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# RURAL SANITATION IN

# THE ARAB REPUBLIC OF EGYPT

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# SUMMARY

The purpose of this study is threefold: (1) to examine the behavior of individuals and groups in rural Egypt with regard to sanitation, especially water supply and waste disposal; (2) to assess the existing sanitation facilities and services in the rural sector; and (3) to make recommendations for improvements in sanitation that can be incorporated into USAID projects in Egypt.

The study team consisted of two cultural anthropologists with experience in the Middle East and a civil engineer specializing in rural sanitation. Research was conducted in two ecologically distinct governorates: Menoufia in the Delta region and Assiut in Upper Egypt. An anthropological study was carried out in selected villages by participant observation, interviews and a household survey. Emphasis was placed on eliciting the attitudes and activities of villagers in relation to sanitation and the health consequences of sanitation problems. Local sanitation facilities were examined. Meetings were held with government officials responsible for health services, family planning, potable water, sewage collection, garbage collection and agriculture.

## FINDINGS

The Egyptian village is currently an unsanitary environment with acute health consequences for the people. The major sanitation problems documented by this study include:

1) Contamination of the water supplies;

2) Inadequate drainage for public water systems and household sullage;

3) Lack of appropriate sanitary facilities for human waste management;

4) The unsanitary collection and use of animal manure;

5) Lack of services for management of garbage, trash and other solid wastes.

Although there are public water systems in most villages, not all villagers have access to the water. Due to lack of maintenance and repair, almost all systems have serious leaks. In many cases water stands in stagnant pools near the public water outlets, since there is no adequate drainage. Many villagers rely on shallow wells, which are easily contaminated by close proximity to cesspools. Some villagers use contaminated canal water, especially for laundry and washing of cooking utensils. The contamination of existing water supplies is one of the most immediate sanitation problems in rural Egypt.

There is an obvious lack of latrines in the rural areas. Although men may have access to latrines in a local mosque, women often defecate on the roof or in the fields. Latrines installed in public shools and rural health centers are

inappropriate, relying on a flush system that has no continual supply of water. School latrines are often unsanitary and present health risks for the students. There is no adequate public or private system for disposal of human wastes. Existing cesspools contribute to contamination of ground water. Villagers must arrange with private cleaners to have their latrines or cesspools cleaned out. The sludge is sometimes dumped into open drainage canals near the villages. It is clear that existing waste disposal services are inadequate. Water-carriage sewage systems do not represent a viable option, because of the lack of water, the lack of space in the village for on-site sewage disposal, the cost and the complexity of the technology.

The Egyptian farmer depends on animals for his agricultural livelihood. The stable is usually placed within the house, placing the villager in intimate contact with his animals. The manure is removed and generally placed in a pile in the street. The piles of manure provide a breeding ground for flies. Many women shape dung cakes for use as fuel. The existing system of using animal dung for organic fertilizer and fuel is a health hazard.

The disposal of garbage and trash is not a serious problem in the Egyptian village. Organic garbage is generally eaten by domestic animals or mixed in with the compost pile. Paper waste is used as fuel and cans are usually used for containers and dippers. With the introduction of more and more consumer goods into Egyptian villages, litter will become a problem, since there are no public services in most villages for garbage collection.

## RECOMMENDATIONS

The problem of sanitation cannot be effectively addressed except as part of an overall approach to the fundamental problem of a population that has outstripped available resources and services. The high population density in Egypt results in a rural sector that resembles an urban environment in physical characteristics. Proposed sanitation interventions must be appropriate to a high density environment. And, unless there is a viable program in family planning, any gains in potable water supply, health services and sanitation will be nullified by the increasing demands of an expanding population.

There is a crucial need in rural Egypt for promoting an awareness of the health consequences of an unsanitary environment, especially the link between human excrement and disease. Information on appropriate sanitation facilities and their use has not been translated into concepts and terms understandable to the general populace. Villagers have not been provided with positive models of sanitary facilities in public schools and health units.

The introduction of any sanitation intervention in rural Egypt should be based on assessment of existing sanitation facilities and services. The major problem documented in this report is the lack of proper maintenance and operation of technological interventions, particularly at the village level. The technology has been installed, but not effectively transferred. A practical hands-on training approach is necessary for the successful implementation of any sanitation intervention.

If the village council is to assume responsibility for local sanitation, it is important to introduce appropriate technologies and to train personnel at the village level for their installation, operation and upkeep. Villages need facilities and services that require a minimum of service from higher levels of government. There is a need for funding at the local level, but funds provided need to be managed according to a regularly planned budget which includes provisions for operation and maintenance.

## Existing AID Programs

Sanitation is not part of a specific sector, but is related to water supply, health services, education and agriculture. Since sanitation problems are due to a variety of factors, it is important that all existing programs be implemented in a way that can deal with the associated sanitation problems. The recommendations presented in this report are linked with existing USAID projects in Egypt, specifically Basic Village Services (BVS) and Strengthening Rural Health Delivery (SRHD).

Among the concerns of the BVS project are the provision of a potable water supply, solution of drainage problems and introduction of sanitation facilities. The installation of any water system must be accompanied with a practical training component. A comprehensive training program is needed for engineer managers on how to manage a maintenance program, the use of tools and equipment, skills training, scheduling, budgets, etc. A practical hands-on training course is needed for operators and maintenance personnel of the water systems at the local level.

There are a number of sanitation interventions that are appropriate for rural Egypt that could be supported by BVS. The most promising intervention appears to be the compost privy. The compost privy is a low cost simple technology that can benefit the most needy in the rural sector. In addition to removing human wastes from the village environment, as does a common pit privy, the compost privy recycles human wastes as a continuous source of fertilizer as well as protects shallow ground water from fecal contamination. The compost privy has been previously introduced into Egypt, but not in any systematic way. A proposal for a pilot compost privy project is presented in the report. It is also proposed that BVS projects implement appropriate drainage systems, such as subsoil drains and soakaways, in conjunction with construction of public water systems. A number of technological options, including cartage, biogas, and communal facilities, are evaluated but not recommended as appropriate at this time.

The SRHD project is concerned with improving rural health care. Part of this project deals with the training of sanitarians, the health personnel at the local level responsible for sanitation and hygiene. Specific suggestions for practical implementation of a training program for sanitarians are made here. In order to promote health awareness, it is necessary that all health personnel practice a preventive approach and provide practical guidance on hygiene. It is imperative that sanitation facilities in the health unit and schools be properly maintained and serve as positive examples.

Although the fostering of health and sanitation awareness requires an effort on all levels, it is crucial that an effective program be instituted in the schools. The existing curriculum does not relate hygiene to the villager, nor does the student perceive a positive sanitary environment in the public schools. A specific

recommendation here is that a school sanitation program be implemented to provide the student with a sanitary school environment and practical instruction on personal hygiene and sanitation.

Because the sanitation problems in Egypt have such critical health consequences, it is vital that USAID implement projects with a concern for improving sanitation. The lack of services and facilities cannot be solved by any one project. However, any contributions to raising health awareness and to providing people themselves with the means to maintain a sanitary environment will work towards a long-term solution.

بسم الله الرحمن الرحيم

## موجـــــز
## تصميـــــم البحـــــث

لهذه الدراسة .ثة أهداف :-

أولا : اختيار سلوك الأفراد والجماعات بالنسبة لصحة البيئة فى الريف المصرى .

ثانيا: تقييم الخدمات والمرافق الموجودة حاليا.

ثالثا: تقديم بعض المقترحات لتحسين صحة البيئة بحيث يكون ادماجها فى مشروعات الهيئة الأمريكية للتنمية الدولية فى مصر.

يتكون فريق الدراسة من عالمان فى الأنثروبولوجيا لهما خبرة واسعة فى منطقة الشرق الأوسط ومهندس مدنى متخصص فى صحة البيئة الريفية .

ولقد تم اجراء البحث فى محافظتين متميزتين هما :-

محافظة المنوفية فى الوجه البحرى ومحافظة أسيوط فى الوجه القبلى . وأجريت الدراسة الأنثروبولوجية عن طريق الملاحظة المعيشية والمقابلات فى أربع قرى مختارة ، وكان التركيز موجها لاظهار تفهم أهل القرى وموقفهم تجاه النواحى المختلفة لصحة البيئة وعلاقتها بالصحة الجسمانية . وفى نفس الوقت قام فريق البحث بدراسة المرافق المحيطة وأجرى مقابلات مع موظفى المحافظتين المسئولين عن الخدمات الصحية وتنظيم الأسرة ومياه الشرب وكسح المجارى وجمع القمامة والزراعة . كما أعد فريق الدراسة صحيفة استبيان تم استخدامها فى " مسح المنازل " فى قرى الدراسة الأربع .

## الخلاصـــــة

يمكن وصف صحة البيئة فى القرى المصرية بأربعة نقاط رئيسية :-

١ - عدم توافر مياه الشرب على نحو كاف .

٢ - نقص فى التسهيلات اللازمة لازالة مياه البالوعات مع وجود مشكلة فى الصرف بصفة عامة .

٣ - عدم توافر التسهيلات الملائمة لاستغلال مخلفات الانسان .

٤ - نقص فى الخدمات والتسهيلات اللازمة لاستغلال القمامة والبقايا الصلبة الأخرى .

وتعد هذه المشاكل نتيجة أساسية لمفهوم صحة البيئة عند عامة الشعب من القروى الى موظف الحكومة . كما يشكل النقص فى امداد الخدمات المناسبة عاملا مساعدا لتفاقم هذه المشكلة .

فهناك شبكات لمياه الشرب ، الا أنها غير مصانة . وهناك مراحيض ، الا أن استخدامها سئ ، كما أن القمامة والنفاية ترمى بدون تفرقة . وعليه فلن يكون هناك تقدما ملموسا فى ظروف صحة البيئة فى مصر حتى يدرك القروى المصرى أن صحة البيئة مشكلة لها تأثير على صحته وحياته وحتى يعى العلاقة بين الماء الملوث والبراز والأمراض ويتفهم ويتقبل الأنظمة التى تهدف الى معالجة هذا الموقف . كما أنه لن يجدي ادخال التكنولوجيا مالم يتم تفهمها بالطريقة الصحيحة . هذا ويجب أن يكون ادخال التكنولوجيا ملائما لظروف البيئة العمرانية والاجتماعية والاقتصادية لكل منطقة .

ولايمكن تناول مشكلة صحة البيئة بفاعلية الا من خلال المفهوم الكلى للمشكلة الأساسية لشعب فاق تعداده كل المصادر والخدمات المتاحة . فالكثافة السكانية للريف والتى قدرت بحوالى ١٠٥٠ فردا فى الكيلو متر المربع ، تجعله متشابها مع أكثر المناطق الحضرية كثافة . فنجد أن كل المجهودات الفردية التى تبذل لتحسين الصحة سرعان ماتتلاشى أمام تلك الظروف غير الصحية . فأى زيادة فى مصادر مياه الشرب والخدمات الصحية عادة مايختفى أثرها نتيجة الزيادة السكانية . لذلك فلن ينجح أى برنامج تعليمى لتحسين الصحة والتوعية لها دون التركيز على تنظيم الأسرة .

## التوصيات

يجب أن تخاطب برامج المساعدات التى تقدمها الهيئة الأمريكية للتنمية الدولية مشكلة المفاهيم والتوعية . فأى محاولة من شأنها ادخال تكنولوجيا جديدة لابد وأن يصاحبها برنامج تعليمى وتدريبى . وهناك حاجة ملحة لادخال برامج تدريبية وتعليمية فى المشروعات الحالية فمشروعات مياه الشرب التى تمولها " خدمات القرية الأساسية " تحتاج عقودها الى أكثر من تعهد لتأكيد تمويل عمليات الصيانة . كما يتطلب الأمر أن يكون هناك برنامج تدريبى شامل للمهندسين الاداريين للمشروع لتدريبهم عمليا على كيفية ادارة برنامج الصيانة وتقدير المعدات والآلات اللازمة والمهارات التدريبية للصيانة والبرمجة

والميزانية ، الخ .. كما أن هناك ضرورة لتقديم برنامج تدريبى عملى آخر للقائمين بتشغيل شبكات مياه الشرب على المستوى المحلى .

وأهم مايجب أن يركز عليه مشروع تنمية الخدمات الصحية فى الريف هو التدريب العملى لموظفى الصحية بالوحدات المحلية . كما يحتاج مفتشو لصحة الى خبرات عملية تمكنهم من اقامة واستخدام المشروعات الصحية بأسلوب أمثل فيجب أن يمارس مفتش الصحة دورا أكثر فاعلية من مجرد القاء المحاضرات واعطاء بيانات غير مفهومة للقرويين . ولكى يتم نشر التوعية الصحية يجب على موظفى الصحة تقديم الحلول العملية للظروف غير الصحية وذلك عن طريق ممارسة المفهوم الوقائى . كما يجب صيانة وحسن استخدام المرافق الصحية فى الوحدات الصحية والمدارس .

ولقد أصبحت البيئة العمرانية للقرية المصرية مكتظة بالقمامة والنفايات . ومن الضرورى ادراك أن هذه الفضلات يمكن أن تكون مصدرا للطاقة فى بلد يفتقر الى مثل هذه المصادر. فيجب أن تهتم المرافق والخدمات الصحية الجديدة بازالة هذه الفضلات من القرية وان أمكن اعادة دورة تصنيعها بدلا من التخلص منها، ونقترح أن تبحث الوكالة الأمريكية للتنمية الدولية مشروع " المرحاض الكومبوست " ( مرحاض سباخ ذو شقين ) حيث يحتفظ هذا النوع بتوازن البراز حتى يسهل ازالته واستخدامه كسماد. هذا بالاضافة الى أنه يتمتع بمزايا أكثر من المرحاض ذو الحفرة المغطى والذى يسبب تلوث الماء الأرضى . كما أن شق المصارف يساعد على خفض مستوى الماء الأرضى خصوصا فى قرى الدلتا التى تعانى من ارتفاع منسوب المياه بها. وقد ييسر وجود نظام محكم لازالة النفايات والقمامة عملية اعادة دورة تصنيع الفضلات الصلبة بدلا من الوضع الحالى الذى لايحدد وسيلة التخلص منها. ويتناول هذا التقرير بالتفصيل مقيدات كل من المشروعات الصحية وفوائدها المرتقبة .

