reached about LE 336,000.

The farm net revenue was estimated at LE 123,580, and LE 6,179 per feddan.

Case No. (21)

Borrolus Lake, Kafr El-Shikh Governorate

El-Zawya public sector fish farm

Location: El-Zawya Fish Farm/GAFRD, Lake Borrolus.
Farm area: 1,000 feddan on the Lake
Utilization: Traditional and semi-intensive fish farm

Remarks:

- The farm is a public sector farm on Lake Borrolus operated by GAFRD. Only direct costs are recorded at the farm; indirect and other costs are recorded at GAFRD's Headquarters.
- Data of the costs and revenues were extracted from the financial statements of costs that were prepared by the General Department of Budgeting & Planning at GAFRD's Headquarters for the year ending 30/6/2000.
- Data collected are aggregate data that include the direct and indirect costs divided into four main items: labor, physical inputs, service inputs, and current transfer payments. The following shows the aggregate costs and revenues:

a. Costs:

Direct Costs		Indirect Costs	Total Costs
Items	(LE)	(LE)	(LE)
Wages	518,338	180,913	
Physical Inputs	1,387,414	19,241	
Service Inputs	81,368	6,186	
Current Transfer Payments	2,185	181,905	
Total	1,989,305	388,245	3,673,093(*)

Source: GAFRD records at Perseeq Farm and Headquarters for year 1999/2000.

(*) Include estimated interest (LE 63,448) and depreciation (LE 117,833).

b. Production and Revenue:

The estimated production is as follows:

About 718 tons (mullet - 116 tons, tilapia - 439 tons, carp - 148 tons, and catfish - 15 tons). Thus, estimated farm net revenue is about LE 1,295,544, and LE 1,295 per feddan.

Case No. (22)

Borrolus Lake, Kafr El-Shikh Governorate

Dried reclaimed land converted to traditional fish farm

Location: El-Mansour Sector, Lake Borrolus
 Owner Name: Abed Hazaa Abdella
 Utilization: Converted traditional fish farm

Estimated Costs and Revenue:

a. Operating Costs:

	LE / feddan
Tilapia Fries	630
Mullet Fries	450
Fodder	4,025
Organic matter	600
Fuel	300
Labor/ fishing	105
Labor/guard	900
Repair & Maintenance	655
Total	7,665

b. Production and Revenue:

Production value per feddan was estimated at LE 11,000 (6,500 - super tilapia, LE 2,500 - tilapia, and LE 2,000 – mullet). The net revenue per feddan was estimated at LE 2,585.

Case No. (23)

Borrolus Lake, Kafr El-Shikh Governorate

Dried Reclaimed lands cultivated with field crops

Location: El-Mansour Sector, El-Shorta Society, Lake Borrolus
Farm area: 20 feddans of dried reclaimed lands
Owner Name: Ahmed Ibrahim Abdel Wahed
Utilization: Field crop farm

Estimated Costs and Revenue:

1. Cost and return of the first trial to cultivate maize:

<u>Cost:</u>	LE
Land preparation	200
Land leaching	3,000
Seed	1,000
Irrigation	3,500
Total	7,700

Revenue:

The land did not produce; thus the costs (LE 7,700) were considered losses.

2. Cost and return of the second trial to cultivate wheat:

<u>Cost:</u>	LE
Land preparation	200
Land leaching	3,000
Seed	1,500
Irrigation	3,500
Total	8,200

Revenue:

The land did not produce; thus the costs (LE 8,200) were considered losses.

3. Cost and return of the third trial to cultivate sugar beet:

<u>Cost:</u>	LE
Land preparation & improving	3,200
Land leaching	300
Seed	800
Irrigation	3,500
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Total	7,800

Revenue:

The revenue was estimated at LE 2,000. Thus, the loss was about LE 5,800.

4. Fourth trial (leasing the land):

The land was leased as a fish farm at LE 150 per feddan. Total revenue was estimated in this case at about LE 3,000. This revenue was used to improve the agricultural lands.

