

TRIP REPORT

PD-AAR-694
ISN 41105

Date submitted 20 Dec 1978

936-5305

NAME G. L. COREY *G. L. Corey* TITLE Water Management Specialist DIV./UNIT DS/AGR

000064

PERIOD OF TRAVEL (inclusive dates) 27 Nov - 15 Dec 1978

ITINERARY Cairo, Egypt at request of USAID/Cairo
(Use attachment for details, including time schedule)

PURPOSE To assist Mission Team with defining scope of New Lands Development Project and in a site selection for the project.

ORGANIZATIONS AND PERSONS CONTACTED:
(Use attachment for details.)
See attached.

COPY

RESULTS/ACCOMPLISHMENTS:

1. Reviewed New Lands Concept with Mission.
 2. Visited 6 field sites.
 3. Prepared report (attached) and presented it to the Mission.
- Etc.

FOLLOW-UP ACTION REQUIRED:

(Indicate what, by whom, when.)
Mission will negotiate with GOE relative to suggested project sites.
PP team will be organized.

OTHER REMARKS:

(May include other information, observations, and impressions of general interest.)

- Attachments:
1. List of persons contacted.
 - (List) 2. Memo: Corey/Elliott
 3. Report to Mission and GOE.

Distribution:

(List)

- | | | |
|-------------------------|--------------------|-----------------------|
| DS/AGR, DPeterson | DS/PO, RSimpson | USAID/Cairo, JEdwards |
| DS/AGR, Division Chiefs | NE/TECH/AD, Rolson | |
| DS/DAA/FN, TBabb | NE/EI, JRoberts | |

PERSONS CONTACTED DURING EGYPT TDY

G. L. Corey
27 Nov - 15 Dec 1978

Government of Egypt:

Adel Ezzy - Vice Minister Land Reclamation
El Anadi Abdel Raouf - Chairman Agency for Land Dev. & Agri. Research
Dr. Rifki Anwar - Consultant to Min. of Land Reclamation
Dr. Abdel Aziz Gheis - Soil Scientist, Min. of Land Reclamation
Engr. Yousri Wissa - Hydraulic Engr., Min. of Land Reclamation
Engr. Gamil Zanati - Irrig. Engr., Min. of Land Reclamation
Mohd. Abu-Zeid - Director, Water Mgt. Res. Min. of Irrig.
Chairmen of Agr. Development Companies in Ismailia/Misr, North Tahrir,
Seed Farm, South Tahrir, and North and South Samalout.
Several farmer settlers and graduate farmers.

USAID:

Dr. Donald Brown - Director
Dr. R. J. Edwards - Asst. Dir./Agriculture
Mari Winter - Deputy/Agri.
Jennifer Bremer
John Elliott - Project Director/New Lands.
Niel Dimick
John Foster
John Rogers
Malcolm Noris
Dr. Royal Brooks, Chief of Party, CID Water Management Consultant
Dr. Sarah Voll, Consultant

December 13, 1978

Mr. Gil Corey DS/AGR

New Lands Feasibility Study Team

Mr. John Elliott TA/AGR

I believe the required studies for the PP on the subject project should be contracted to a firm who has experience in these types of studies. It is my belief that AID has designated certain firms for these and it is not necessary to go open bidding.

The team I worked with recently in Sri Lanka was CH2M-Hill. They are a good firm and could do the job. I will check to see if their agreement with AID is still in effect. It may be that we retain more than one such firm also. I am hoping we can go this way because if feasibility studies have to be bid, it will cause considerable delay and many of the types of firms we need simply will not bid on feasibility studies, and of course, they are the good ones - the ones we want.

Regardless, we will be able to specify disciplines and even people as team members. There are several good specialists which are readily available to us through our present contracts. The On-Farm Water Management Project here in Egypt can supply anyone from the Consortium for International Development and, of course, I and Dr. Dean Peterson, DS/AGR can be called on.

I believe these specialists could be used to assist the contract firms or to review their study and recommend specific items to be included or excluded from the final PP. I will be glad to work with you and NE/JECH insseeing that a good team of experts is put together for these studies. They will be especially important to the final success of anything done in the New Lands.

While in Sri Lanka, I noted that the contractors' scope of work was especially well done. I plan to get a copy of that and re-work it into one which might be considered for your project. I will send this to you prior to January 1.

New Lands Project Sites and Technical Aspects

Drs. G. L. Corey,
Water Management Specialist, A
and E. V. Richardson, Professor
Civil Engineering, Colo. State

Dec. 19

The GOE and USAID have begun preliminary discussions regarding the possibility of U.S. assistance in the New Lands with a goal of raising production in these areas while maximizing employment and insuring an adequate income for settled families.

We assume that the project will need to develop and improve methodologies to expedite the process of development of New Lands into economically viable small farmer operated units. This implies that the process of converting raw land to farm units is not now well defined or at least there is need for improvement. Evidence on Egypt's development projects which have been reclaimed over the past 20 years verifies this conclusion.

Discussions to date have led to a project concept where three types or categories of activities would be pursued more or less simultaneously. These three categories are based on stage of development and are described as follows:

- A. - Provide assistance as needed to raise the output of an already-reclaimed area that has been distributed to farmers but still suffers from low productivity.
- B. - Provide social infrastructure and improvements to the agriculture system of an area now being farmed by the Ministry of Land Reclamation or a state-owned Company to enable small farmers to assume management and raise its output to an economic level.
- C. - Carry out land-leveling, construction of irrigation and road networks, and other works to bring a new area under cultivation, to be managed for a number of years with the goal of raising soil productivity to the point where the land can be distributed to small farmers.