# SECTION 1

# INTRODUCTION

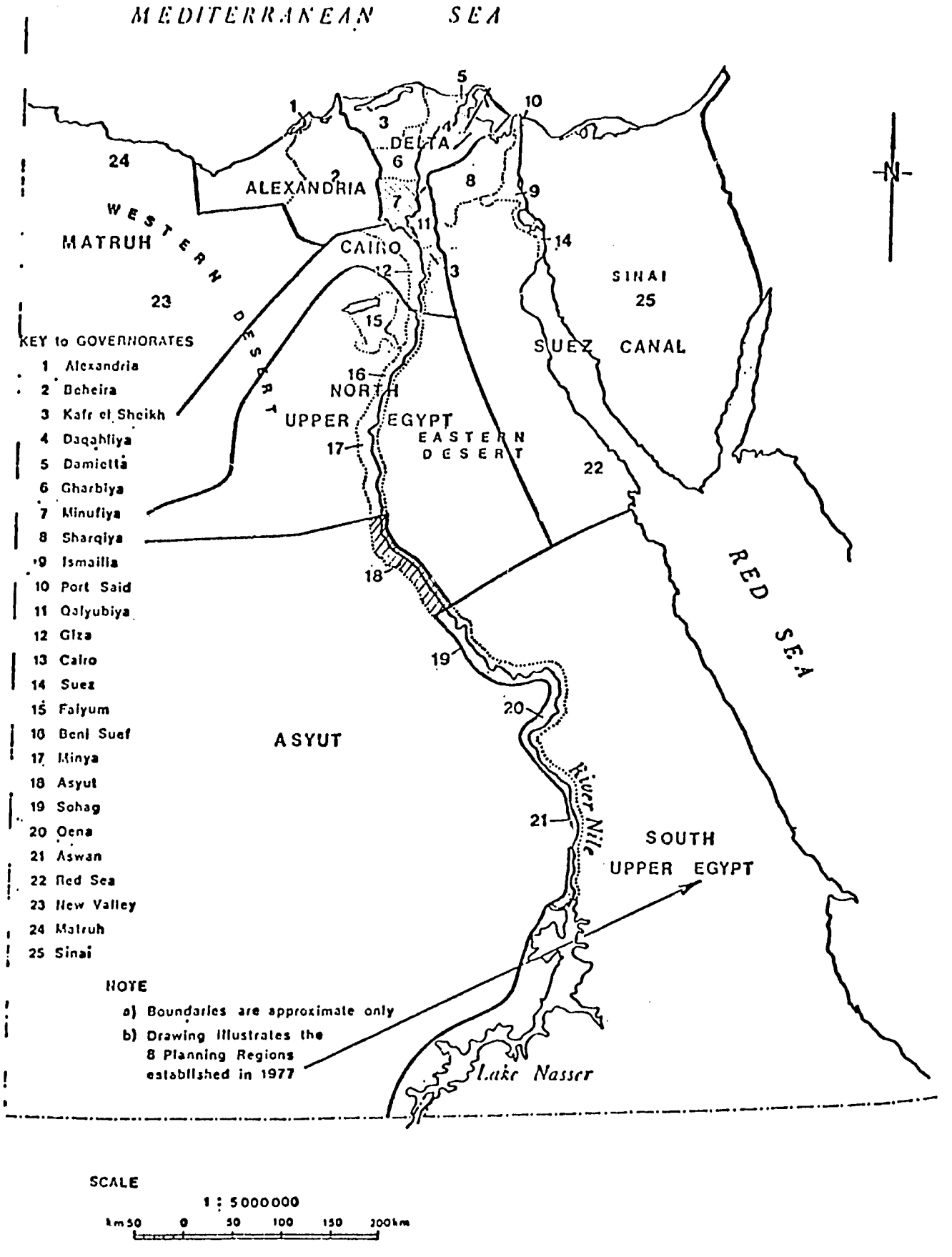
The objective of this study is to analyze the existing sanitation conditions in rural Egypt in order to identify major sanitation problems with health consequences and to develop recommendations for improving sanitation. Sanitation is defined to include the quality of domestic water, the disposal and utilization of human excreta, and use of animal dung as fuel and fertilizer, the disposal of solid waste and garbage, and the general environmental context affecting health. The team assembled by MetaMetrics for this study included Daniel Varisco, an ecological anthropologist and team leader, Dr. Hind Khattab, a cultural anthropologist with extensive research experience in Egypt, and Max Kroschel, a civil engineer in rural sanitation alternatives. The team members coordinated their efforts in order to define the relevant data to be collected and in the evaluation of the results.

The research was conducted in Egypt between January 10, 1981 and March 31, 1981. After several field trips and consultation, two governorates were chosen for the study: Menoufia in Lower Egypt and Assiut in Upper Egypt (Figure 1). Menoufia is the site of an on-going Basic Village Services (BVS) program. Assiut is a site for the AID Strengthening Rural Health Delivery Project. This project will be implemented in three districts of the governorate of Assiut, and include 56 rural health units. The project is already underway in Assiut District, with a total of 20 health units for 28 village councils. The research in Menoufia was coordinated by Dr. Khattab and included the collection of quantitative and qualitative data of the governorate, district and village levels. Parallel research was carried out by Varisco in Assiut.

Before going into the field, team members defined a set of data needs to guide and facilitate information gathering. The anthropologists both observed sanitation conditions in the village and conducted interviews with officials and ordinary villagers. The engineer made several visits to the field sites to interview governorate engineers and officials, observe the sanitation at first hand, advise the anthropologists on technical options and help define the data needs.

In addition to the qualitative data obtained by intensive study in selected villages in both governorates, a household survey was conducted. Dr. Khattab pre-tested a set of some 90 questions in Menoufia. From this the team met and chose a more concise survey questionnaire of 60 questions related to sanitation facilities, attitudes and problems (see Appendix 6). This survey was conducted on sanitation in Shanawan, as well as Babel Wa Kafr El Hamam in Menoufia for a total of 40 households. The same survey was conducted in the villages of El Matiya and Shaghaba in Assiut. The results of the 80 surveys have been tabulated and evaluated as a major part of this final report. It should be noted that the survey was not meant to be a random or representative sample, but was purposely stratified to obtain information on all economic and educational levels.

Figure 1. Map of Egypt with Locations of Menoufia and Assiut




POLITICAL BOUNDARIES

The study combined both qualitative and quantitative methods of research. The qualitative approach emphasized in-depth observation and discussion with respondents. This procedure allowed the anthropologists to probe beneath superficial responses. The chief value of this approach is the ability to identify attitudes within the actual living context, which allows for follow-up and expansion on specific points of relevance. The household survey, conducted near the end of the study, served to generalize the qualitative field data and to provide verification on specific sanitation practices and attitudes. Without the base of detailed qualitative data, the survey results would have been very difficult to interpret accurately.

Survey data was tabulated according to general economic level of the people. Of the 20 people interviewed in each village, approximately one-third were from each of the three general economic levels. This was purposely kept balanced in order to get a general perspective. Individuals with certain general economic levels were chosen with the assistance of a village leader.

Results of the survey were further discussed with the anthropologists and researchers listed in Appendix I to get their general concurrence with the findings and assess the applicability to other areas of Egypt. The results have been incorporated into the general discussion to support basic points in the study.

During the course of the study it was decided to add an assessment of the bio-gas project potential in Egypt for the Basic Village Services program. This assessment is included as an appendix to this report.

The people and organizations consulted during the course of this research are listed in Appendix 1.

## SECTION 2

## OPTIONS AND RECOMMENDATIONS

The study team identified sanitation problems in rural Egypt in relation to water supply and drainage, human waste management, animal manure, and garbage and solid waste. There are a number of possible options for improving rural sanitation in Egypt. The specific recommendations suggested here are linked to existing USAID programs in Egypt, specifically Basic Village Services (BVS) and Strengthening Rural Health Delivery (SRHD).

One of the most essential needs with regard to sanitation is a program for on-the-job training of maintenance personnel to insure proper up-keep and operation of public water systems. Contaminated water is a major health risk facing the Egyptian villager. The technical and social impact of potential sanitary interventions are assessed for the compost privy, cartage, biogas digesters, sub-soil drains, soakaways and communal facilities.

There is a great need for fostering health and sanitation awareness. The SRHD has recognized the need for upgrading training of sanitarians, but this must emphasize practical knowledge and experience. The sanitarian must be able to relate hygiene to the context in which the villagers live. Further, he must have some practical knowledge of sanitary facilities. A specific recommendation for providing health education is a sanitation program for rural schools, providing relevant information and providing an example of sanitary facilities.

### 2.1 SANITATION POLICY

Egypt lacks a sanitation policy. Some government officials are not even convinced sanitation is a problem and funding is grudgingly applied to improve sanitation. It is necessary for AID to adopt a sanitation policy that treats sanitation needs as an essential part of on-going projects in a variety of sectors. There is a need for a model of adequate services and facilities, stressing attainable goals for all Egyptian villages and not just a select few. A specific policy will help coordinate technological interventions, basic services and educational programs into an overall plan to deal with the endemic problems of an increasingly deteriorating environment in the villages.

There are four fundamental aspects vital to an overall sanitation policy in Egypt. First, sanitation must be approached as part of the overall problem of overpopulation. In 1976 over 38 million inhabitants lived on only 3.5% of the total land area of Egypt (1,002 sq. Km.). The population density in Assiut is 2,603 people per square mile. The Egyptian population is currently increasing at a rate of 1,200,000 per year. These figures point to the greatest obstacle affecting development in Egypt — a population expanding beyond its resource base. The dilemma is that the costs of providing adequate water supply, sanitation facilities and services to rural Egypt are enormous. Those few systems which can be implemented will inevitably be nullified by the cumulative effect of a population

expanding beyond the basic services that can be provided. Sanitation must be pursued as part of an overall policy of family planning.

Second, stress should be placed on prevention. The physical network of rural health units can theoretically reach practically the entire population. Many efforts have been made to provide medicine and basic medical services, as well as inoculation against infectious diseases. A major problem in the rural sector is lack of health consciousness. The relationship between health and sanitation has not been translated into terms meaningful to the majority of Egyptian villagers. Although there is a sanitarian in most local health units who is trained in some aspects of sanitation, he has little practical training in appropriate sanitary facilities and domestic hygiene. Efforts need to be expanded, whether through the use of media or trained social workers, to make the villager aware of how he can improve the sanitation of his household and hygiene of his family.

Third, there is a need for appropriate and affordable technological alternatives. The alternatives must be feasible in a high density "rural" environment and must take into account the local environment, especially drainage characteristics. The rural sector should not be treated as a future urban environment. A technical intervention cannot be successfully introduced without developing the necessary infrastructure for the operation, maintenance and future expansion of the system. The approach cannot simply be to build it and forget about it. The existing non-functional public water systems in Egypt exemplify the result of this approach. The installation of flush toilets in public schools and health units, in spite of the fact that there is often no continual supply of water for flushing nor an effective system for waste water disposal, is a prime example of an inappropriate intervention. Attention should be given to alternatives such as compost privies which may deal with the problem of human waste disposal in villages in a manner that is more effective, manageable and affordable than the expensive and technically complicated flush toilet.

Finally, technology transfer in a country like Egypt requires a training and educational component. Many projects are designed and implemented by people who have grown up familiar with modern technology. The Egyptian villager in many areas has only recently been introduced on a limited basis to potable water, electricity and other modern technologies. Due to a lack of previous practical experience and no training, it is not difficult to see how problems arise, particularly in terms of maintenance. It is not that the villager is incapable of learning; it is simply that no effort has been made to "translate" the technology into terms understandable to him. Potable water systems and sanitary facilities do not take care of themselves. Unless the recipient of the technology is aware of how to deal with it, its effectiveness will be short lived.

## 2.2 RECOMMENDATIONS FOR BASIC VILLAGE SERVICES (BVS)

One of the significant findings of this study has been the extent of sanitary problems resulting from improper operation and inadequate maintenance of existing potable water systems in Egypt. Loss of pressure within the system can allow contaminated ground water to seep in through loose connections and holes in the pipes. Major leakages result in pools of stagnant water along distribution lines and near the public water stands. Many of these systems are 20 years old or more and need to be overhauled and expanded. Before building new systems in the rural

sector, the BVS program should insure that the new systems are designed and implemented based on assessment of previous problems. Properly functioning water systems could help towards the elimination of a major health hazard in rural Egypt.

### 2.2.1 Training Program for Maintenance and Upkeep

Although the BVS Project Paper (USAID 1980: Annex VIII) mentions environmental analysis as an important consideration, the emphasis is on monitoring by an environmental consultant. What is needed is a "preventive" approach. A major component of water projects in rural Egypt should be a training program in proper operation and maintenance at the local level. It is recommended that new water projects provide: 1) training in practical skills at the local level; and 2) budgeting for maintenance equipment and spare parts.

The training of engineers responsible for water supply should not simply be according to guidelines established for developed countries like the United States. The training should be related to the context of Egypt, considering the tools, equipment, skills, funding and cultural attitudes that affect the operation of water supply on a day-to-day basis. There is not enough concern with designing systems in terms of past experience. Planning for the future is a necessity, but we must make sure that the future will not always be something that is planned for — the Egyptian villager still lives in the present.

The training of engineers in water supply and sanitation would cover basic design of water systems appropriate to Egypt (hydraulic calculations, materials choice, corrosion protection), and maintenance of water systems (tools and equipment necessary, vehicles and their maintenance, administration and scheduling, training needs of local personnel, how to run skills training programs). In addition, it is important to train engineers in the sanitary options available. This would include design of septic systems, subsurface disposal systems, leach lines, leach fields, mounds, subsurface sand filters, hydraulic dosing, evapotranspiration systems using plants and trees, and design of subsoil drains.

The training of maintenance personnel should emphasize a hands-on, practical approach — on the job training. Simple things like how to change washers and fix faucets need to be understood. The engineers and technicians must also have these practical skills. It is not enough to read about it in a book or listen to a lecture. Consultants and project personnel can supply basic information and provide practical experience training, but ultimately the success or failure rests on "translating" technology and technical training into terms that can be understood. This is imperative at the village level, where the responsibilities will rest more and more on the shoulders of the villagers themselves.