5. Fifth trial to cultivate sugar beet for the second time:

The land was again cultivated with sugar beet. The cost was estimated at about LE 15,000. Revenue was estimated at about LE 9,000. Thus, the loss was LE 6,000. The owner sold the land after all the trials.

Case No. (24)

Borrolus Lake, Kafr El-Shikh Governorate

Dried reclaimed lands cultivated with field crops

Location: El-Mansour Sector, El-Shorta Society, Lake Borrolus
Farm area: 5 feddans of dried reclaimed lands
Owner Name: Abed Hazaa Abdalla
Utilization: Field crop farm

Remarks:

- The land was delivered after land leveling, roads, main and field irrigation & drainage networks were finished at a rate of LE 3,500 per feddan. The owner paid 10% in advance (i.e., LE 350) and the remainder (i.e., LE 3,150) was to be paid in equal installments of LE 630 over five years.
- The land was then cultivated with field crops (i.e., rice, cotton, beet, wheat, and berseem) according to the season.

Estimated Costs and Revenue:

1. <u>Investment Cost:</u>	LE
Irrigation Pump	1,500
Pipes and Water bond	150

Buildings	450
Total	2,100

2. Operating costs for cultivating rice and berseem:

Cost Items (LE/feddan)	Rice	Berseem	Total
Land preparation	45		
Seed	46	75	
Fertilizer	42	14	
Labor	100		
Irrigation	50	10	
Land installment			
Depreciation			360
Total			1,372

3. Operating costs for cultivating cotton and wheat:

Cost Items (LE / feddan)	Cotton	Wheat	Total
Land preparation	80	45	
Seed	50	56	
Fertilizer	131	88	
Labor	250	100	
Irrigation	30	15	
Land installment			630
Depreciation			360
Total			1,835

4. Operating costs for cultivating cotton and beet:

Cost Items (LE / feddan)	Cotton	Beet	Total
Land preparation	80		
Seed	50	100	
Fertilizer	131	142	
Labor	250	150	
Irrigation	30	50	
Land installment			630
Depreciation			360
Total			1,973

5. Production and Revenue:

Estimated production value from the first rotation (i.e., rice and berseem) was LE 950, and the loss was LE 421 per feddan.

For the second rotation (i.e., cotton and wheat), estimated production value was LE 1,450. The loss was estimated at LE 385 per feddan.

For the second rotation of cotton and beet, estimated production value was LE 1,825. The loss was estimated at LE 148 per feddan.

Case No. (25)

Edko Lake, Behera Governorate

Location: Open fishing activity
Fisherman: Abdel Monaam Abu Senaa
Number of fishing days: 250/year

Estimated Costs and Revenue:

1. <u>Investment Cost:</u>	LE
Fishing boat	400
Equipment	600
2. <u>Operating Costs:</u>	
Various expenses	100
Maintenance	7
Depreciation	670
Total	777

3. Production and Revenue:

Average production per day = LE 30
Average annual production = LE 7,500.
Net revenue was estimated at LE 6,660 per year (LE 555 per month).

Case No. (26)

Edko Lake, Behera Governorate

Location: Open fishing activity
Fisherman: Nour Abdella
Number of fishing days: 210/year

Estimated Costs and Revenue:

1. <u>Investment Cost:</u>	LE
Fishing boat (7 meters)	1,000
Equipment and nets	2,000

2. Operating Costs:

Various expenses	200
Maintenance	100
Depreciation	2,200
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Total	2,500
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3. Production and Revenue:

Average production per day = LE 30

Average annual production = LE 3,1500.

Net revenue was estimated at LE 29,000 per year (LE 805 per month).