Visits were made to possible project sites on each side of the Delta below Cairo and one site south of Cairo in the desert west of the Nile between Beni Suef and El Minya. Most of these sites contained possibilities for development of all three categories of activities with company operated land, farmer operated land, and land never having been developed.

This review and recommendations are based upon what we observed and what we learned from talking with the Ministry of Land Reclamation, representatives of the several farming Companies, the Agricultural staff of USAID, and farmers during a 3 week period. We apologize for errors of fact or omission.

For the purpose of this report, reclaimed land is defined as agricultural land where water supplies, drainage facilities, roads, irrigation systems, and other infrastructure are in place. Developed land is reclaimed land which is being farmed on an economic basis by farmers.

I. Description of areas visited.

The following desert land reclamation areas were visited:

1. Mullak desert land reclamation area which is east of the Delta between the Ismailia Canal and the Desert Road from Cairo to Ismailia near Bilbeis.
2. North Tahrir Company which is located in the West Nubaria reclamation area west of the Delta near Alexandria.
3. The Seed Company which is located in the West Nubaria area west of the Delta near Alexandria. The area is along the north side of the El Nasr Canal and east of the Desert Road.
4. The Nahda area which is part of the Abis Company. It is east of Nubaria Canal, and near Alexandria.
5. Unreclaimed Land in West Nubaria area consisting of various parcels of land along the El Nasr Canal or to be served by extensions of the El Nasr Canal.
6. South Tahrir area which is along the Nassar Canal on the west side of the Delta about 80 kilometers northwest of Cairo.
7. North and South Samalout (Mid Egypt) areas which are south of Cairo on desert lands which lie on the west side of the Nile Valley. North Samalout is west and south of Beni Suéf and South Samalout is north and west of El Minya.

A brief description and analysis of each of the above areas for development on the basis of the philosophy of the "New Lands Concepts Paper" is given in the following paragraphs.

1. Mullak

The area presently has about 12,000 feddans under hand move sprinkler irrigation. The area is being developed as a joint venture by the Egyptian government and private investors. There are additional areas in various stages of development ranging from only a development concept

with raw land available for development, to areas with roads and irrigation ditches and water but not farmed. The former are proposed as joint ventures (GOE and private investors) such as that with the Coca Cola Co. and the latter's is represented by land east of the 12,000 feddans being farmed but is presently occupied by the Army.

In this area there is no type "A" development possibility. There are no settlers.

There are also no areas that fit in with the type "B" category. There are no state farms only the one joint venture. The land presently occupied by the Army could be developed as a state farm then transferred to small settlers, but this is not category "B".

There is land available for category "C". If the Coca Cola joint venture does not materialize, this land could be developed as category "C". There is other land in the area suitable for development but there may not be water available in the Ismailia Canal. The land occupied by the Army would also be suitable for category "C". Some of the roads and irrigation system, trees, etc. are in, but there is considerable additional work to be done. The GOE is presently developing it as the Army moves out, but a fixed time table for the Army moving out was not available.

Even though there are limited opportunities for category "C", we do not recommend this area at this time. Much of the land is proposed for joint ventures and the status of the land occupied by the Army is unknown. Also, developing land for eventual distribution to small farmers in near proximity to joint ventures and other types of entrepreneur development could create special problems.

2. North Tahrir Company

The North Tahrir Company is operating 40,000 feddans as a government farm. Oranges, grapes, barley, corn, and clover are grown. The area is flood irrigated by gravity.

The water is pumped from the Nubaria Canal. There is a large dairy project on the farm financed by West Germany. FAO conducted a drainage project in the area. A major canal serving the area has now been converted into a drain.

The area is not suitable for category "A" or "C" because there are no settlers, nor is there undeveloped lands available. The area, if GOE desired, would be suitable for category "B". However, with West Germany and FAO already providing Technical Assistance, it probably should not be considered.

3. Seed Company

The seed production company has 23,000 feddans under development to provide seed stock for Egypt. It is flood irrigated by gravity. Technical and Capital assistance is provided by the World Bank. The Company is operated by the Ministry of Agriculture.

It doesn't fit into categories "A" or "C", but it could be considered for category "B". However, the company is being provided Technical Assistance by the World Bank and all indications are that the GOE is operating it as a State Farm. Another major problem with this area is that it is flood irrigated, is along the El Nassar Canal and potentially (without very careful water management) can contaminate the irrigation water in this canal by seepage from the area. There is already some seepage in the El Nassar Canal and Dr. Mohammed Naguib Hassan, FAO National Team Leader of the Nubaria Project has records showing an increase in dissolved solids in the El Nassar Canal with time.

Finally, under present operation, the Seed Company is a specialized operation and should probably not be settled with farmers until the seed operation is thoroughly developed and perhaps not even then.

4. Nahda area

The Nahda area contains approximately 35,000 feddans. There is one State Farm of about 2,500 feddans which is operated as a dairy with Technical Assistance from the West Germans. Approximately 8,500 feddans have been distributed to small farmers (5,500 feddans to graduates and 3,000 feddans to settlers). The rest, approximately 24,000 feddans is operated by the Company. The soil is heavy (silty clay). The area is flood irrigated by gravity. The source of supply is by gravity from the Nubarria Canal. There are waterlogging and salinity problems in the area. The Company, and farmers need water management help to bring the area up to potential.