### 2.2.2 Technological Assessment

The high population density and generally crowded conditions of the Egyptian village represent a major limitation to potential sanitary options. On-site disposal of waste material is not generally a practical solution, since villages are reaching saturation limits. There is literally nowhere to throw anything away. Waste products need to be removed from the confines of the village and managed in

a sanitary manner. The only practical long-term solution is to treat waste products so that they can be safely reused with minimal health risk and without further environmental degradation. The disposal of waste would be a steadily increasing expense that villagers cannot and will not be able to afford. Resource recycling offers certain economic returns that can offset the cost of collection and treatment.

Water-carriage waste systems, such as cistern flush toilets, are not appropriate for Egyptian villages due to both physical and social restraints. There is simply not enough water available through existing distribution systems to flush toilets, even if the systems functioned at their designed level. Flush toilets account for 40% of domestic water consumption in industrialized western countries (30 gallons out of a per capita daily consumption of 75 gallons). Per capita water consumption is very low in Egypt, only 10 gallons per capita daily by design standard. Widespread use of flush toilets could easily double or even triple domestic water demand. The flush unit is too costly for the average villager and too mechanically complicated to be serviced by the user.

Both disposal and treatment appear to be inappropriate means of dealing with waste water in rural Egypt. On-site waste water disposal (septic system) requires space that is now intensively used for housing or farming. As noted in Section 4, the existing systems such as the cesspool (transh) do not function satisfactorily and contribute directly to ground water pollution. A sewage system would be too expensive to build or operate. Sewage treatment requires both unused land and energy, neither of which are readily available in rural Egypt.

The most appropriate waste disposal system for rural Egypt is a dry toilet. It can be built by the owner using local materials at minimal cost. When properly designed for environmental and cultural factors, it is simple to operate and maintain in a sanitary manner. Ease of owner maintenance is a critical factor for a sanitary facility. Due to the lack of responsibility and maintenance, public sanitation facilities in schools and health units are often in deplorable condition — contributing to rather than resolving sanitation problems.

### 2.2.3 Proposed Compost Privy Project

It is recommended that USAID implement a compost privy project as a specific sanitary intervention in rural Egypt. The compost privy is an appropriate dry system, removing human waste from the immediate household environment to prevent the spread of disease through contact or disease vectors (particularly flies). The compost toilet both stabilizes human waste and provides a source of organic fertilizer for agricultural production. A compost privy project has been introduced in South Yemen by UNICEF with encouraging results (see Appendix 4).

A suitable compost privy can be adapted from the common pit latrine encountered in Egypt. Two cement vaults to hold the sludge need to be built adjacent to each other. A double vault design is more appropriate than a continuously composting type. The latter relies on the creep of the sludge along an angled floor from one vault into a second which is periodically cleaned out. In this continuous system the seepage of urine to the bottom of the pile nullifies the effect of the compost process in killing off pathogens. These compost vaults can even be built above ground to avoid contamination where the water table is near the

surface, such as in the Egyptian Delta. The vaults each need an access hatch for removal of the compost. A screened vent pipe should be installed to allow the decomposition gases and odors to escape. The squat plate must include a tightly fitted lid to prevent flies from breeding in the vault. The size of the pit should be tailored for one year's use. A diagram of a design for the compost toilet is presented in Figure 2.

Justification for Project

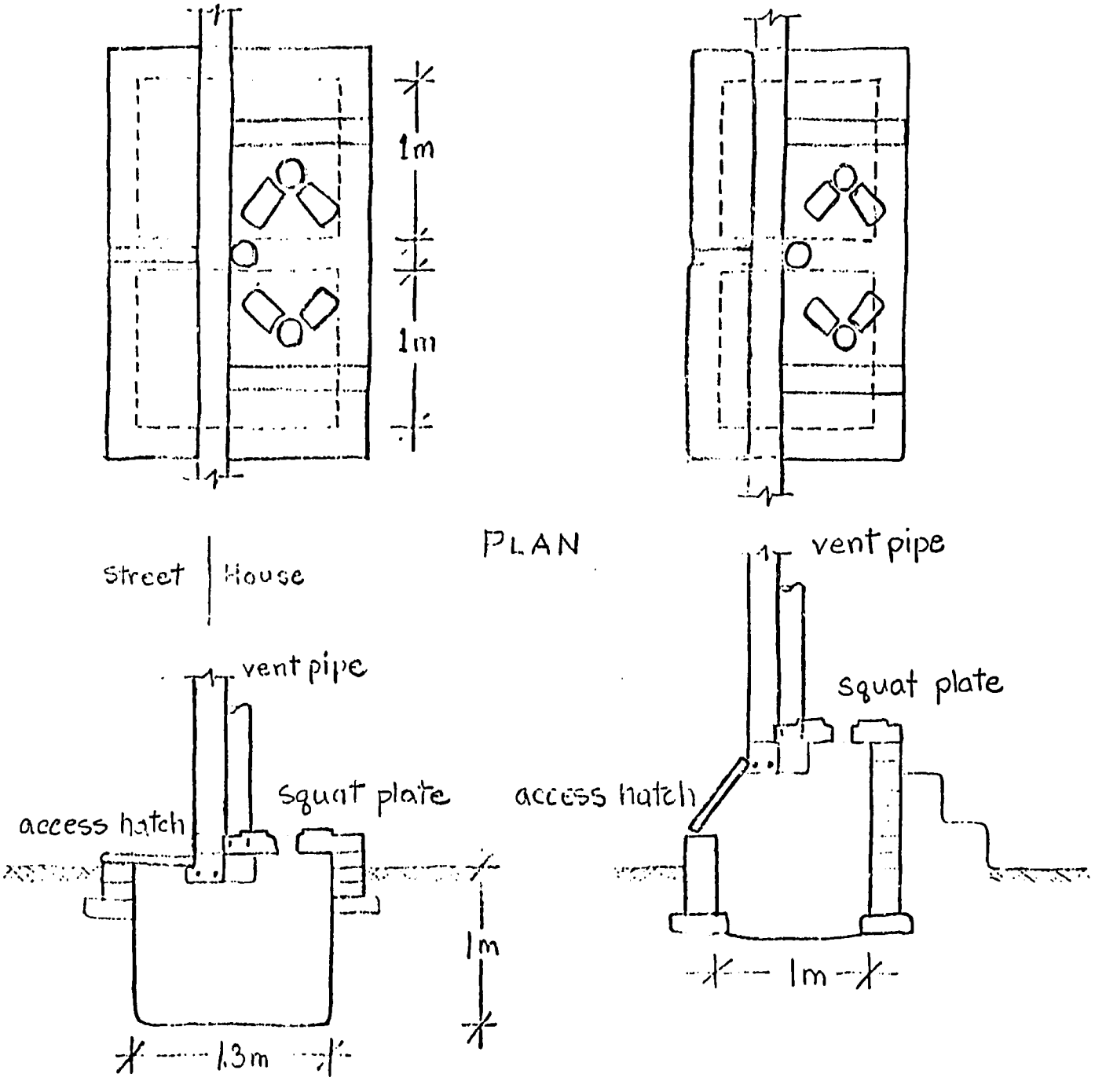
- The compost privy is a low technology intervention which can be operated by the villager with minimal training. It does not necessarily require an institutional infrastructure to be maintained or expanded. Responsibility can be taken over completely by the private sector without need for continued government support.

- The compost privy is a low cost sanitary facility that can be introduced using available materials and labor at the local level. Composting human waste will significantly reduce the chances of contamination and the concurrent spread of disease.

- After one year of aging the aerobic compost process destroys 90 to 95% of of the pathogens and parasites in human waste. In Vietnam, the Ministry of Health reported that compost privies have reduced the incidence of parasitic infestation by 50%.

- Human waste can be composted to produce organic fertilizer in this system. According to discussions with agricultural faculty members at the University of Assiut, there is a general decline in the availability of organic fertilizer from domestic animals in Egypt. In some areas, particularly newly reclaimed land, there is a need for organic manure to supplement chemical fertilizers. If 15,000,000 rural Egyptians were to use the compost privy, the annual fertilizer production would be 45,000 tons of nitrogen or the equivalent or 2,500,000 sacks of urea fertilizer, which would have a total open market value of 25,000,000 LE. per year. The calculations for this figure are as follows: an average human excretes one half pound of feces (.15 lb of dry weight) and one quart of urine (.15 lb dry solids) per day. At 6% nitrogen in feces and 16% nitrogen in urine, this gives the nitrogen equivalent of .033 lb per person per day (.15 lb x .06 + .15 lb x .16). The yearly equivalent is 12 lb nitrogen per person. Assuming that not every member of a family will use the privy all the time and that some of the nitrogen will be lost during composting, it should be possible for 50% of a family's excreted nitrogen to be collected yearly. For an average family of six, this would result in 36 lb of nitrogen per year (12 x 6 x .5). This is equivalent to a 50 Kg sack of urea fertilizer (30% N), the open market value of which is 10 to 12 LE (about double that of subsidized government prices). A family could build a vented two vault privy for less than 50 LE, so that the value of the nitrogen would pay for the privy in five years. If the value of the potassium and phosphorus is considered, the payback period would be even less.

# COMPOST PRIVY DESIGNS FOR EGYPT




PIT VAULT FOR UPPER EGYPT

ABOVE GROUND VAULT FOR THE DELTA REGION

Figure 2

- There is precedence in Egyptian agriculture for the use of human manure. The sludge removed from pit latrines is commonly mixed into piles of animal manure. Some crops, particularly melons and strawberries, are said to grow better if human manure is supplied. The use of human manure is attested in medical Arabic agricultural treatises (Ibn al-Awwam 1802). There appear to be no specific objections on religious grounds, even though excrement and urine are ritually polluting in Islamic religion. A compost toilet has already been developed in the governorate of Qalyubia, near Cairo and is now being recommended for use by the Ministry of Health in Menoufia (see Appendix 3).

- The compost privy is an intervention that can benefit the most needy sector of rural Egypt, i.e., the poor farmers who have no latrines. If the sanitation of the poorest families can be improved, it might have a positive influence on other sectors of rural Egyptian society.

Input Needs from AID or Donor Agency

- Construction Costs. A compost privy can be constructed in rural Egypt for as little as 50 LE for the materials per unit excluding a superstructure. The estimated construction costs are identified in Table 2.1.

Table 2.1

Estimated Construction Costs for Compost Privy in Rural Egypt (not including labor)

| Item | Unit Price | Amount Needed | Cost (LE) |
|---|---|---|---|
| Cement | 3.75 LE/sack | 2 sacks | 07.50 |
| Sand | 2 LE/$m^3$ | 1/2$m^3$ | 01.00 |
| Fired bricks | 20 LE/1,000 | 500 | 10.00 |
| Squat plate | 5 LE | 2 | 10.00 |
| Hatch cover | 5 LE | 2 | 10.00 |
| Vent stack | 10 LE | 1 | 10.00 |
| Lid to cover hole | 1.50 LE | 1 | 01.50 |
| Total | | | 50.00 |

The Donor Agency could make available the squat plate, hatch cover, vent stack and lid for the pilot project (approximately 31.50 LE per unit). The other materials are readily available and could be shared in cost between the villager and the Donor. Labor is available locally, skilled builders receiving 6 LE per day and unskilled laborers taking up to 2 LE per day. The villagers could assist in the construction.

- Training. Local builders in Egypt are familiar with the arched brick, bottomless vaults currently widely used as cesspools. A practical training schedule of design modifications could be made available at the proposed project site. This should be done by Egyptian engineers specifically trained for implementing construction design.

- Monitoring. Practical instruction on use of the facility should be coordinated by the local sanitarians. A training program could be done in conjunction with the AID Strengthening Rural Health Delivery Project. Practical instruction on the removal and use of the composted sludge should be provided by a worker from the local agricultural cooperative. There is no need for institutional monitoring at the governmental level.

Implementation of Project

There are in Egypt several on-going AID funded projects which could incorporate a sanitation component. Both the Basic Village Services and the Strengthening Rural Health Delivery projects could include sanitation work. UNICEF has also expressed some interest in this area. Given the magnitude of the problem all can have a significant involvement. The initial stages of the recommended compost privy project will require some experimentation to develop a working model composting toilet which can be installed with minor variation throughout the country.

- Development of Project Design. The project should be designed by a three person team capable of evaluating the technological, sociological, economic and institutional project alternatives to determine how and where such a project could best be implemented.

- Selection of Village Site. A pilot project should include at least five villages in a district. Contracts could be made through the village council to find some of the poorest farmers, especially those on the outskirts of villages without any sanitary facilities. It is suggested that a minimum of ten households be included in each village.

- Pre-Construction Training. Short practical training courses should be given to a few local builders, the local sanitarians and a member of the agricultural cooperative society. These should be developed by a team with expertise in compost toilet facilities, health consequences of sanitation and use of organic fertilizers.

- On-Site Implementation. A team should be sent to the field site to oversee and coordinate the construction of the privies. This can be coordinated through the governorate ORDEV office. Included in the team should be an anthropologist with experience in rural Egypt. He or she could help in the providing of practical information in terms understandable to the villager, while at the same time helping the other

members become aware of local cultural attitudes that have a bearing on the project.

- Building a Sense of Responsibility. One of the biggest problems facing any development project in rural Egypt is the lack of awareness on the part of the recipient that he must take the responsibility for that which he has been provided. For this reason, it is important that the villager share in the minimal cost of the unit and that he receive practical training that is relevant to his agricultural practices.

- Follow-Up Assessment. An Egyptian trained by the team should be sent to follow-up on the use of the facility after the first yearly removal of the sludge. A formal report should be submitted to AID assessing the project and recommending modifications and expansion.

### 2.2.4 Cartage

The simplest and cheapest waste removal system is cartage, a system that has been successful in densely populated areas of the Far East, specifically China. Many of the elements of a cartage system exist in towns and villages of rural Egypt, particularly the use of donkey carts in the removal of sludge. These services, however, are incomplete, inadequate, uncoordinated and inefficient.