**Annex (5) Calculation of Internal Rate of Return
Aquaculture fish farming on 5 feddans of reclaimed lands**

ITEMS	Total C & R	Project Time Life															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Revenues (LE)																	
Value of Production:																	
Super Tilapia		0	14625	22750	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500
Different types of Tilapia		0	5000	7500	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500
Mullet		0	4800	8000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Other Reve.(Residual Value)																	1000
ther Reve.(Working Capital)																	19405
Total Revenues		0	24425	38250	55000	75405.31											
Expenditures (LE)																	
Investment:																	
Basic Infrastructure	75000																
Farm Infrastructure	36250	3625	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
Farm Assets:																	
Constructions of bonds	3500	3500					3500										3500
Irrigation Pump	2000	2000									2000						
Irrigation & drainage tubes	1500	1500						1500						1500			
Cleaning weeds	1750	1750	1750														
Working Capital		5378	7042	6985													
Investment & W. Capital	120000	17753	9917	8110	1125	1125	4625	2625	1125	1125	3125	1125	1125	6125	1125	1125	1125
Current operating Cost:																	
Fry & Finger			1650	2475	3300	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150
Mullet Fry			1200	1800	2400	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250
Fodder			10063	15094	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125
Fuel & Oil			1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Organic materials			3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250
Labor			1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Guards			1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Maintenance & Repair			300	500	800	800	800	800	1000	1000	1000	1000	1000	1000	1000	1000	1000
Total Operating Cost			21513	28169	34925	34625	34625	34625	34825								
Total Costs		17753	31430	36279	36050	35750	39250	37250	35950	35950	37950	35950	35950	40950	35950	35950	35950
Net Present Value		-17753	-7005	1971	18950	19250	15750	17750	19050	19050	17050	19050	19050	14050	19050	19050	39455
NPV at 11% d.f.	\$73,295	Value(70%)	(\$7,109)														
Internal Rate of Return	42%																

**Annex (5) Calculation of Internal Rate of Return
Aquaculture Fish farming on 5 feddan by rent from GAFRD**

I T E M S	Rev./Cost	P r o j e c t L i f e T i m e															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Revenues (LE)																	
Value of Fish Production																	
Super Tilapia		0	16250	24375	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500	32500
Different types of Tilapia		0	6250	8750	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500	12500
Mullet		0	5200	8000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Other Reve.(Residual Value)																	1000
ther Reve.(Working Capital)																	8607
Total Revenues		0	27700	41125	55000	55000	55000	55000	55000	55000	55000	55000	55000	55000	55000	55000	64606.63
Expenditures (LE)																	
Investment:																	
Basic Infrastructure	0	0															
Farm Infrastructure	0	0															
Farm Assets:																	
Constructions of bonds	12500	12500															
Irrigation Pump	2000	2000															
Irrigation & drainage tubes	2500	2500															
Buildings	2000	2000															
Replacement of assets							2500			9500				2500			
Working Capital		3080	5527														
Total Investment Costs		22080	5527	0	0	0	0	2500	0	0	9500	0	0	0	2500	0	0
Operating Cost:																	
Tilapia Fry	0	1575	2362.5	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150	3150
Mullet Fry	0	1125	1687.5	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250	2250
Fodder	0	10063	15094	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125	20125
Fuel & Oil	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Organic Matters	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250
Labor	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
Guards	720	720	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440
Mainten. & Repair	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Rent	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Total Operating Cost		7270	20532.5	27633.75	34015	34015	34015	34015	34015	34015	34015	34015	34015	34015	34015	34015	34015
Total Costs		29350	26059	27634	34015	34015	34015	36515	34015	34015	43515	34015	34015	34015	36515	34015	34015
Net Present Value (NPV)		-29350	1641	13491	20985	20985	20985	18485	20985	20985	11485	20985	20985	20985	18485	20985	30592
NPV at 11%	\$85,004.35	value 60%	(\$6,066.93)														
Inter. Rate of Return (IRR)	45%																

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Annex (5) Calculation of Internal Rate of Return

Crop Production on 5 feddan of newly Reclaimed Lands

Cropping Patterns (production value, yield, and costs)