The area fits into the "A" category. There are farmers on the land who need help to increase productivity. However, the area is not typical of most of the new "old lands" or the New Lands that will be developed in the future. The soils are similar to the Delta soils although they developed in place rather than being alluvial soils. Most problems could be solved with a water management project similar to the one in the old lands.

The area fits the type "B" category. There is land being farmed as a State Farm. The Germans are developing a State owned dairy, but there is additional State Company farmed areas. The land and irrigation system (heavy soil and gravity surface system) is not typical of the land that GOE must develop in the future. Although there may be similar land in the Northern Sinai. There doesn't appear to be category "C" land in the area.

5. Unreclaimed land in West Nubarria area

There are several large parcels of land in the West Nubarria area scheduled for development by the GOE. These lands are in the following areas. (1) South of the El Nassar Canal and east of the Desert Road (approximately 50,000 feddans); (2) North and south of the

El Nasr Canal as extend to pumping station 4 and west of the Desert Road (approximately 50,000 feddans) and (3) approximately 200,000 feddans west of the Mariyut Company area and north of the extention of the El Nasr Canal beyond pumping plant 4. This extension of the El Nasr Canal beyond pumping plant 4 has not yet been constructed.

Practically all this land has been offered to potential developers as joint ventures with the GOE. An example is 10,000 feddans along the west side of the Desert Road and adjacent to the south side of El Nasr Canal which has been offered to Swift and Co. for a farm to grow alfalfa to be converted into protein. However, the Ministry of Land Reclamation officials are interested in having the U.S. develop a portion of the land.

Potential problems with this area are:

- a. The unclear status of what land is available because of it being offered to others as joint ventures.
- b. The potential degradation of the water in the El Nasr Canal resulting from seepage from the Seed Farm and other land developments along it. If good water management, adequate drainage and better lining of the El Nasr Canal are not carried out, the water in the Canal may become unsuitable for irrigation. The present concrete lining, (evidenced by Dr. Naguib Hassan's measurements of changes in water quality with time, FAO measurements of seepage losses and close observation of its condition) is not a good barrier to seepage into the Canal from the adjacent land.

- c. The land is sand and most all nutrients will have to be supplied. The type and amount of fertilizer must be determined.
- d. The pumps in the plants we visited in the West Nubaria area were operating and appeared to be in a good state of maintenance. This was not true of some of the other areas we visited.
- e. The land will require especially careful water management.

The area has several advantages, however. These are:

- a. It is located in an area that the GOE plans on developing another two to five hundred thousand feddans. It is typical of other areas that the GOE plans to develop. Also, there are reclaimed lands in the area that are having problems. A successful project could be replicated.
- b. The area is visible so that a successful project would reflect favorably on the program and would be a continuous advertisement of good project development.
- c. The area is accessible for logistical support and housing would be available in Alexandria for personnel working on the project. It is close to Alexandria (70^k kilometers) and there are other GOE support facilities close by.

6. South Tahrir area

The South Tahrir area has a Company or State Owned Farm, a joint venture farm with First Arabian Corp. and an area distributed to small farmers (this latter area is called Tahadi). The State Owned Company's major crop is citrus. The State Farm is flood irrigated

by gravity. The main canals obtain their water by a series of pumping stations lifting water from the Nubaria Canal. There are some wells in the area. In this farm there are four villages that have 833 families owning and farming 3900 feddans surrounding the village. The small farmers are raising field crops (ground nuts, clover, grain). These villages provide labor for the State Owned Farm. Adjacent to and west of the State Owned Farm there is approximately 10,000 feddans of undeveloped land available for development. The joint venture is developing about 10,000 feddans as a Company managed farm.

The Tahadi area is northwest of the South Tahrir Company and the joint venture farm. There are around 37,000 feddans in this area. The soil is sand. There are citrus, grapes, peanuts, clover, small grain, broad beans, and alfalfa grown in the area.

The 37,000 feddans is distributed as follows:

3,155 feddans for 1149 settlers
 13,142 feddans to 584 graduates
 10,000 feddans undistributed
10,000 feddans unreclaimed
 37,000 feddans

Settlers are selected from landless uneducated laborers and small uneducated farmers. Graduates refers to high school and university graduates who have been given land. Undistributed land is land ready for small farmers but because of pumping plant problems, lacks water. The 10,000 unreclaimed lands is land that does not have the irrigation delivery system, roads and related infrastructure.

The GOE policy on land distribution is to allow purchase under a loan agreement of up to 6 feddans by landless poor called settlers, 20 feddans by high school graduates and 30 feddans by university graduates if the land is in

field crops. If the land is in developed orchards then half the above allotments may be purchased. We found that some graduates had received loans to purchase a few (4 or 5) extra feddans if there were some problem soils or poor land in their plot. All settlers we talked to had less than the six feddans. Settlers and graduates were given or allowed loans for the purchase of a limited number of cattle and to construct a home. Cooperatives were available for seeds and fertilizer. In general the settler and graduates lacked capital, needed additional credit, extension services, farm machinery etc. This was true in all areas visited where land was being or had been distributed.