Cartage is a communal effort at waste disposal. Each residence must have a container or chamber pot with a tightly fitting lid for collection of nightsoil, household organic wastes and sweepings. This material would be collected daily in a cart and taken to a site at the edge of the village. The waste material would be composted for use as fertilizer. This compost could be sold to farmers to help cover the cost of collection. Separate carts would be used to transport trash and garbage collected from the streets, particularly from open markets. Recycling of various elements of trash would depend on the quantities produced and the markets available. Paper and cardboard could be composted if there was no market available for it.

The costs of a cartage system as well as the responsibilities, are divided between the public and private sectors. Individual households must have their own chamber pots. The community would provide the funds for the collectors' salaries and the upkeep of equipment. Sites for composting the wastes would have to be allocated. Existing pump trucks, which clear out the cesspools, could deliver their materials to the compost site or sites for processing. Additional space would be needed for segregating and storing recyclable materials such as metal, plastic and paper.

In some respects the collection and recycling system of the Zabbalin in Cairo (El Hakim 1976) sets a precedent for a cartage system. However, the Zabbalin do not collect human wastes. Furthermore, the Zabbalin are an outcast social group in Egyptian society. Cartage is technologically simple and low cost, but it requires a high level of cooperation, collaboration and coordination between private individuals and the public sector. The coordination of a community-wide cartage system is beyond the present capability of the village councils. Although there has long been cooperation between Egyptian farmers in agriculture, there is no tradition of cooperating in the disposal of wastes.

Although a cartage system is not feasible at this time, a modified cartage system could evolve over time. The compost privy represents the first step towards a cartage system. These would serve as on-site waste collection and storage facilities for individual households and even public buildings. There would be no need for daily collection of wastes, but only occasional collection from those households with no need of organic fertilizer or with individuals who do not wish to deal with the wastes directly. Private collectors would continue to service their customers, and public service would only be supplemental.

The most important aspect of a cartage system is the processing site, where organic wastes are composted and trash is recycled. The site could be small to begin with, but there should be room to expand. Both donkey carts and septage pump trucks could be used to bring wastes to the site. A cartage system cannot be installed overnight, but with the initial set-up of compost privies, it could become a goal for the village community to work toward.

### 2.2.5 Biogas Technology

Considerable interest has recently been generated in biogas digesters as potential sanitary interventions. However, many of the claims in the literature about the sanitary treatment aspects of the anaerobic process are inaccurate or misleading. The major beneficial aspect of the operation of a biogas (anaerobic) digester is that organic wastes are removed from the environment so that flies and other disease vectors do not have access to them. The biogas unit also generates methane gas, which can be used as a local energy source.

The anaerobic digestion process, however, is not in itself a reliable sanitary treatment for human wastes. It does not destroy as large a proportion of pathogens and parasites contained in human excreta as is sometimes claimed. There is a reduction in these organisms, but the rate is not much higher than the normal environmental die-off rate. The literature on biogas in China, where it has been implemented so successfully, indicates that reduction of parasite eggs in digester effluent is due to sedimentation (physical separation) inside the digester. The parasite larvae and eggs are concentrated in the sludge at the bottom of the digester. This sludge, which must be periodially cleaned out, has a higher concentration of parasites than the raw excrement influent. This is recognized by the Chinese, who mix the sludge with straw and hot compost it to treat it before use as fertilizer.

The major problem with the use of a biogas digester for domestic waste management is that it requires daily attention and maintenance. The system does not dispose of wastes, but merely processes them. A quantity of liquid manure effluent is produced daily. This must be dealt with on a regular basis or the net effect on sanitation would be the same as a failed (overflowing) septic system. A full discussion of the potential of biogas technology for rural Egypt is presented in Appendix 5. In light of the shortcomings, biogas digesters cannot be recommended as generally applicable for use in rural Egypt.

### 2.2.6 Soakaway

One of the major sanitation problems related to the public water systems is the lack of adequate drainage at the public water stands. A soakaway is a low cost drainage system for standpost water taps. This is generally just a gravel filled pit. Water either falls directly on the gravel from the faucet or is directed into the gravel from a basin via a concrete or ceramic pipe. The pores in the gravel act as a reservoir for the water until it can soak into the surrounding soil.

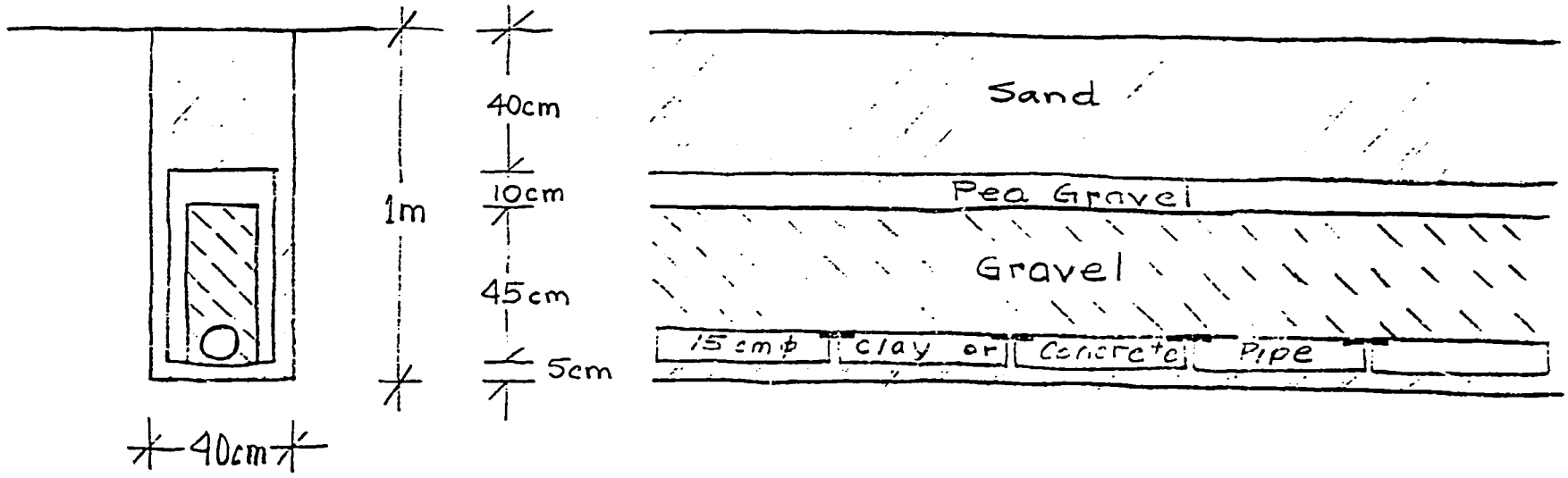
Soakaways fail when the pores become filled in with particles either due to intrusion of soil particles from the sides and top of the pit or from organic matter and grit washed in from wastewater. Soil intrusion can be prevented and the infiltration rate (efficiency) of the soakaway improved by using layers of graded aggregate in trenches rather than just gravel. Sand is placed in contact with the soil wall of the trench. This is followed by a layer of pea gravel and then the core of the trench is filled with the larger gravel (See Figure 3). The pea gravel prevents intrusion of the finer sand, which in turn excludes the finer silt and dust soil particles. A "shadow" is formed where gravel in a drain is in direct contact with fine soil, reducing the effective soil area for water infiltration. The sand layer eliminates this problem.

A settling basin at the public water stand is necessary to prevent clogging of the gravel with organic matter and grit from the incoming wash water. The basin would need to be cleaned of sediment periodically to continue to function properly. This should be made part of the inspection and maintenance routine for the water stand. Maintenance is essential, since a continually dripping faucet would soon overload the best soakaway.

In the Delta where the water table is high, there is minimal soil capable of absorbing waste water. The use of trees with a high evapotranspiration rate is recommended to assist the dissipation of waste water and sullage. The locally available Eucalyptus tree would be useful for this purpose. The trees would provide shade in summer and could be pruned periodically for supplemental fuel. The use of trees with soakaways in rural Egypt is recommended, so that even waste water can be recycled. Thus, this would be appropriate to Upper Egypt as well as the Delta.

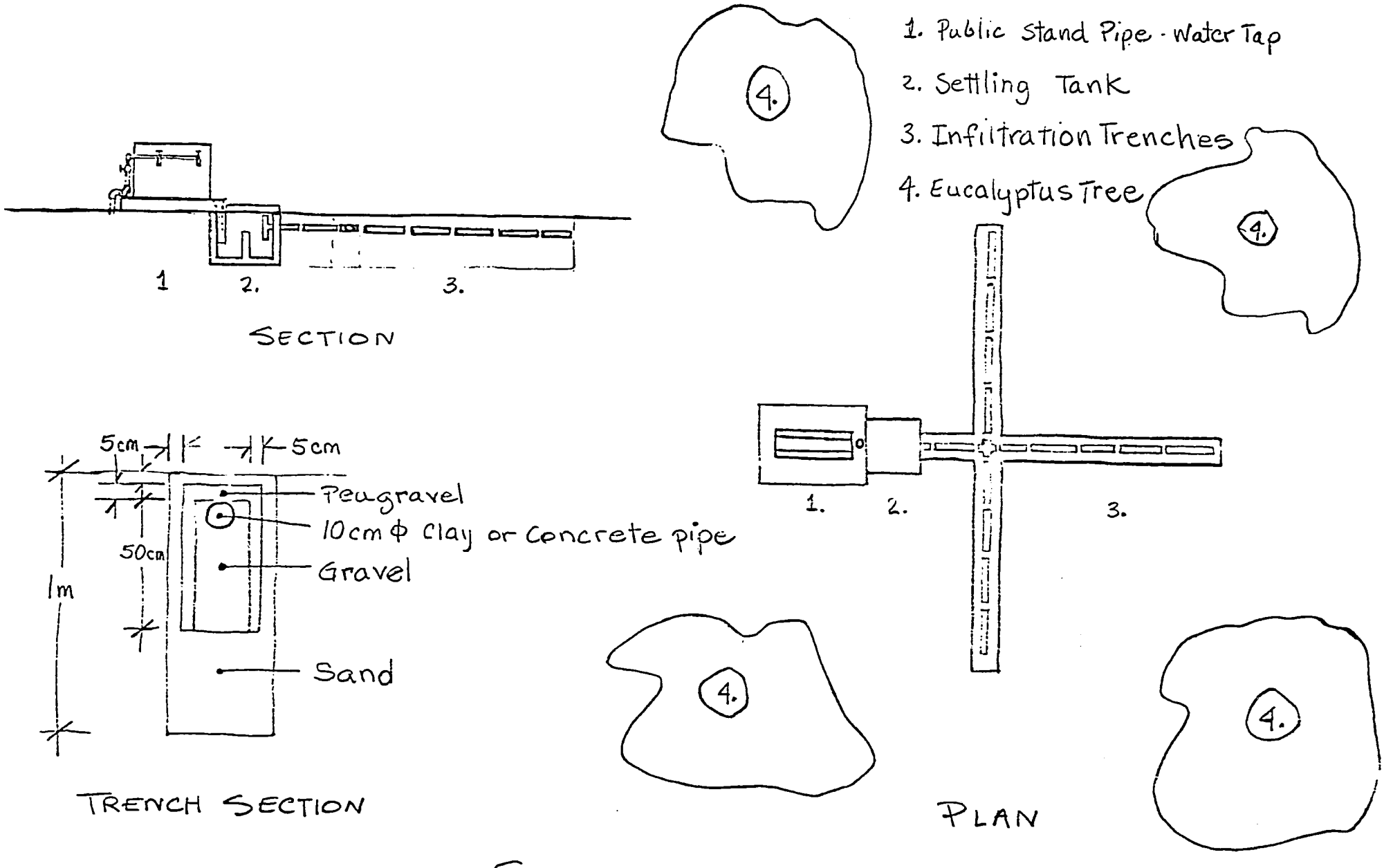
### 2.2.7 Subsoil Drains for Waterlogged Villages

The situation of waterlogging and saturated soils in the Delta region of Egypt is related to environmental sanitation. An intermediate solution for this problem is the construction of subsoil drains to allow subsurface water to flow rapidly to the drainage canal (See Figure 4). Construction would be similar to agricultural drains. Small diameter (6-8 inch or 15-20 cm) concrete or clay pipe would be laid with open joints (to allow for infiltration) in a bed of gravel in trenches down the center of major streets out to the drainage canal. The pipe would be completely surrounded with 15 -35 mm gravel. A second layer of peagravel (3 - 12 mm) of 75 mm thick surrounds the larger gravel and the rest of the trench is filled with sand. The effect is that of a slow sand filter with an underdrain.




SUBSOIL DRAIN

Figure 3




SOAKAWAYS

Figure 4

No house connections are made directly to the drain. Water should filter through the natural soil and then through the sand to reach the drain pipe. This will considerably reduce the solids contents. In essence, the soil and sand serve to filter the water and afford it a certain degree of treatment. Individual households and public standposts would still require soakaways, but these should perform better with the ground water table reduced to the level of the drainage canal.

Rigid quality control would be necessary during construction to insure that the gravel and sand were properly placed and to prevent direct house drain connections. The sand and gravel have to be placed in graded sequence. Otherwise, the sand will fill up the gravel pores and the drain will clog. Direct connections to the drain from houses must be strictly prohibited or the drain will become a sewer and grossly pollute the open drainage canal.

### 2.2.8 Communal Sanitary Facilities

One of the potential interventions in a society where there are inadequate private facilities is to provide communal facilities for washing dishes and clothes, bathing and latrines. The technical design can be tailored to meet local interests, but the location and use of such facilities depends on a combination of cultural factors. These factors are outlined below based on the findings of the research study.

#### Interest in a Communal Facility

The idea of a communal facility in general is found in Egypt. In urban areas there were public baths, however, these were never part of traditional village life. The mosque generally includes a communal facility for defecation and ablutions, but these are restricted (except in a few urban cases) to men. Essentially, defecation and bathing are very private. Even acts commonly done in public, such as urinating, are made private by the discretion of the act (e.g., squatting with the robe or galabiya providing cover from general view). In fact, most communal facilities in the western world recognize a need for privacy.