Crops	Years	Productivity per feddan		Unit Price (LE)		Produc. Value/ fed.		T. Value	T. Crop	Production	Operating Cost per Feddan						T. Crop	T. Cost	T. Revenue.		
		Unit	M. Prod.	Sec. Prod.	M. Product	Sec. Prod.	M. Produc	Sec. Prod.	per fedan	Production	Rotation	Seed	Fertilizer	Pests	Labor	Machines	Others	Total cost/fed.	Costs	Per Year	Per Rotation
Rice+Berseem																					
Rice																					
Rice (summer)	1	Ton	1.5		600.0		900.0	0.0	900.0	2250.0	3750.0	70.0	300.0	45.0	270.0	70.0	30.0	785.0	1962.5	3000.0	750.0
	2	Ton	1.5		600.0		900.0	0.0	900.0	2250.0	4500.0	70.0	300.0	45.0	270.0	70.0	30.0	785.0	1962.5	3000.0	1500.0
	3	Ton	2.0		600.0		1200.0	0.0	1200.0	3000.0	6000.0	70.0	300.0	45.0	270.0	70.0	30.0	785.0	1962.5	3000.0	3000.0
	4	Ton	2.5		600.0		1500.0	0.0	1500.0	3750.0	6750.0	70.0	300.0	45.0	270.0	70.0	30.0	785.0	1962.5	3000.0	3750.0
	5	Ton	3.0		600.0		1800.0	0.0	1800.0	4500.0	7500.0	70.0	300.0	45.0	270.0	70.0	30.0	785.0	1962.5	3000.0	4500.0
	6 - 10	Ton	3.5		600.0		2100.0	0.0	2100.0	5250.0	8250.0	70.0	300.0	45.0	270.0	70.0	30.0	785.0	1962.5	3000.0	5250.0
Berseem																					
Berseem (Winter)	1	Cut	2.0		300.0		600.0	0.0	600.0	1500.0		75.0	150.0	20.0	120.0	40.0	10.0	415.0	1037.5		
	2	Cut	3.0		300.0		900.0		900.0	2250.0		75.0	150.0	20.0	120.0	40.0	10.0	415.0	1037.5		
	3	Cut	4.0		300.0		1200.0		1200.0	3000.0		75.0	150.0	20.0	120.0	40.0	10.0	415.0	1037.5		
	4	Cut	4.0		300.0		1200.0		1200.0	3000.0		75.0	150.0	20.0	120.0	40.0	10.0	415.0	1037.5		
	5	Cut	4.0		300.0		1200.0		1200.0	3000.0		75.0	150.0	20.0	120.0	40.0	10.0	415.0	1037.5		
	6 - 10	Cut	4.0		300.0		1200.0		1200.0	3000.0		75.0	150.0	20.0	120.0	40.0	10.0	415.0	1037.5		
Cot.+Wheat																					
Cotton (Summer)	1	Qentar	2.5		500.0		1250.0		1250.0	3125.0	4900.0	50.0	135.0	150.0	250.0	130.0	100.0	815.0	2037.5	2937.5	1962.5
	2	Qentar	2.5		500.0		1250.0		1250.0	3125.0	5100.0	50.0	135.0	150.0	300.0	130.0	100.0	865.0	2162.5	3062.5	2037.5
	3	Qentar	3.0		500.0		1500.0		1500.0	3750.0	5925.0	50.0	160.0	150.0	300.0	130.0	100.0	890.0	2225.0	3150.0	2775.0
	4	Qentar	3.0		500.0		1500.0		1500.0	3750.0	5925.0	50.0	175.0	170.0	350.0	130.0	100.0	975.0	2437.5	3412.5	2512.5
	5	Qentar	3.5		500.0		1750.0		1750.0	4375.0	6662.5	50.0	185.0	170.0	350.0	130.0	150.0	1035.0	2587.5	3562.5	3100.0
	6 - 10	Qentar	4.0		500.0		2000.0		2000.0	5000.0	7400.0	50.0	185.0	170.0	350.0	130.0	150.0	1035.0	2587.5	3562.5	3837.5
Wheat																					
Wheat (winter)	1	Ardeb/10end	4.0	10.0	90.0	35.0	360.0	350.0	710.0	1775.0		60.0	80.0	30.0	110.0	50.0	30.0	360.0	900.0		
	2	Ardeb/10end	4.5	11.0	90.0	35.0	405.0	385.0	790.0	1975.0		60.0	80.0	30.0	110.0	50.0	30.0	360.0	900.0		
	3	Ardeb/10end	5.0	12.0	90.0	35.0	450.0	420.0	870.0	2175.0		60.0	80.0	30.0	120.0	50.0	30.0	370.0	925.0		
	4	Ardeb/10end	5.0	12.0	90.0	35.0	450.0	420.0	870.0	2175.0		60.0	100.0	30.0	120.0	50.0	30.0	390.0	975.0		
	5	Ardeb/10end	5.5	12.0	90.0	35.0	495.0	420.0	915.0	2287.5		60.0	100.0	30.0	120.0	50.0	30.0	390.0	975.0		
	6 - 10	Ardeb/10end	6.0	12.0	90.0	35.0	540.0	420.0	960.0	2400.0		60.0	100.0	30.0	120.0	50.0	30.0	390.0	975.0		