In the Tahadi area most of the infrastructure (roads, schools, villages, power, cooperatives, etc. are installed, although additional construction or expansion of facilities is needed. The basic irrigation system has been installed, but needs considerable rehabilitation. The Tahadi system was constructed in 1964 and operated as a company farm until 1977. The land is now being offered to homesteaders. The settlers and graduates we talked to had been on the land less than a year. The water comes from the Nubaria Canal in a series of four lift stations. There are six pumps in the first lifting station and decreasing numbers in the others due to water being utilized on land in the intervening areas. The pumps in lift station number 1 need to be replaced. The pumps at the other station may be in reasonable condition but probably should also be replaced. The canals appear to be in good condition but may need some cleaning. The adequacy of the capacity of the canals would need to be checked and also

their seepage losses determined if this area were selected for category "A" development.

The method of irrigation in the Tahadi area is hand move sprinkler irrigation. Pumping stations are located along open ditches. They consist of two well constructed buildings housing three to six high head pumps which deliver into a manifold serving two to four main lines. Each main line is perpendicular to the canal and serves from 4 to 800 feddans. The lines are concrete asbestos pipe 6 to 8 inches in diameter. Risers from the pipe are spaced so that a hand set aluminum pipe sprinkler system can be used to irrigate around 20 feddans on either side of the pipe. One aluminum line is furnished for every 15 - 20 feddans regardless of the number of settlers. They must therefore cooperate in the use of the line. The aluminum hand move irrigation system including the sprinkler heads is in poor condition. The pipe lines and buildings appear to be in good condition. Most of the pumps were operating but we could not determine their condition either from observation or from records of water discharge and water pressure. As was the case in all areas we visited where pumps were operated, records were kept of electrical variables, but no measurements or records were made of water discharge (rate and quantity) or of line pressure. From observations of the sprinklers it was obvious, however, that line pressure was inadequate in many cases. More than likely these sprinkler pumps will need to be replaced soon.

The Tahadi area would be suitable for category "A" development. There are no lands in the area being farmed by a Government Company which rules out category "B".

There are 10,000 feddans in the area which are undeveloped and may be suitable for category "C". Thus in a very compact area served by one canal category "A" and "C" type development could be done. Surface irrigation would not be recommended but all types of closed conduit (sprinkler, drip, bubble, gated pipe, etc.) irrigation systems could be used to develop the techniques needed to successfully irrigate desert sands. The sprinkler systems would be hand move, center pivot, lateral travelling sprinkler, side roll and hose pull.

7. North and South Samalut

North and South Samalut have 58,000 feddans about evenly divided between them. The land is divided as follows (according to information verbally supplied):

South Samalut

2,000 f. sprinkler, graduates farming

6,000 f. sprinkler, company farm

3,000 f. quick coupling pipe, company farm

12,000 f. surface, company farm

23,000 feddans

North Samalut

500 f. surface, settlers farming

3,000 f. surface, graduates farming

3,000 f. quick coupling pipe, company farm

2,000 f. sprinkler, company farm

12,000 f. surface, company farm

20,500 feddans

14,500 feddans unaccounted for

Each area is served by two main canals which pump water from Bahr Yousef to the desert lands that are 40 to 80 meters above the Nile valley. Only about 40 to 50 percent of the area is being farmed and most of this is in North Samalut. In fact if you start in the

northern part of North Samalut and drive south on the North-South project road, areas being farmed decrease to the south. In one area in North Samalut the sprinklers were started this year for the first time, although they had been installed for eight years.

The pumping plants on the main supply ditch are only partially functioning. At both lift stations that were visited (one in each area) 3 out of 5 pumps were operable. The other two at each station were dismantled for repairs. The operating pumps probably could not deliver design discharge. The sprinkler system was similar to that described for South Tahrir. Buried main distribution lines serving hand move sprinkler systems, the main lines coming from a central pumping station with 4 or 5 pumps. The condition of the pumps ranged from hardly used to badly worn.

Irrigation of this area created a seepage (waterlogging and salinity) problem in the adjacent old lands. A drain was constructed parallel to Bahr Yousef and east of the area to intercept water from the area. This drain needs cleaning. Also drains were constructed in the North Samalut area. Most of these drains were dry. There were many areas along the road in North Samalut that appeared to have black alkali problems. These should be investigated. The major problem in the minds of project staff is lack of water. The shortage is caused by the poor condition of the pumping plants. There is plenty of water available in the Bahr Yousef Canal for these projects. Most of the infrastructure (roads, electric power, schools, hospitals, etc.) is in. In fact, there are abandoned villages because housing was constructed in the area for refugees from the Suez Canal Area. An improved road from the area to the main Nile Valley road or the Faiyum to Beni Suef road

would need to be constructed and the main North-South project road would need to be improved. Housing for project staff would be available in the area and at El Minya and Beni Suef. Logistical support for this area would be more difficult than for any of the other areas visited. The area is a three to four hour drive or train ride from Cairo.

The area has potential for category "A" and "B". Also there appears to be sufficient undeveloped area to the west of North Samalut or in South Samalut for category "C" development. However, before selecting this area for a feasibility study a soils scientist should investigate the soils further from standpoint of alkali problems and suitability for development.

II. Project Technical Considerations

The project categories "A", "B", and "C" can actually be considered as stages of development. Under present governmental policy New Lands development proceeds from "C" through "B" to "A" over a period of several years. Therefore, it was decided that development of improved procedures could be expedited by studying and working in all phases of the process simultaneously. This is especially worthwhile since, in Egypt, there are very large areas of land in each of the categories ("A" - farmer operated, "B" - government operated, or "C" - undeveloped). And if the final goal is to have all lands under farmer operation each category is vitally important.