The question "private" vs. "public" is crucial to understanding attitudes in rural Egypt regarding communal sanitary facilities. In the western world it is the act itself (e.g., bathing or urinating) that is either private or public. In Egyptian culture there is a pervasive idea the the actor is "private" or "public." In a very real sense the man belongs to a public world and the woman must operate in a private world focused on the house. Given this basic factor of traditional culture, the introduction of anything communal or public that involves women raises a problem.

In answer to the survey question about wanting a communal facility for washing, the answer varied according to sex. In Menoufia the men were uniformly against the idea ("A woman's place is the home" mentality), but the 20 women without potable water at home welcomed the idea. In Assiut both the men and women were generally against the idea. One of the women surveyed who thought it might be a good idea was very wealthy. She did not need to use such a facility, but she thought it might be a good idea for the very poor, who are far away from any potable water system. Transporting water is a major time-consuming activity of women. A female informant in Assiut said that she would always prefer to do her

washing and bathing at home and what she really wanted as a water connection in the house.

Is there sufficient interest in the rural sector to define a communal facility as a felt need? Clearly, there is a "need" on the part of many women. It is important to take into consideration what the women think, because it is a viewpoint rarely asked. The women are the ones who suffer the most from the lack of facilities, since they have least access to sanitary facilities and are responsible for domestic chores. There is clearly a need for those who are most poor and have no choice but to use contaminated canal water. However, the fact that most men do not want communal facilities for women of their households is something that any project implementation plan must take into consideration. There is definitely a need and evidence suggests an interest among women who live with that need day by day.

Design Criteria

One of the first considerations is what the facility should include. Washing utensils, laundry, bathing and defecation are not all on the same order of cultural distinction. An important consideration is the fact that defecation is a polluting act. The traditional pit latrine is for defecation and urinating only. If water is provided, it is for anal cleansing. Even in many new houses, the sink for washing is located outside the latrine. Because of basic design criteria copied from the western world, there is appearing a "bathroom" with flush toilet, sink and shower. However, the school latrines examined in Menoufia and Assiut clearly demonstrate that the traditional distinction still holds force. The functional sinks are invariably found outside the latrine room. It is suggested that any facility designed clearly separate the place for bathing from the place for latrines.

If a facility is to be used for washing and bathing, it must have hot water. Traditionally in winter, water is heated in the home for the bath. Women surveyed in the study said that hot and cold water should be provided. Also, there is generally a problem at public stands with the lack of sufficient faucets. Since washing is a daily activity, there should be enough faucets to avoid overcrowding. Wash basins that the women themselves feel comfortable using need to be provided. The shower stalls must be separated and private. Adequate room must be provided for dressing in private.

A concrete washing stand could be built along a canal, where access to public water is not available. A sand filter could act as a soakaway to filter out and partially treat water returning to the canal. It would filter through sand and soil into the canal, rather than return directly. Several pitcher type hand pumps would provide ground water for washing. The pumps would draw water from the canal through soil to filter it somewhat. The facility would have a sloped concrete surface to serve as a washboard and a separate deep sink for soaking and rinsing. A shallow sink could serve for washing of dishes and utensils. If a public water system was near, fresh water taps would provide for the rinsing.

Location

The best locations for community facilities must be determined after a survey of the specific village concerned. In general, there is a felt need to cover each section of the village. Several informants indicated that facilities should help the poorest, those generally farthest from existing village water stands. A woman in Menoufia made the interesting observation that the facility should be placed in a discreet spot, so women could come and go without attracting attention. Thus, it should not be built near a public facility where men congregate.

Operation and Maintenance

Theoretically, a communal facility could be introduced into Egyptian villages. There are certain cultural barriers to overcome, but these are neither impregnable nor sacred. Practically, it is difficult to imagine such a system really working. Based on the use and maintenance of previous interventions, the sanitary problems created by a communal facility would probably be greater than the benefits. There are technical considerations, such as the provision for adequate drainage, an effective way of supplying hot water, repairs to the plumbing, etc. These facilities would be provided in many cases to the very poor — those least aware of what they are using and least able to maintain it. The infrastructure of the village council is not currently providing for what limited facilities and services have been introduced. It is uncommon to find a properly maintained and sanitary public water stand. How could a more complex facility be cared for?

The crux of the problem is that the Egyptian villager must ultimately provide for his own development. The basic needs in this country are beyond the capabilities of any infrastructure that can be realistically imposed after the fact. To simply go on building facilities that depend on future implementation of basic services is to add to the problem. A communal facility is an important idea and serious efforts should be made. We cannot recommend any project which would provide such a facility, unless it is modified according to existing services and manpower.

## 2.3 RECOMMENDATIONS FOR STRENGTHENING RURAL HEALTH DELIVERY (SRHD)

There is a vital need in rural Egypt for educational outreach on personal hygiene, nutrition and sanitation. The villager has no practical awareness of the link between specific sanitation problems and disease. As old sanitation problems become more acute and new problems are introduced, a preventive health program becomes more and more vital. Health facilities are spread throughout Egypt, but health services do not reach much of the general populace.

An important goal in improving health services for rural Egypt is to equip health personnel with the practical knowledge needed to guide the villagers in maintaining a healthy environment in the home and in the village. Only an effort by a wide spectrum of public officials and private individuals can have an effect on the existing sanitation problems. The villagers need to be provided with practical alternatives to problems that have accelerated beyond their abilities to deal with them. It is not enough simply to identify the problems; realistic solutions must be proposed and communicated effectively.

The drastic health and sanitation problems affecting rural Egypt cannot be solved by one program. However, rural health delivery can be made more effective by helping people become aware of specific health hazards and by providing practical alternatives through example and educational outreach. The two specific recommendations of this report for SRHD are the need for a practical hands-on training component in the education of sanitarians and the development of a school sanitation program.

### 2.3.1 Training of Sanitarians

Within the existing rural health infrastructure in Egypt, the sanitarian is the official at the local level responsible for improving and promoting sanitation. A training manual has been prepared by Miller (1980), which identifies a variety of sanitation problems and lists several potential sanitary interventions. The parameters of a training program are set forth, but the mechanisms for implementing such a program in the field are not indicated. It is important to implement a training program for sanitarians that addresses itself to the specific problems and feasible alternatives of rural sanitation and hygiene.

The specific aspects of a training program for sanitarians in the SRHD project need to include the following:

- a refinement of the potential range of curriculum that is relevant to sanitation problems in rural Egypt;
- a practical training component in the types of sanitation facilities, their proper use and maintenance; and
- training for effective communication and educational outreach to the villagers.

The potential range of curriculum has been outlined by Miller (1980), but this needs to be refined. There are three basic responsibilities defined for the sanitarian: 1) clerical duties; 2) inspection of facilities for health risks to the community; and 3) health education outreach. There is a danger in creating too many clerical duties for the sanitarian, which will prevent him from helping to deal with sanitation problems in the community. The sanitarian must have maximum contact with the villagers; thus, his role should be that of an extension agent. The sanitarian can perform an important function in inspection of public water systems, latrines in schools and health units and food-handling facilities. However, he should be trained with knowledge of how to lessen and prevent health risks rather than simply documenting problems.

The general curriculum of relevant health education needs to be supplemented with practical experience-oriented training in the types of appropriate sanitation facilities and services. If the sanitarian is to have an impact on sanitation in the local community, he must be able to offer specific suggestions for dealing with the problems people face. For example, the sanitarian could be trained in the basic construction design and maintenance needs of a compost privy, in conjunction with the implementation of a compost privy project as outlined in this report. Due to the fact that existing sanitation facilities are often unsanitary in schools and health units, it is important that the sanitarian have the practical

experience necessary to insure proper maintenance and cleaning on the part of custodial workers.

The sanitarian must be trained to have an effective educational outreach. The mere reciting of a lecture in a public health center is not sufficient. Awareness of health risks and ways to improve personal hygiene and sanitation must be communicated in concepts and terms understandable to the villagers. The potential of audio-visual materials needs to be carefully evaluated. The use of movie projectors can become problematic, for example, if there is no one capable of repairing the projector or if relevant films are not readily available. Practical visual guides, such as the magnetic plastic sheets designed by MacMillan (1981), are inexpensive and appropriate to outreach in the villages.

The report by Miller (1980) provides a range of materials for a training program, but there is a need to design an implementation program relevant to rural Egypt. This is especially the case for sanitarians who are trained to return to their local communities. The skills needed to implement such a training program include a specialist capable of designing a practical hands-on training program for appropriate sanitation facilities, a specialist capable of balancing practical training with basic health education, and a social scientist to assess the relevance of the training program to the needs of the community and cultural context of the trainees. Knowledge of Egyptian culture and Arabic is a high priority, especially for the social scientist. The inclusion of male and female social scientists in the team is advisable, since hygiene and sanitation are often topics specifically related to one sex or the other.

The goal of this training program must be to train Egyptians to be the trainers of health personnel. Thus, it is not only important to train a selected group of sanitarians, but to set up a continuing program for health training. In all phases of any training program, the specialists should work in close consultation with Egyptian health officials and university medical faculty.

### 2.3.2 School Sanitation Program

The students in rural Egyptian schools do not receive relevant instruction on personal hygiene and sanitation. The facility itself does not provide a positive example of a sanitary facility. It is recommended that USAID implement a school sanitation program specifically for rural schools. This would involve the development of a supplemental educational package on hygiene and sanitation, as well as a program to insure proper upkeep and maintenance of school latrines.

The standardized curriculum on hygiene and sanitation is far removed from the context of rural Egypt. A school text for the first grade includes a lesson with pictures of sanitation facilities, but these are western-style flush toilets, urban bathrooms and even bidets. Many of the school children in rural areas have never seen these facilities. No practical information relevant to the living context of the student is provided. The result is that a rural student assumes that he cannot have a sanitary environment in his own village.

There is a need for a supplemental educational package that addresses the sanitation problems and alternative solutions relevant to existing conditions in rural Egypt. An artist should accurately depict scenes from the village context that the

student can identify with. Posters and audio-visual materials can be provided. The package should be developed by a health educator with experience in rural Egypt. The emphasis must be on effective communication to the rural student. Materials should be as simple as possible, so that teachers can use them without the need for formal training. The sanitarian could be trained to help teachers present the lessons on hygiene and sanitation to the students.

No educational package can be successful unless the student has a positive example to follow. Existing school latrines are usually in need of repair and represent serious health risks to the students. An essential part of any school sanitation program must be the provision of clean and properly functioning latrines. In areas with frequent interruptions in water supply, alternative sanitation facilities, such as compost privies, should be considered.

# SECTION 3

# RURAL INFRASTRUCTURE AND THE EGYPTIAN VILLAGE

The key to understanding the Egyptian village is the realization that it is characterized by a high population density and limited space for expansion. A village may contain from several hundred to as many as 30,000 inhabitants. In many respects the rural sector in Egypt shares the same basic problems with the urban environment. The general high density of rural Egypt is significant for the proposed introduction of sanitary interventions. Some interventions that have worked successfully in village communities in other parts of the world may not be appropriate for Egypt. The sheer volume of people necessitates an approach to environmental sanitation based on close cooperation at the local level and/or effective organization of services at higher institutional levels.

A village (qarya) is represented in an institutional sense by the village council (maglis al qarya), which consists of a president and locally elected council members. This council meets formally about once a month (in El Matiya, in Assiut), but many decisions are made between formal meetings. The village council is complemented by a local village unit (wahda mahaliya), which consists of on-going personnel responsible for clerical work and certain basic services. Among the services available at the village level in many Egyptian villages are public water systems, health units, agricultural cooperative societies, primary schools, various social welfare units and mosques or churches. Since 1974 access has been established to a village bank. Above the village is the level of the district (markaz). At the district level are departments responsible for services like public water supply, rural health care, sewage collection and garbage collection or street cleaning. In Assiut District most of the services are concentrated in the city of Assiut; in fact, the district officials are mostly housed in the city council (maglis al madina) building. Several village council presidents interviewed indicated that many of the services provided by the district did not really extend to outlying villages. Above the district level is the governorate (muhafaza), and which is the main link with the central Egyptian government. The permission of the governor is necessary for projects and some services in the villages. Some village council presidents said that it was often necessary to go right to the governor, avoiding the intermediate district level, to get action or funding. The budgets for the village councils and for all services in the governorate are determined at the governorate levels. If sanitation interventions are to be implemented in rural Egypt, it is important to understand the existing institutional framework within which the village must operate.

## 3.1 GENERAL DESCRIPTION

A brief description of the Egyptian village is useful before detailing the infrastructure of those villages analyzed for this study. Most houses in Egyptian villages are constructed of mud brick, which can be manufactured locally and dried in the sun. Mud brick is inexpensive, but presents structural problems which limit upward expansion. Most new houses are constructed of fired bricks, which are in

some cases built up within reinforced concrete frames. In Assiut it is quite common to see large piles of bricks in the agricultural fields and on the outskirts of villages. These piles are actually kilns, which are fired after a special type of gas has been poured over the bricks. Unfortunately, the use of mud as mortar in some construction compromises the structural strength of the fired bricks. In Assiut the cost of a thousand fired bricks is about 20 Egyptian pounds, and the cost of a thousand mud bricks about 7 to 10 pounds.

The houses in the village are often connected together and the streets are narrow. There does not apear to be much wasted or extra land available for expansion and new construction. The use of sorghum stalks as roofing material in the village of Shaghaba in the governorate of Assiut was cited by a local official as a serious fire hazard, particularly in summer. The actual houses vary in size and construction. A poor family may live in a mud hut without any effective covering overhead. One house in Shaghaba had one small room, a passageway and a stable; 15 people lived here. Houses of wealthier families may have more than one level. It is practice in some villages to build up when a son is married and needs a place to live. Many villagers have domestic animals, which are kept in a stable inside the house. Services such as electricity and potable water rarely reach the majority of houses. Many older houses, particularly in Assiut governate, do not have any sort of latrine.

The streets in the village are universally littered with animal dung, sullage and garbage, although people often sit outside the house near the door. A traditional architectural item seen in villages is the mastaba, a mud brick bench in front of some houses where friends and neighbors sit and talk. It is significant to note that the Egyptian villager spends a great deal of time outdoors, particularly in the villages studied in Assiut. Even the roof of the house is an important place for the villager — a place for storage, for a latrine, and for some domestic activities.