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Calculating IRR for Agriculture Project
Cultivating five feddan of field crops on reclaimed lands

I T E M S	T.Rev./Got	P r o j e c t T i m e H o r i z o n														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Revenues (LE)																
Value of Crop Production	Rice+Bersm	0	0	3750.0	4500.0	6000.0	6750.0	7500.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0
	Cot.+Wheat	0	0	4900.0	5100.0	5925.0	5925.0	6662.5	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0
	Cot.+Bersm	0	0	4625.0	5375.0	6750.0	6750.0	7375.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0
Other Values (Salvage)																
Other Values (W.Capital)																
Total Revenues																
	Rice+Bersm	0	0	3750.0	4500.0	6000.0	6750.0	7500.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0
	Cot.+Wheat	0	0	4900.0	5100.0	5925.0	5925.0	6662.5	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0
	Cot.+Bersm	0	0	4625.0	5375.0	6750.0	6750.0	7375.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0
Costs (LE)																
Investment																
Const. Basic Infrastructure	75000.0															
Const. On farm Infrastruct.	36250.0	3625.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0
Farm Assets																
Pumping & equipment	2000.0	2000.0														
Irrigation Networks	1500.0	1500.0														
Buildings	450.0	450.0														
Replacement of Assets																
Soil Improvement	1750.0	1750.0	1750.0													
T. Investment	40200.0	9325.0	2875.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	2625.0	1125.0	3125.0	1125.0	1125.0	1125.0
Working Capital																
Operating Costs		450.0	600.0													
	Rice+Bersm	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
	Cot.+Wheat	2937.5	3062.5	3150.0	3412.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5
	Cot.+Bersm	3075.0	3200.0	3262.5	3475.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0
Fixed Costs																
T. Operating Costs		500.0	500.0	500.0	500.0	600.0	600.0	600.0	600.0	600.0	700.0	700.0	700.0	700.0	700.0	700.0
	Rice+Bersm	3500.0	3500.0	3500.0	3500.0	3600.0	3600.0	3600.0	3600.0	3600.0	3700.0	3700.0	3700.0	3700.0	3700.0	3700.0
	Cot.+Wheat	3437.5	3562.5	3650.0	3912.5	4162.5	4162.5	4162.5	4162.5	4162.5	4262.5	4262.5	4262.5	4262.5	4262.5	4262.5
	Cot.+Bersm	3575.0	3700.0	3762.5	3975.0	4225.0	4225.0	4225.0	4225.0	4225.0	4325.0	4325.0	4325.0	4325.0	4325.0	4325.0
Total Costs																
	Rice+Bersm	13275.0	6975.0	4625.0	4625.0	4725.0	4725.0	4725.0	4725.0	4725.0	6325.0	4825.0	6825.0	4825.0	4825.0	4825.0
	Cot.+Wheat	13212.5	7037.5	4775.0	5037.5	5287.5	5287.5	5287.5	5287.5	5287.5	6887.5	5387.5	7387.5	5387.5	5387.5	5387.5
	Cot.+Bersm	13350.0	7175.0	4887.5	5100.0	5350.0	5350.0	5350.0	5350.0	5350.0	6950.0	5450.0	7450.0	5450.0	5450.0	5450.0
Net Present Value (NPV)																
	Rice+Bersm	-9525.0	-2475.0	1375.0	2125.0	2775.0	3525.0	3525.0	3525.0	3525.0	1925.0	3425.0	1425.0	3425.0	3425.0	3425.0
	Cot.+Wheat	-8312.5	-1937.5	1150.0	887.5	1375.0	2112.5	2112.5	2112.5	2112.5	512.5	2012.5	12.5	2012.5	2012.5	2012.5
	Cot.+Bersm	-8725.0	-1800.0	1862.5	1650.0	2025.0	2650.0	2650.0	2650.0	2650.0	1050.0	2550.0	550.0	2550.0	2550.0	2550.0
NPV (at 11%)	Rice+Bersm	\$8,677.56	value 20%	\$3,348.77												
NPV (at 11%)	Cot.+Wheat	\$1,414.44	Value 10%	\$2,344.33												
NPV (at 11%)	Cot.+Bersm	\$5,194.48	Value 10%	\$6,499.89												
Internal Rate Of Return	Rice+Bersm	19%														
Internal Rate Of Return	Cot.+Wheat	13%														
Internal Rate Of Return	Cot.+Bersm	17%														