The technical aspects or technologies to be introduced in each category are somewhat different, however, because of the different stages of development. It does not appear necessary to conduct all three categories in the same area although an argument for locating "A" and "B" types together can be made. It is obvious that almost all New Land developed to date is in need of improvement. Therefore, the technologies learned under "A" and "B" are applicable to all of these areas. The "C" category, of course, is applicable to all lands to be developed in the future and therefore need not necessarily be tied to any presently existing project.

Some technical aspects relating to each of the separate categories are outlined below:

Category A. Assistance to raise output of distributed reclaimed land.

Several thousand feddans within the reclaimed new lands have been distributed to farmers (settlers and graduates). In most cases these units are not producing near to a level one would expect given the soil, water, and climatic

resources within the areas. There are many reasons for this, some obvious and some not, but in any case it is expected that an assistance program could be developed to increase production several fold in most of the settled areas.

Category "A" project activities should include:

1. Repair, replace, and renovate the distribution and drainage systems, pumps, and equipment to bring it up to design operation. Where sprinkler systems exist, then analyze the system, repair, replace and renovate the system to bring it up to standards for small farm operation.
2. Monitor the irrigation and drainage systems to develop operation, monitoring, maintenance procedures. Once developed put them into operation so that management can be improved and changed to meet specific deficiencies or changes.
3. Determine the farmer's irrigation techniques, his knowledge, and his constraints in applying water according to crop needs. Survey cropping patterns, intensities, and yields. After analyzing these data, make alterations in the system, scheduling of water, cropping patterns, and cultural practices according to the social, economic, and institutional desires and flexibilities within the area.
4. Provide the necessary inputs to the farmer to accomplish the improved management system. These could include credit, training, seeds, fertilizers, pesticides and an advisory service.
5. Analyze marketing possibilities for produced crops and arrange crops and cropping patterns to take advantage of market potentials within the framework of available resources.

6. Analyze the infrastructure (roads, credit system, schools, water supply, sanitary facilities, marketing, hospitals, etc.) for the area and make the changes needed to bring it up to design.

Category "B" Improvements to permit settlement of land presently operated by Companies or the Ministry.

It is customary to operate and manage the agricultural land by State Owned Companies once it has been reclaimed. The policy of transferring the land from companies to private operators is not clear. Some areas have significant quantities of land in private ownership, others have very little. In any case, in the interest of increased food production it is desirable to develop the land and get it into private hands as soon as possible because the evidence is strong that privately operated farms outproduce company operated land many fold.

Any project in this category should be directed toward providing improvements within the farming system, the irrigation system, and the social infrastructure so that farmers could assume management of small units of land and farm at an economic level.

Project activities would need to include:

1. Repair, replace, and renovate the irrigation and drainage systems, pumps and other equipment so that the water management system operates according to design.
2. a) In the case of flood irrigated areas, level the land into farm sized units and build farm distribution (ditch) system to efficiently transport water from canals to fields.
b) In the case of sprinkler irrigated areas, divide land into farm units and place sprinkler system lines such that each individual farm can be operated as a unit.

3. Operate the entire area irrigation and farming system as a series of farms so that management problems can be worked out prior to settlement by farmers.
4. When production reaches an economic level, salts have been removed from the soils, and the irrigation system is reliable the farmers can be settled.
5. During the initial stages of development when the land is being farmed by the Government, there should also be a program of building the social infrastructure such as roads, schools, credit institutions, extension, etc. Once the farmers are settled all of these things will be needed. In this regard, it may be desirable to bring the farmers to the area early so they can work with the Government for a few years during development. In this case, the farmers initial private efforts at farming the land would not be abrupt. He would already be familiar with the irrigation systems and he and his family would be in a settled condition.

Category "C" Development from raw new land through settlement of farmers.

This category requires total reclamation and development from raw desert land including selection of suitable soils and provision of water to the site. Since much of the available raw land is composed of very sandy soils, category "C" development should include sprinkler irrigation as a method with flood irrigation used only where the soils permit. It is especially difficult to irrigate sand by the flooding method and impossible to do so efficiently.

It is apparent that all land developed under sprinkler to date is not being irrigated efficiently nor is its production anywhere near optimal. The evidence therefore, strongly suggests that before large areas are reclaimed, by this method, a pilot project needs to be conducted to

learn how to adapt this type of irrigation to local conditions. Various sprinkler systems should be tested including center pivot, wheel move, and conventional hand move types. If the area soils permit, a system of flood and/or furrow irrigation could be tested as a comparison. In this case gated pipe, siphon tubes, spiles and other water control devices could be tested.

Each tested area should be of sufficient size to permit a realistic economic, social, and technical evaluation of the specific type. Center pivot would require 6 - 700 feddans as an operational unit, for reliable comparison, because four adjacent circles should be tested and an economically sized circle is between 150 - 160 feddans. Operational units for the other types of sprinklers should include areas at least equal to one center pivot circle. Then, in addition to the area needed for center pivots an approximate 5 - 600 feddans would be needed to test other types of irrigation application systems. A total category "C" unit for test of the physical system would then be in the order of 1,200 feddans. Social, economic, and institutional factors will undoubtedly require that a larger area be used, but in no case should it get so large that monitoring data cannot carefully be taken.