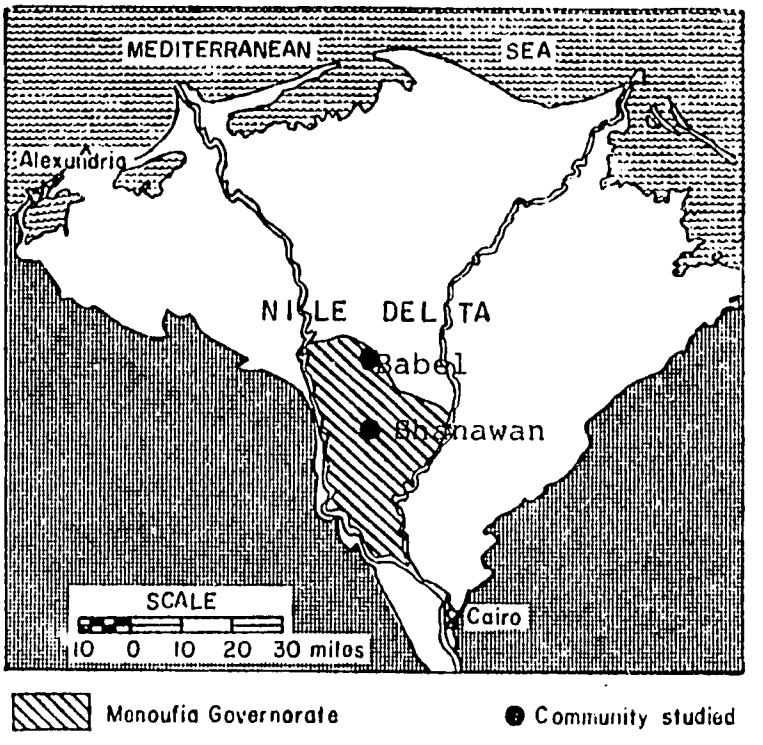
## 3.2 PROFILES OF VILLAGES STUDIED

The villages selected represent the basic ecological and economic differences between Upper and Lower Egypt. For Upper Egypt the research was conducted primarily in four villages of Assiut governorate. Two of these were near the Nile and two were adjacent to the western desert. For Lower Egypt the field study was carried out in three villages of Manoufia governorate (see Figure 5). A general overview of the infrastructure of the villages studied is outlined in Table 3.1. A profile of the villages is presented below.

The village unit of El Matiya is in Assiut district of Assiut governorate. Six villages are served by the village council, representing a total population of 35,793 in 1979. The main village of El Matiya houses the village unit offices and has the most facilities and services available in the unit. The satellite village of Shaghaba does not receive many of the services available in El Matiya village. The villages of El Matiya are located along the main road 12-18 km south of the city of Assiut and near the Nile. The population is primarily Muslim, but about 15% of the villagers are Christian. The Population and Development Project of UNFPA has initiated a sewing project for the women in one of the villages of the unit.

Figure 5

Location of Shanawan, Kafr Shanawan and Babel in Menoufia governorate (from Gadalla 1978)



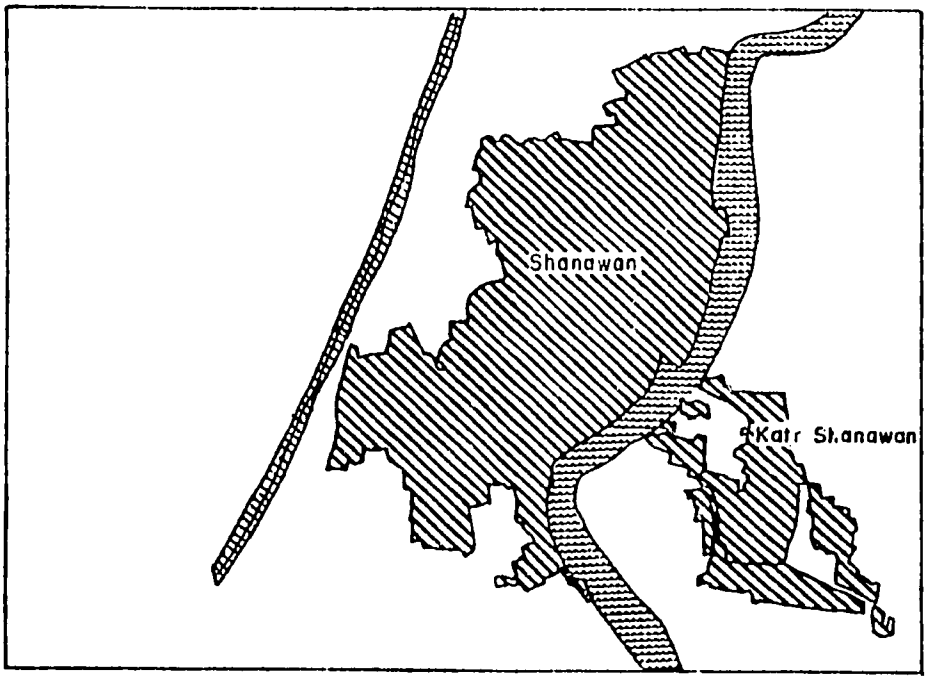



Table 3.1

Infrastructure of Villages Studied
in Assiut and Menoufia

| Village | Population | Total Land Area | Public Water System Connection | # of Public Water Stands in Operation | % of Households with Connections to Public Water Stand System | % of Households with Electricity | % of Households with Latrines | Health Unit in Village | # of Mosques in Village |
|---|---|---|---|---|---|---|---|---|---|
| ASSIUT GOVERNORATE | | | | | | | | | |
| El Matiya | 18,896 | 3209 ha | X | 08 | | 25% | 20% | X | |
| Shaghaba | 03,379 | | X | 03 | | 15% | 15% | | 20 |
| Beni Adi | 30,000 | | X | 10 | 25% | 50% | 30% | X | 40 |
| Jahdam | 07,000 | | X | 03 | 05% | 25% | 20% | | 06 |
| MENOUFIA GOVERNORATE | | | | | | | | | |
| Shanawan | 16,632 | 1280 ha | X | 4 | 25% | 80% | 95% | X | 11 |
| Kafr Shanawan | 03,521 | 0157 ha | | 0 | | | | | |
| Babel Wa Kafr Hammam | 05,732 | | X | 4 | 25% | 60% | 70% | | 4 |

* Figures from Assiut based on 1979 estimates. Figures for Menoufia based on 1976 census.

The village unit of Beni Adi is in Manfalut district of Assiut governorate. The seven villages in the unit contain a population of about 45,000. The satellite village of Jahdam has far less services, such as a water tank or health unit, than the main village of Beni Adi. Beni Adi is located 37 km northwest of the city of Assiut and 10 km west of the Nile. Unlike the villages of El Matiya, the villages in Beni Adi border on desert so that waste land is potentially available for expansion.

In the Manoufia governorate one of the village units chosen was Shanawan, which contained only the villages of Shanawan and Kafr Shanawan. These two villages are separated by a canal, indicative of the extensive canal network that runs through the Delta region of Egypt. Shanawan is located only 6 km south of the district capital of Shebin El Kom and many of the residents go to Shebin El Kom for private and public health services. There is a community development center which has helped introduce numerous projects, such as serving workshops and nursery schools.

The village of Babel Wa Kafr Hammam is one of 43 villages in the district of Tala at the northern edge of Manoufia governorate. A canal separates the two sections of Babel and Kafr Hammam, but the two sections are considered as one village. The public water system is located in a neighboring village and the public health unit is located a kilometer from the center of the village. A community development center supervises a nursery in the village.

The villages selected in Assiut differ in important respects from those studied in Menoufia. A basic ecological difference is the high water table and extensive canal system of the Delta villages in contrast with Upper Egypt. The two village units chosen in Assiut, Upper Egypt represent the ecological differences of being adjacent to the Nile or adjacent to the desert. In each unit there is a clear difference between the infrastructure services available in the main village and those that trickle down to the satellite villages. The villages in Assiut were generally less well-off in terms of public services and facilities than those in Menoufia, which may be due in part to the proximity of Menoufia to Cairo. All of these villages taken together provide a broad sample base for assessing the specific sanitation problems encountered in Egyptian villages.

# SECTION 4

# SANITATION PROBLEMS

The study team was given the task of identifying rural sanitation problems and describing the existing services and facilities relating to sanitation at the village, district and governorate levels. The following discussion relates to sanitation and health consequences to water supply, sullage and drainage; human defecation and the disposal or use of human excreta; domestic animals, the stable and manure; and garbage and solid wastes. The descriptive characterization of each of these aspects is complemented with a concise summary of the essential problems.

## 4.1 WATER SUPPLY DRAINAGE AND SULLAGE DISPOSAL

The provision of potable water has long been recognized as one of the most crucial needs of rural Egpyt. According to information from the 1976 census, 36% of the Egyptian population in rural areas had no access to a public water system. In many villages a sizeable percentage can utilize public water stands, but perhaps as many as 50% of the villagers in some areas may be dependent on shallow wells (Middleton 1979). A major goal of the Basic Village Services (BVS) project of AID is to increase access to a protected water supply for the Egyptian village. This section will cover existing public water systems in the rural sector, water supply from traditional wells and canals, the domestic uses of water, the disposal of sullage and sanitary drainage, and factors contributing to ground-water pollution.

### 4.1.1 Description of Public Water Systems

The governorates of Menoufia and Assiut both have fresh ground water at relatively shallow depths (2-10 m in Menoufia, 10-40 m in Assiut). The public water systems viewed by the team and described by engineers and officials all have similar designs, which consist of a borehole well, a pump house, an elevated tank, and a pipe distribution network with both public water stands and individual house connections. The older systems were originally equipped with diesel engines. In El Matiya, for example, a British manufactured 16 hp engine (1,500 rpm) is used. Most have now been replaced or augmented by electric motors which are more efficient and economical to operate and have a higher capacity. The electric motor used in El Matiya is 4.5 hp. The diesel engines are older, tend to break down more often, and require more maintenance. Due to frequent interruptions in electricity, the diesel engines are still important.

The elevated holding tanks average about 60 cubic meters in capacity. This is sufficient to provide water pressure in the mains for two to four hours, depending on the age of the system and the demand for the water (population served). The pipe distribution networks are made from various materials. The most commonly observed, particularly in smaller sized pipes of 4-10 inch diameters, is a fabricated

steel pipe made by wrapping a long 4-10 inch wide plate diagonally around a mold and welding it. This pipe is not very corrosion resistant and can rust out badly without regular maintenance. Cast iron pipes are also common. Many of the newer pipes use asbestos cement, which is more maintenance free. The pipes lead mostly to public water stands and only a few house connections.

The general operating procedure for the water systems observed was to pump for several hours until the tank was full, then quit and go home. For the villages surveyed, this pumping was done only once or twice a day. In general, service was intermittent and irregular. In El Matiya of Assiut water was only available about eight hours a day. In practice, water was not available at night. This helps to explain why most households observed in both governorates stored water. This type of pumping schedule hits hardest at the outer fringes of the system. The extremities are the last to get water pressure and the first to lose it.

It is evident from interviews with officials at every level of the institutional framework that potable water is given a high priority. In an area like the Sinai, where there are very few potable water systems, water supply is clearly the most crucial need. It is not necessarily the case that officials and villages are unaware of other problems, such as sanitation. Their attitude is that energies and funds should first be applied to solve the most crucial problem and deal with lower priority problems later. Part of this is due to the belief that funding may not be available in the future. When villagers are asked if they want a public water supply, they generally say yes immediately. Sever respondents in Menoufia, however, noted that they did not want a water connection in their mud-brick houses, because they feared a water flow problem might damage the house.

It is important to note that all piped, public water systems are referred to as "potable water systems." Design inadequacies and lack of maintenance make it highly unlikely that potable water is in fact supplied. Because of their formal designation they are by definition assumed to supply potable water. This report refers to them as public water system.

### 4.1.2 Problems with Existing Public Water Systems

The two essential problems compromising the effectiveness of existing public water systems are inadequate maintenance and repair, and intermittent services. A World Bank study has indicated that up to 50% of the water pumped from the wells is lost from leaks in the distribution system and does not reach the consumer (Middleton 1979). The systems are not adequately maintained or repaired. Diesel engines often break down or there is no electricity to run the electric motors for pumping water. There are numerous leaks at pipe connections, and holes and breaks in distribution pipes. Near a public stand in Shaghaba, for example, a continual stream of water is bubbling out of the ground over the pipeline. Almost all of the public water stands observed had leaking or broken valves and missing taps. In the village of Kafr Shanawan in Menoufia the two existing public water stands have been broken and out of use for several years. In many cases both in Menoufia and Assiut there is only one tap functional at a stand that generally has space for four. In Shaghaba a piece of wood had been inserted to block a pipe where the tap had been removed. This wood would periodically fall out and the water would literally gush out.

The twin problems of lack of maintenance and the need for repair exist in water and sanitation facilities throughout the public sector. It is by no means limited to the village level, but is characteristic of sinks, water closets and pipe distribution systems for public buildings, schools, health units and government offices at the district and governorate levels. The extent of the overall maintenance problem is related to a combination of factors, including lack of clearly defined institutional responsibilities, inadequately trained and equipped manpower and insufficient funds allocated.

Responsibility for local maintenance and upkeep of water systems is not clearly delineated between the district and the village council. At the governorate level there is a Central Department for Maintenance and Repair of Potable Water Systems in the department of housing. The first engineer for water supply in Assiut governorate noted that at present there is insufficient equipment and personnel to perform the maintenance functions of the department. At the governorate level the tasks are currently more clerical than practical. A variety of pipes are stored at the facility, but there are few spare parts for the potable water systems. The department currently has one lorry, one station wagon and three pick-up trucks. The first engineer cited a real need for basic tools and welding equipment.