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0
7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0
8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0
														1398.8
														3450.0
8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	8250.0	13098.8
7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	7400.0	12248.8
8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0	12848.8
1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0
			1500.0				2000.0							
1125.0	1125.0	1125.0	2625.0	1125.0	1125.0	1125.0	3125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0	1125.0
3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0	3000.0
3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5	3562.5
3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0	3625.0
700.0	700.0	700.0	800.0	800.0	800.0	800.0	800.0	800.0	800.0	800.0	800.0	800.0	800.0	800.0
3700.0	3700.0	3700.0	3800.0	3800.0	3800.0	3800.0	3800.0	3800.0	3800.0	3800.0	3800.0	3800.0	3800.0	3800.0
4262.5	4262.5	4262.5	4362.5	4362.5	4362.5	4362.5	4362.5	4362.5	4362.5	4362.5	4362.5	4362.5	4362.5	4362.5
4325.0	4325.0	4325.0	4425.0	4425.0	4425.0	4425.0	4425.0	4425.0	4425.0	4425.0	4425.0	4425.0	4425.0	4425.0
4825.0	4825.0	4825.0	6425.0	4925.0	4925.0	4925.0	4925.0	6925.0	4925.0	4925.0	4925.0	4925.0	4925.0	4925.0
5387.5	5387.5	5387.5	6987.5	5487.5	5487.5	5487.5	5487.5	7487.5	5487.5	5487.5	5487.5	5487.5	5487.5	5487.5
5450.0	5450.0	5450.0	7050.0	5550.0	5550.0	5550.0	5550.0	7550.0	5550.0	5550.0	5550.0	5550.0	5550.0	5550.0
3425.0	3425.0	3425.0	1825.0	3325.0	3325.0	3325.0	3325.0	1325.0	3325.0	3325.0	3325.0	3325.0	8173.8	-4925.0
2012.5	2012.5	2012.5	412.5	1912.5	1912.5	1912.5	1912.5	-87.5	1912.5	1912.5	1912.5	1912.5	6761.3	-5487.5
2550.0	2550.0	2550.0	950.0	2450.0	2450.0	2450.0	2450.0	450.0	2450.0	2450.0	2450.0	2450.0	7298.8	-5550.0

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