The specific components of the project should include the following activities: ³

1. Delineate the area for testing using criteria which recognizes that farmers will eventually be settled on the land.
2. Select species of crops to be grown and cropping patterns to be tested.
3. Provide sufficient water at the site for perennial irrigation of the crops and cropping patterns selected.
4. Design and install the irrigation systems.

- 5 Design and implement a monitoring program to continually evaluate the water table depth, soil and groundwater salinity, and operation of the irrigation systems. Records of water discharge and quantity at selected points in the system should be kept. Also for sprinkler system, record of water pressure should be kept.
- 6 Determine optimum frequency and amounts of irrigation water application.
- 7 In the case of center pivots, determine the feasibility of growing several crops under one pivot and determine best method of dividing land under pivots into farming units.
- 8 Develop and conduct a monitoring program to learn maintenance problems and schedules, and to develop proper cultural practices for optimal production of the specific crops and crop mixes.
- 9 Train company (Ministry) employees in the operation and maintenance of the systems, in the monitoring of the activities and in the improved farming practices.
- 10 Provide infrastructure for each area (each irrigation system) such as: roads, domestic water supply, shelter belts, stores, sanitary facilities, schools, dispensaries, village facilities, etc.
- 11 Settle with farmers only after all the above are accomplished and the units are operating sufficiently well to insure a reasonable probability of success for the farmers. Although farmers might be brought in during reclamation to provide labor and become familiar with the area.
- 12 Provide credit, extension education, and other assistance as needed as follow-on activities after settlement.

III. Site and Technology Selection

1. The Samalut area is a good site for category "A" and "B" development. It is an important area, its present productivity is extremely low, and it has both Company operated farms, settlers and graduates. Flood irrigation, hand move sprinkler and quick set pipe irrigation methods are in use. Other methods could readily be installed. The project area needs water management, pump replacement in the distribution system and in the hand move sprinkler system, cleaning of the main interceptor drain, technical help to improve the citrus and other fruit growing operations, extension service, farm machinery, social help in organizing cooperatives for joint use of farm machinery and control of all inputs such as fertilizer and water, marketing help, road construction and improvement, technical help on all crops that are grown, domestic livestock improvement and improvement of the other infrastructure.

Various types of irrigation methods can be studied. Some suggested methods are surface, sprinkler, bubble, and gated pipe. Sprinkler systems that could be installed would be side roll, hand move, permanent set, small center pivot, and lateral move. From these various irrigation methods operating costs, suitability of each method for Egypt's conditions and the technology for installation, operation and maintenance including the infrastructure could be determined.

Villages are in place and have schools, electricity, guest houses, Company headquarters, hospital, etc. There is additional housing available for settlers. A major road either to connect to the Faiyum-Beni Suef road or the Beni Suef-El Minya road is needed. The connection to Faiyum-Beni Suef road has the advantage of using desert land and providing a shorter distance to Cairo.

It is possible to develop category "C" development in the area but the costs would be higher because of location and it would lack the visibility of an area closer to where the major new land developments are planned and GOE has no plans to reclaim large quantities of new land in the area.

There are 4 canals serving the Samalut area. Two in North Samalut and two in South Samalut. Each canal brings water from the Bahr Yousef Canal through a series of pumping stations.

Development is fairly complete on the northernmost canal system with citrus, guavas, vegetables, and fodder being grown quite successfully. As one proceeds south through the other three canal areas development is increasingly less accomplished.

Should the Samalut area be finally selected as a project site for "A" and "B" categories, project developers will have to decide on which and how many canal systems would be undertaken for rehabilitation.

The North Samalut offers some advantages since much of it has open drains in place; the Company has demonstrated that several crops are adaptable; there is a large area of settler - there is both sprinkler and surface irrigation. There are also several large field areas which have mature windbreaks around them, yet the soil has not yet been farmed. These areas offer opportunity to level land prior to division and settling with farms and would provide opportunity for rather rapid development into economic production.

The North Samalut comprises some 20,000 foddans which may or may not be considered too large an area for this project. In case it is determined to renovate only one canal system, we strongly recommend that the Southernmost canal in North Samalut be selected because of its

stage of development and it is the only canal system where settlers are farming.

2. The Tahadi area in South Tahrir is a good site for category "A" and "C" development. There are graduates and settlers on the land. No Company operated land and about 10,000 feddans remains undeveloped. The soil is sand which is not suitable for surface irrigation. The present irrigation method is hand move sprinkler irrigation. The area needs new pumps in the main distributory canals and most of the pumps in the sprinkler system will have to be replaced. Other types of sprinkler (side rolling, lateral move, center pivot, etc.) bubble, gated pipe, plastic gated pipe, irrigation system could be used in the area.

Except for about 10,000 feddans the canals, roads, villages, schools and other infrastructure is in. In contrast to Samalut all the farmers do not live in villages but are constructing houses on their land. If this is not satisfactory, additional villages or housing in the village will have to be constructed. Although the basic infrastructure is in, much more will be needed such as credit, farm machinery and pump repair facilities, etc. Also the items mentioned for Samalut will be needed.

In Tahadi, as mentioned previously, there are approximately 16,000 feddans distributed to farmers, 10,000 feddans that can be distributed if the delivery system (main canal and sprinkler pumping station) was upgraded and about 10,000 feddans that is undeveloped.

Category "C" could be the previously mentioned 10,000 feddans in the Tahadi area or 8,000 to 10,000 feddans west of the South Tahrir Company land.