The district is theoretically the main resource base for maintenance of water systems. In general, there are two engineers, two mechanics and two to four plumbers at each district office in Assiut. The average salary of the engineer is LE 50 per month in Assiut district and LE 35 per month in the other districts. The plumber earns about LE 50 per month, but generally supplements this with private practice. Each district office is equipped with one pick-up. Maintenance facilities visited in Assiut, Menoufia and Faiyum were all characterized by a lack of tools and equipment to maintain the water systems. At the district of Quaisna in Menuoufia, workers at the maintenance facility were asked where their tools were. They replied that "the wrench" is out being used on a job. About 22 employees, including several engineers, were crowded into a facility without any basic tools in evidence. The one pick-up truck sometimes available was not adequate transportation. There were no maps or diagrams of the water systems for which they were responsible. In Faiyum, where there is no ground water available, the entire governorate is served by a large central water treatment plant. However, the map of the system was current only up to 1965.

Engineers at the governorate and district levels often have inappropriate education and experience for their jobs. In one district in Menoufia the water department consisted of a petroleum engineer (the department head), a mining engineer, and two electrical engineers. None had any formal training or prior experience to prepare them for the jobs. In Menoufia, the district of Shebin El Kom had a mechanical engineer in charge of water supply and sanitation for rural villages. Another problem is that the engineer ends up doing a lot of clerical work.

The village council has the responsibility for maintenance of its public water system. All major repairs must be referred to the district or governorate. The engineer in charge of operating the pump house may not have any formal training. Much of his time is spent working on repair of the diesel engines. Each village council is supposed to have plumbers available. In practice the pump house mechanic, the agricultural engineer, or any villager with some knowledge of plumbing may be called upon to fix minor problems. The basic tools available are simple wrenches, a monkey wrench, a pipe wrench, pliers and a hammer. Washers are often made of leather. Twine is used for packing and pipe connections. Some

leaks have been "temporarily" wrapped with cloth. In the absence of the proper parts and materials, recourse is made to whatever is available. In the villages studied in Menoufia it was noted that villagers often arrange to fix simple plumbing problems themselves, when the problem reaches crisis proportions, since the assistance of the village council may not be forthcoming.

One of the obvious problems is the lack of funding for maintenance and repairs at all levels of the institutional set-up. Complaints about the lack of funds were heard at every level. Decisions about the budget are basically made at the governorate level and consequently the district offices and village councils often find it difficult to obtain the necessary funds. Funding is provided for salaries, but operating expenses must be appropriated. Appropriations are requested after the fact, so that repairs of breakdowns must often be delayed until the next fiscal period. In Assiut, the maintenance center for potable water was allocated only a small amount the past year for operation of the facility, spare parts, transportation, etc. (all expenses other than salaries). This amount was not adequate, in the opinion of the first engineer, to provide basic upkeep for both the urban centers and villages. Several village council presidents complained that there was basically no budget for maintenance of the water system, other than salaries. It is important to note that the problem is not just the lack of money, but the efficiency of the administration of budgets from the highest to the lowest institutional levels. Pumping money into the existing fiscal system would result in quite heavy leakage.

The other significant problem with existing public water systems is the effect of intermittent service. This is a potential source of contamination as well as inconvenience for the villager. When water pressure drops to zero at the pumping station, suction is created in the distribution network which draws in polluted ground water or soil moisture through leaky connections or holes in the pipes. Regular pressure loss, which is the practice in most village systems, results in regular contamination. This seriously compromises the effectiveness of the system as a source of "potable water."

The Ministry of Health has the responsibility to inspect the quality of water in the public water systems. It is one of the duties of the sanitarians (see Appendix 2) to take water samples. Urban water distribution systems are analyzed monthly for bacteria. During the summer, daily samples are taken from tanks in the districts of Shebin El Kom and Menouf to check for contagious disease. Deep well systems, which are found in the villages, are supposed to be checked every three months for chemical and bacteriological content. The samples are analyzed at the governorate level. It is unclear to what extent the sanitarians perform their task. In one village in Assiut, which does not have a local health unit, it was stated that the sanitarian had not been there in over a year. The samples also appear to be taken at the wellhead, rather than at any tap. Thus, the extent of contamination in the pipe distribution system is never measured.

The interruptions in flow also cause inconvenience to the community. A local health unit may be without water for several hours in the day. The flush latrines in the health units and public schools become health hazards when there is no water to flush with. The survey results indicate that interruptions range from a few hours to a few days. In the villages surveyed in Assiut, the water system only functions for about eight hours a day. These daily interruptions can create social problems, with young girls fighting over use of the taps or tap at the public stand. A woman may have to make twice as many trips to the stand not knowing whether

it is working or not. Each round trip may be as long as 500 meters, according to results from Assiut. It becomes necessary to store more and more water at home, increasing the opportunity for contamination of the stored water. As village populations continue to grow, these problems magnify in scope and the environmental sanitation conditions deteriorate on a geometric scale.

### 4.1.3 Water Supply and Domestic Activities

During the course of the study public water systems in all villages were examined. In Kafr Shanawan the two public stands were not functional. In Assiut about half the respondents noted that they were within 100 meters of a water stand. Almost all of the rest were within 200 meters. The houses in Menoufia surveyed ranged from a few meters to over 600 meters from the public stand. When the public water supply is cut off, more than half of the respondents in Assiut said they used a shallow well. Some said they stored extra water in the house for times when flow was interrupted. In Menoufia, the majority of the survey cases indicated that water is cut off daily for at least one or two hours.

It has been estimated that as many as half of the rural villages still utilize shallow wells. Water is drawn from these either with hand pumps or rope and bucket. In Beni Adi of Assiut several wells were observed. The water table was about five meters and the wells generally extended to eight meters. Most of the wells examined were located inside the courtyards of houses. In some cases there was access to the water from outside. Wells are also located near areas where mud bricks are made.

In Menoufia canals are often found running through the villages. According to the survey, 25 of 40 respondents do not have public water and resort to the use of canal water. The use of canal water appears to be widespread in rural Egypt, even in areas where public water systems have been introduced. However, in the villages surveyed in Assiut it was rare to find women using canals. This difference is no doubt due in part to the ecological context, since canals in Assiut do not generally run through villages. The use of canal water, especially by those without access to wells or a public water system, is practiced in Upper Egypt, but it appears to be confined to poorer households than those in Menoufia.

The woman has primary responsibility for water supply. She is the one who goes to the stand, well or canal to obtain water. Water is generally carried on the head in a large plastic bucket. Young girls learn by carrying smaller containers. In Beni Adi, it was said that women generally made two trips to the public water stand, morning and afternoon. A household of 10 people would require about eight buckets per day on the average. Walking to the standpost, rinsing the bucket and filling it, and returning to the house is time-consuming. It is not surprizing that all of the households surveyed in the Assiut sample wanted household connections. One of the respondents in Menoufia said that he would like to have potable water, but his mud brick home could not withstand the water flow without a proper drainage system.

Drinking and cooking water is usually taken from the public water system. A few key informants in Menoufia mentioned that canal water is still preferred to the piped water for cooking beans and lentils. It is said to enhance their flavor. Most of the women in the Assiut survey said they washed dishes in a basin inside the

house, using either water from the public stand or a shallow well. Those households with kitchens and water connections have sinks, but these are not common. In Menoufia, 23 of the 25 respondents who did not have potable water, washed dishes in canal water. A few washed in the canal water and rinsed with water from the public system. A high percentage in the survey said they used public water supply for the month in winter when the canals were drained and cleaned. Almost all the women in both governorates try to use soap, when it is available. Many villagers cannot afford soap, and probably tend to use what they have from their rationed supply more for laundry. Those who wash at the canal in Menoufia use sand and mud for aluminum utensils and red ash for copper ones. In Assiut, where the women generally wash in the court where the open stove is, ashes and sand are used for cleaning utensils.

In the Menoufia sample the majority of the women washed their clothes at home. Only ten surveyed did so at the canal. Washing machines are very rare. In Assiut all of the women surveyed washed clothes at home. Several informants said it would be a shame for other people to see some of the clothes in public. Poor women who live in isolated hamlets outside the main villages are more apt to resort to a canal. In general, laundry appears to be slightly more private in Assiut than in Menoufia. All of those surveyed in the Menoufia sample used soap, either bar or detergent. Only half of those surveyed in Assiut said they regularly used soap. Since the water must be carried to the house in many cases, it quickly becomes dirty from washing clothes. There is a problem in using water clean enough to effectively clean the clothes.

Water is also used for bathing. Men sometimes have access to a shower in the mosque. Women bathe in the home, pouring water over themselves while in a copper or alumium basin. Informants in Assiut said it was important to heat the water for the bath in winter. This is generally done on a kerosene stove. Almost all have access to bar soap. The frequency of bathing varies and is hard to document. A woman must fully bathe herself after sexual intercourse. The majority of those surveyed related self cleanliness to their religious beliefs, particularly the ablutions to be performed before prayer. The frequency of fully bathing may vary from once daily in summer to as little as once a month. The ablutions are only necessary for extremities and the vital parts of the body. The interest in a communal bathing facility has been discussed in Section One.

All of the households visited had some sort of container for water storage. The common container is a clay pot called a zir. This is used to store drinking water, and is said to keep it cool in the summer. Even houses in Assiut villages with water faucets will also have a water storage pot. This type of pot is up to two meters in height, although a smaller pot may be utilized. There are other clay pots, plastic, aluminum and copper containers in use. The containers are usually covered, but in Assiut it was noticed that sometimes the cover is ineffective and sediment and organic material fall in. The storage pot provides cool water, but not safe water. A clay pot filtration system might be applied to improve water storage. An old can or cup is used as a dipper, and this may increase the danger of contamination of the water stored.

A sanitation problem in the village is the disposal of sullage or waste-water. In theory, it is illegal to throw water in the street. A muddy street is a health hazard, especially due to the attraction of flies in summer. In practice, most water from the household, often soapy, is thrown into the streets. Anyone who has walked through a village is aware of the extent of the practice. In

Menoufia, some women said they would throw it inside the house, but not if they owned livestock. It is considered harmful to the animal if he licks the sullage. Those with cement floor latrines will throw the waste water down the hole, especially in new houses. In winter the women questioned in Menoufia sometimes throw water in the canal. In general, the water is thrown in the most convenient place, which is usually the street.

### 4.1.4 Sanitary Drainage and Sullage Disposal

A monumental problem in rural Egypt is that of sanitary drainage and sullage disposal. It must be stressed that this problem is directly related in many cases to problems with the existing public water systems. The full extent of the drainage problem is due to a combination of factors, including leakage from the public water system, existing water disposal systems, indiscriminate disposal of sullage in the village, and irrigation. Inadequate drainage and the consequent health risks from stagnant and contaminated water are a serious sanitation problem facing rural Egypt. Before detailing drainage facilities and problems, it is important to consider the difference between soils in the Delta and soils in Upper Egypt.

#### Soils and Drainage Problems

Delta soils are silty clay which have been built up over centuries of flooding by the Nile. They are characterized by a low permeability, absorbing water slowly, due to their fine structure. When layers of clay subsoil are saturated, they become completely impermeable. Water is trapped on top, which can cause surface ponding. The ground-water table is maintained abnormally high in the Delta due to the extensive system of canals. They may be less than one meter from the surface. By contrast, in Assiut soils are sandy and highly permeable. The water table is generally about five meters deep, increasing with distance from the Nile. Thus, the acute drainage problems of the Delta are generally not relevant to parts of Upper Egypt.

#### Drainage and Potable Water Systems

As noted earlier, it is estimated that up to 50% of the water going through the public water systems in the villages leaks out of the pipes and faucets. Leakage is a problem readily observed at any village system. Inadequate maintenance and the lack of repairs extend to the pipe distribution network and the public water stands. In several villages in both Menoufia and Assiut, pools of standing water were observed on the land surrounding the pump house. In El Matiya a local engineer said that trees were originally planted to help absorb the surface collections, but that local animals had grazed and eaten them. Leaks in the pipes are endemic, especially since many of the systems date back to the early 1950's and 1960's.

One of the most obvious sanitation problems relates to leakage and lack of drainage at the public water stands. Each stand is basically a cement slab and wall with taps at waist height. Invariably, these stands are surrounded by mud and standing water. Some of this results from water thrown away by the women when rinsing containers in which they carry water. Other water is the direct consequence of leaks causing differential settlement and rotation of the concrete

support structure. Some stand pipes have been built with soakaways or drainage systems, but none appeared to be in working order. At one village a stand was observed where food particles and other solid matter had apparently clogged the associated drainage system. It is important to note that even an appropriately designed and properly maintained drainage system for the stand could not cope with the flow of water from a continually leaking faucet. The soakaway drainage system has been discussed as a recommendation in Section One.

In several villages in Assiut the pipe leakage and surplus water from the stands were creating a serious problem by the accumulation of water into stagnant pools. At one stand in Nukheila, for example, a channel had been dug to drain the excess water towards a nearby hollow. This hollow was located in a public square and was still used in part for tethering animals during the day. The drainage had created a virtual lake of water, which was polluted with garbage and excreta. The villagers said that this water collected year round and did not even evaporate away in summer. Animals near the polluted water, particularly sheep and goals, could easily drink from it. Children were playing nearby. The village mayor said that an underground drain was needed. At Shaghaba there was a similar pool of stagnant water which had collected beneath the stand in a hollow with several palm trees. The trees were incapable of absorbing the almost continual flow of leakage from the water system. Since this pool had already collected, it had become a place to throw garbage and even human excreta removed from the roofs. At Jahdam there were two large pools, but one of them was clearly related to surplus water from the irrigation canals. These pools represent a major sanitary problem, especially in providing a breeding place for mosquitos and flies.

Existing Waste Water Disposal Systems

Houses and public buildings with individual water connections, particularly newer houses with modern plumbing, sometimes have a type of cesspool called a transh (an Arabic transliteration of the French term, trench). This is an open-bottomed underground vault built of fired bricks and with an arched top. A system observed under construction in Menoufia was approvimately two meters deep, two meters wide and 12 meters long. The length was said to be as long as space and money would allow. The ground water was only 1.7 meters below the surface and there was a 30 cm accumulation in the bottom of the transh. With ground water this close to the ground surface, there is really no place for the sullage to go, except to seep laterally through the porous bricks or between cracks in the loosely mortared walls. The solids that build up on the floor of the transh will form an anaerobic mat which then becomes impermeable. The tank eventually fills up with sludge and liquids, and has to be pumped out.