An argument can be made for selecting "A" category in both Samalut and South Tahrir since there is much more sprinkler irrigation being practiced by farmers in South Tahrir. Apparently this method will be most suited to Egypt's future newly reclaimed areas which, we are told, contain predominantly very sandy soils.

The area has the distinct advantage of being readily accessible to Cairo via the Desert Road.

3. West Nubaria has land that could be used for category "C" development if some of the issues described in Section I-5 were resolved. That is, the conflict with other potential developers being promised land in the area and the potential contamination of the available irrigation water. The area along the Desert Road where it crosses the El Nasr Canal would be an excellent site. It is close to Alexandria and has other logistical support facilities close by. It is close to markets and is also close to an additional two to three hundred thousand feddans the GOE plans to develop. A successful project there would help in the development of these lands.

The soil is sand with low water holding capacity and high infiltration thus should be irrigated with sprinkler, bubble, gated pipes or other non surface irrigation methods. The management of these technologies should be tested and developed for Egyptian conditions. The area would be particularly suited for center pivot irrigation.

IV. Studies Required in Development of Project

U.S. Government legal requirements will necessitate a technical and economic feasibility study prior to project approval. It is recommended that this study/report be contracted with an engineering firm which has experience in irrigation and agricultural projects. It is our understanding that AID has a contract with such a firm for these types of studies. The U.S. Bureau of Reclamation could also do it on a PASSA type arrangement. Special personnel could also be supplied for the study if need be. These would be specialists who can be furnished from other AID projects and/or AID/W such as DS/AGR, EWUP, Water Synthesis project (Sprinkler Irrigation Specialist), but the overall study responsibility should be centered with a firm selected for the study.

This study would provide the basis for the essential components of the Project Paper. The scope of work for the study should include the following specific requirements:

1. A technical evaluation and description of how land has been developed in the past. What has been the experience with sprinkler irrigation? - with drainage? - with settlers? This could be considered a technical report as a companion to Sarah Voll's historical report.
(Irrigation engineer, Agronomist, Sociologist)
2. Determine the adequacy of irrigation water for the area(s) selected. Evaluate the condition of the existing system and determine necessary inputs to make it fully operational.
(Pump specialist, Irrigation engineer)
3. Conceptualize and prepare preliminary designs for total irrigation system including canal delivery, pumping stations, field delivery and on farm systems including sprinklers and land preparation for flood irrigation. Prepare cost estimates for these systems.
(Irrigation engineer)

4. Evaluate the area(s) soils and drainage problems to determine suitability of soil to crops and to delineate any special problems which might arise with soils, salinity, alkalinity, fertilizer, or high water tables.
(Soils, Drainage specialist)
5. Prepare a social soundness analysis including an evaluation of existing institutions and recommendations on institutional requirements for the project including village infrastructure, markets, roads and other requirements of the project.
(Sociologist and all other team members)
6. Recommend types of training programs needed for the project. Specify any special extension needs to provide farmers with latest technologies. Pay special attention to the use of on-the-job training for all management aspects of the project for both the irrigation system and the farming system.
(All team members)
7. Describe all inputs necessary for successful completion of the project including technical assistance, equipment, structures, roads, training, commodities and operational expenses.
(All team members)
8. Provide an economic feasibility (cost/benefit) analysis for the project. This will have to be separated into the "A" and "B" category and "C" category because of the somewhat different nature of " ".
(Agricultural Economist)
9. Provide a technical feasibility based on the existing infrastructure and agricultural system, the social analysis, and the project proposal.
(Irrigation engineer and others)

The study team would need to be of 7 - 8 members in size with an Agronomist, Soils Specialist, Irrigation Engineer, Hydraulic Engineer, Drainage Specialist, Sociologist and Economist considered essential. It is possible that two of the above could be found in one individual but the required work is sufficient to need the team for perhaps 6 to 8 weeks. Shorter term help would probably be needed from a construction and/or road Engineer, Sprinkler /Drip Irrigation Expert, and someone with settlement experience.

An environmental impact statement will need to be prepared for the project. This can be done by a separate person or firm and would not necessarily need to be done simultaneously with the technical and socio-economic evaluations. As soon as the sites are selected and a rough approximation is known regarding size and technologies the environmental impact analysis could proceed

V. Other Comments

Based on our discussions, field trips, and other experiences in Egypt and other countries, the following comments are made. Although they are not necessarily recommendations, we feel them worthy of note and possible use by GOE, USAID, or the Project Team which develops this program further.

1. Water quantity - There should be sufficient water available for any of the developments considered here and also for Egypt's future development plans. Therefore, the project could be replicated.

The Ministry of Irrigation estimates that there are 16.76 milliard m³ or 13.59 million acre ft. of water available in the Nile River for future agricultural expansion. According to them, this should be sufficient for 2.5 million additional feddans. With more efficient use of irrigation water the available water supply could be larger. Other studies indicate that the available surplus water is of the above order of magnitude. The World Bank is conducting a study on the available water as part of its Nile Water Master Plan study. They should be able to provide additional data on the gross water available.

There appears to be sufficient capacity in the canals serving the areas we visited for a development project. The one exception was the Ismailia Canal. We were told that because of expansion in the Ismailia area the capacity of the Ismailia Canal is strained and that future expansion of agriculture will depend on the planned expansion of the canal. New head works are already under construction for the increased capacity.

In the investigation of each area, prior to final selection and for the area selected the amount of water required will have to be determined. This should be based on the consumptive use (CU) of the planned co-ops using

modern equations rather than being based on research conducted in the old lands. Soil types and methods of irrigation along with CU values will determine the total water requirement. Of course, soil types, crops and available water will determine methods of irrigation. The quantity of water needed for the area will be used to check canal and pumping capacity in categories "A" and "B" and to determine them in "C". In general there is a tendency for designers to overdesign an irrigation system. Often by a factor of two. This leads to excess water and poor water management and contributes to many other project problems. A conservative design might be to provide only the water needed instead of excess water. This might be accomplished by having the usual standby pump installed to provide extra water during peak use and one or two extra pumps in storage that could be quickly installed when a pump breaks down. These extra pumps could be used to replace pumps when service is needed.

In the design and selection of pumps care should be exercised in the design tail water depth or elevation. The elevation of the tail water often varies considerably in Egyptian practice which can cause cavitation problems.

2. Water Quality - The quality of the Nile water is excellent 2 to 300 parts per million TDS. However, the design of all the canal systems serving the reclamation areas is such that these canals can be contaminated by seepage from the newly developed adjacent lands.

This has happened in the West Nubaria area. This possibility should be carefully investigated. The FAO research project in the Nubaria area is a good source of information and has a ground water model for that area. Lining of canals may help eliminate inflow but

concrete lining unless carefully constructed and maintained (asphalt sealing of cracks and joints) will not serve as a barrier. Plastic lining if properly placed buried deep (18 inches), with good underlay, is a good material having a long life. The possibility of creating waterlogging and salinity problems in older irrigated areas which are lower in elevation than the proposed category "A", "B" and "C" site will also need to be considered. In most of the farm areas visited inceptor drains have been constructed but some of them are in bad condition because of weeds and lack of cleaning.

3. Water Measurements

An observation on all the lands we visited was that there were no records of water measurements, neither rate of flow or volume of water delivered. Each pumping station had records of time the pumps were on, which pumps were operative, electrical power consumption, etc. Power consumed and time of pumping is not a record of rate of flow or amount of water delivered. Efficiencies of pumping plants change with time. The pumps might not even work at specified (contract) efficiency when installed and even if pumps do operate at specified efficiencies, valves not fully opened, pipe deterioration or tail water and head water elevations changes can greatly effect the amount of water pumped. Therefore, independent methods of measurement of water must be installed. This could be Parshall flumes, venturi meters, spalling meters, pressure measurements across the pump, etc. Regardless of the methods used adequate records of daily water deliveries must be kept. These records should be for the major pumping stations, branch stations, sprinkler pumping stations, selected branch canals and on-farm water deliveries.

In addition to keeping records of the quantity of water delivered or pumped with time, records of line pressures on all sprinkler manifolds should be kept. These could be daily measurements. Periodically pressures should be measured and recorded on the outer ends of main sprinkler lines.

Records of water delivered and line pressures are needed for managers to determine if the system is operating correctly (pumps, ditches, sprinkler, etc. are ok). These are a must for proper water management.

4. Soils

In general the desert soils have low fertility, high infiltration rates and low waterholding capacity. The soils in the area will need careful evaluation both in the feasibility study and during design, reclamation and development.

- a. Soils analysis - The Ministry of Land Reclamation has soil analyses but many are old so some additional soil sampling will be desirable. The Soil and Water Research Institute in the Ministry of Agriculture has a well equipped laboratory that could be used for the feasibility study. But the design will require additional samples and one of the essential services for the small farmer will be soil fertility analysis. Therefore an adequate soils laboratory probably will be needed for the project and future developments. The adequacy of the soils laboratory in the Ministry of Land Reclamation or in the Ministry of Agriculture will need investigation.
- b. Fertility - The desert soils are low in fertility but even if fertile, cropping and intensive agriculture requires the replacement of nutrients that are used by the crops. Natural replacement using legumes and manure is not sufficient so chemical

fertilizers are added. The availability of sufficient fertilizer both from the standpoint of supply and distribution will need study. Most farmers we talked to insisted they did not receive enough fertilizers. However, everywhere we went fertilizer was in evidence; being transported, in storage, and being placed on crops. Over use of water (leaching) may contribute to this problem.

- c. Salinity - The salt contents of the soil and deeper strata will need investigation because this is the source of salinity problems. Some of the sandy soils may not have large quantity of salts which would make development easier.
 - d. Water holding capacity and infiltration rate - Of course these two parameters must be determined and in the case of category "A" and "B" would only mean checking to see if changes have occurred.
 - e. General - There has been the practice in Egyptian land development to haul silts and clay from the Nile Valley and Delta to desert lands. The value of these practices in terms of their costs and contribution to increased productivity is questionable. Tillage practice and fertilization requirements are more important issues with these soils than trying to change their texture by hauling in manure and Delta soils.
5. Perhaps the policy which indicates that new agricultural land must be first reclaimed, developed, and "seasoned" by the government prior to settlement by farmers needs to be reviewed. Would it not be possible to settle the land at the outset, use the farmers for labor to build the system and infrastructure, and assist them with development of each farm into an economic unit?

Would this be more costly than having two different Management units (the government and the families) each learn how to manage the soil and water resources?

6. There appears to be 4 Ministries involved with land reclamation and development. These are:

- a. The Ministry of Agriculture
- b. The Ministry of Irrigation
- c. The Ministry of Land Reclamation
- d. The Ministry of Construction and Land Development

Category "A" would involve a. and b.; category "B" a., b., and c. and category "C" development would include all 4.