A cesspool was also observed being built in the village of Dronka near the city of Assiut. A pit of about 2-1/2 meters in diameter and six meters deep had been dug and lined with fired bricks. The bottom was left open and the top would be arched. The builder said that it was important to build the cesspool deep, so it could reach the water table, which was about five meters here. In was argued that the deeper the cesspool, the less often it would have to be cleaned. Several public buildings and mosques observed had cesspools which were over 30 years old without having once been cleaned. It was explained that the permeable sandy soil here allowed the water to seep continuously into the subsoil. The cost of digging the pit was put to about LE 300 and the cost of bricking it at another LE 300. In Beni Adi a transh was being built that was three meters wide and 16 meters deep at a cost of LE 3,000. Three workmen planned to work for four months on the construction.

Apartment houses and multi-story buildings in the larger towns sometimes use a large septic tank or series of tanks. These are generally made of concrete or at least have concrete lids. The concrete walls do not allow exfiltration of the waste water, so the tanks fill up rapidly and require frequent pumping. These systems do not appear to have leach lines for soil absorption of the waste water. This may be due to lack of space. Such systems are not really designed; they are just built and sized as large as possible. These septic tanks are not very common in the villages in Assiut. Near the city of Shebin El Kom in Menoufia a relatively new apartment building with a septic tank was observed. The tank had filled up, partially due to clogging from foreign material that had fallen in the broken lid of the tank. In order to prevent the waste water from backing up in the apartments, the drainage pipe from the building had been broken open above the ground. The waste water was collecting on the surface and eventually draining into a nearby drainage canal.

### The Problem of Waterlogging

The installation of individual household water connections and the resultant increase in per capita water consumption by an exploding population density has resulted in a hydraulic overload, saturating the soils and subsoils of many parts of the Delta region. Put simply, water is entering the village soils faster than it can leave, so it is accumulating. One village near Shebin El Kom has extremely severe waterlogging problems. The water table was observed in some spots to be within 30 cm of the surface. Several houses downhill from a mosque (which is a large water consumer) had acute problems with what appeared to be artesian springs bubbling out of the ground at the foundation level. These houses had no individual water connections. When the ground is so wet, the mud brick walls of the buildings are constantly damp from capillary action wicking up the soil moisture. This can lead to structural weakening and collapse of walls. Dr. Ahmed Difrawi, the director of ORDEV, noted that the problem of house damage due to waterlogging has become quite severe in the Delta region.

Saturated soil can result from several causes. There is gross leakage from the pipes and taps of potable water systems, which could be remedied in part by proper maintenance. The increased use of water and its disposal out onto the streets is a contributing factor on the local level. Surplus water spilling over from the irrigation system must also be taken into account. The problem is basically micro-ecological, affecting some parts of villages more seriously than others. By collecting in surface pools and by generally degrading the local environment context, the problem of waterlogging ultimately is a factor affecting rural health.

### Ground Water Pollution

The existing disposal systems for water, sullage and sewage encourage the contamination of the ground-water supply. The cesspool and pit latrines are built to reach the ground-water table. The extent of contamination depends on the physical nature of the aquifer and the relative movement of water within it. Many households have shallow wells, which may be only four or five meters from the disposal pit. This well water is almost certain to be contaminated. The sanitarian is charged with the responsibility of checking water quality, but there is no schedule for sampling private wells. Monitoring the quality of shallow wells would provide basic data on the extent of contamination, but it would not resolve the problem. Once an aquifer is polluted, it is difficult to restore its purity. A water quality survey of existing shallow wells in homes with deep cesspools would be a

useful study prior to the continued construction of shallow well systems, which may end up pumping non-potable water.

Contamination of the water in rural Egypt may be the greatest single sanitation problem to be faced. Given the priority placed on public water systems by village councils, steps should be taken in existing AID programs to attack both sides of this same problem — water sanitation and water quality.

## 4.2 HUMAN WASTE MANAGEMENT (EXCRETA AND URINE)

Although there have been several attempts in the past to introduce and improve latrines in rural Egypt (i.e., Rockefeller Foundation 1933), many villagers are still without access to sanitary facilities. It is important to briefly describe the existing types of latrines in the rural sector — in the house, the mosque, school and health clinics. Toilet habits of men, women and children were studied, as well as social attitudes towards defecation and the handling of feces. A major problem is the sanitary disposal of feces and sludge. After describing the human waste process, the specific sanitation problems and health consequences will be summarized.

The most common type of latrine in rural Egypt is the pit latrine, either a simple hole in the ground or a hole in a cement clab. Newer houses as well as public buildings usually have a porcelain squat plate and a flush unit if there is a water connection. Several designs of latrines installed in Egypt are documented in Appendix 3. Western style toilets are rarely encountered in the villages. In several new houses of moderately wealthy individuals, there were two rooms with toilets, one a flushing squat plate and one a flush throne toilet. In several health clinics visited there was a western style toilet in a room off the doctor's office.

### 4.2.1 Household Latrines

The percentage of households with latrines in Egyptian villages varies across the country (Table 4.1). Results of the field study and some relevant published material indicate that the majority of households in the Menoufia study had latrines. A total of 10 households of the 30 with latrines in the sample were built in the last 10 years. In Shanawan it was difficult to find households without latrines. The villages visited in Assiut were characterized by a relatively low percentage of households with any facilities. It was noted by village officials and several builders in Assiut that all new houses have latrines installed. A high percentage of the latrines in Menoufia, in contrast to Assiut, have cement slabs.

The actual location of the pit latrine in the traditional Egyptian house is not strictly defined. In Assiut the latrines with dirt floors tend to be located off the main interior courtyard. There was usually a roughly fitted wooden door, but no windows. Consequently, the ventilation was poor and the latrine was dark. The rooms were generally just large enough for a hole and a person to fit in. A can of water for cleansing was sometimes kept inside, but many informants indicated they carried the water in with them each time. No bathing would be done in the room with the latrine. The size of the pit or cesspool under these pit latrines could vary from one to several meters deep. Dirt floor latrines were swept periodically by the

women, but water was not applied to the floor (which would have merely made it muddy). Latrines with cement floors are cleaned with water. Most of the respondents in both Menoufia and Assiut did not describe their latrines as smelly. However, the traditional pit latrine in Egypt is not properly ventilated. In one wealthy household in Assiut a women produced a bottle of disinfectant she said she used to help clean the latrine, but this was not a common practice. If there was a water connection, a flush unit might be installed. In most cases observed in Assiut the flush in household latrines was either not hooked up or broken. In newer houses there would generally be a small tap near the squat plate, since water is used for anal cleansing.

Table 4.1

Percentage of Households with Latrines
for Several Villages in Menoufia and Assiut

| Village | % Present | % Not Present | Source of Data |
|---|---|---|---|
| MENOUFIA GOVERNORATE | | | |
| Shanawan and Kafr Shanawan | 95 | 5 | Village informants |
| Babel Wa Kafr El-Haman | 70 | 30 | Village informants |
| Ustubari | 80 | 20 | Lab. Tech. of health unit |
| ASSIUT GOVERNORATE | | | |
| Assiut District | | | |
| El Matiya | 20 | 80 | Village officer |
| Shaghaba | 10-15 | 85-90 | Village officer |
| Salam | 25-30 | 70-75 | Doctor in health unit |
| 'Alwan | 25 | 75 | Doctor in health unit |
| Menfalut District | | | |
| Beni Adi | 30 | 70 | Village official |
| Jahdam | 20 | 80 | Village official |
| Abnub District | | | |
| Beni Murr | 34 | 66 | |
| Beni Zeid and El Akrad | 27 | 73 | Study by Medical Faculty, |
| El Wasta | 54 | 46 | Assiut University (1972) |
| Awlad Sirag | 51 | 49 | |

### 4.2.2 Mosque Latrines

An important part of Islamic religious practice is the performance of ablutions before prayer. The Muslim must cleanse certain parts of his body before each prayer, which for the orthodox is at least five time a day. A discussion of this process is a basic component in the books of religious law. Only water which is defined as pure is valid for use in the ablutions. Thus, it is important that the mosque have a facility to provide for this religious practice.

Almost all of the mosques observed in Menoufia and Assiut had both water taps (some from private wells) and latrines. These two areas must be kept separated, since water polluted with feces or urine is not suitable for the ablutions. A mosque in Beni Adi of Assiut had a courtyard with latrines on one side and a long water sink on the other. There were seven stalls, each installed with a flush unit. Each flush has broken. The stalls were well ventilated and cans of water were provided for anal cleansing and flushing. In general, the mosque latrines were kept clean, although the flushing was often inadequate. A sweeper was employed to keep the mosque and its latrines clean, but plumbing problems require that the mosque seek outside assistance wherever it can be found. Along a sink attached to the wall opposite the latrines were several taps. The sewage and drainage was directed into a central cesspool located outside the mosque.

In rural Egypt the mosque facilities are only for men and young males. Thus, even though a village may be characterized by relatively few latrines, most Muslim men have access to the mosque. The facilities tend to be used in association with prayer, rather than just any time a man wishes to defecate. There were no urinals in the mosques observed. The Christian churches, especially in Assiut governorate which has a relatively high percentage of Christian population, might have one or two pit latrines. However, the importance of a facility for defecation and ablutions is not part of the Coptic religious tradition.

### 4.2.3 Latrines in Schools and Health Units

Public buildings in the rural sector, that is schools and health units, have toilets included in the architectural design. The design elements appear to be fairly uniform throughout Egypt — a squat plate and flush unit. A number of school toilets in Menoufia and Assiut were observed. A primary school in a combined unit in Menoufia had two rest rooms, one for boys and one for girls. In the boys' room were six toilet stalls and four urinals. All of the flush units were broken and had been out of order for some time. A can was placed beneath the tap located in each stall for cleansing. Several taps were continuously leaking. Feces were piled in the hole, clearly indicating inadequate flushing. The windows were open, but the odor was still quite strong. The urinals were all clogged and did not show any evidence of use. A wheelbarrow, straw and garbage were stored in the area next to the urinals. The one sink in the room was non-functional, since there was no drain pipe beneath. Electricity was installed, but there were no bulbs in the sockets. Outside the wall were several taps and a long sink. These were used by boys and girls for washing hands, since the taps on the girls' side were all out of order.

The girls' facility was the same design, minus the urinals. The flushes were all broken. Feces were not only piled in the holes, but were found on the squat plate and even on the floor outside the stalls. There was water on the floor, but the

area did not appear to have been cleaned for several days. The odor was intolerable, as was the general sanitary condition. An excuse was given that the janitor had not been in for a day or so. The situation illustrates the priorities given boys vs. girls facilities and probably indicates the relative level of hygiene instruction given girls compared to boys.

The area behind the school along the back wall was frequently used for defecation (the evidence was piled everywhere). The headmaster explained that children were told to go outside when there was no water available to flush or clean the latrines. Evidently water service was frequently interrupted.

A primary school visited in Assiut had just one facility for boys and girls. Five stalls were said to be for the boys and three for the girls, but these were not marked. The urinals were not functional, but the flush units worked. The sink inside was not used. There were four taps located outside the wall of the latrine. The facility was cleaned and appeared to have adequate flushing. The headmaster claimed that the facilities were cleaned three times a day. Three students were designated as a "sanitation patrol" given the task of reporting sanitation problems in the latrines.

It is difficult to document the extent to which school latrines are sanitary. In one village in Assiut a primary school had three stalls, but these were off limits to the children. One stall was locked, one was used for storage and one was used by the teachers. The entrance area with the sink was used for making tea. The children were simply told to go behind the school, a situation readily confirmed.

The latrines in the health units visited were generally cleaned regularly, at least once a day with water. In most cases the flush units were broken, but the feces appeared to be adequately flushed. A tap was provided near the squat plate, but it sometimes leaked. There was generally a latrine for patients, a separate latrine for staff and sometimes a latrine specifically for urine and stool samples. In the latter case, a window was sometimes placed between the latrine and the lab, so the samples could be handed in directly.

### 4.2.4 Defecation and Urination Practices

The defecation practices of villagers in rural Egypt differ according to sex, age, availability of facilities, and exposure to modern sanitation measures. If there is a latrine in the house, it will generally be used by all the adults. Men have access to the facilities in the mosque. If a man is working in the fields, he will simply squat in the field or nearby along a canal for access to water. The traditional robe of the villager allows this to be done without exposure. Men urinate from the squatting position if wearing a robe, or standing if wearing pants. A man will urinate in the fields, next to a wall in the street, or in the ruins of old buildings, etc. Most informants noted that they do not urinate in the canals, but this could not be confirmed.

The woman, unlike the man, is limited in the places she can use for the toilet. In Assiut, women in households without latrines generally use the roof. A corner of the roof next to a wall offers sufficient privacy for the act. The woman either defecates directly on the dirt floor of the roof, or places a clay chamber pot between two stones. The chamber pot is manufactured locally and is used for this

purpose or as a manger for feeding domestic animals. The dried feces are collected or the chamber pot is emptied about once a week, depending on use. Since there is no water available, the women must bring a can of water or use dry materials (pebbles, etc.) for cleansing.

The results of the survey and interviews in Menoufia and Assiut indicate quite clearly that the stable is not used as a latrine. All the respondents in the Menoufia sample and almost all in the Assiut survey said they did not use the stable for defecation. In Menoufia, several informants said if animals smelled human feces, they would get sick and die. If a household had no animals, the stable might be used, especially for urinating. One informant in Assiut said that it was possible to use the stable, but only if the animals were not present at the time. The findings in this study contradict an earlier study of 4,172 villagers in Qalyubia governorate by Weir, about 30 years ago. Weir (1952:66) found that one-third of the villagers surveyed said they used the stable as a latrine. The cause of this difference is not readily apparent.

Children appear to use any place inside or outside the house. Since much of their time is spent in the courtyard or street near the house, these are frequently used for the toilet. A child is not toilet-trained until about age four, depending on his size. During the day school children generally have access to the school latrines, although many find a spot outside the walls of the school.

It is important to recognize that defecation and bathing or washing are not traditionally linked in one facility, as has evolved with the modern western bathroom. If the pit latrines have water available, it is for anal cleansing after defecation and for flushing. A sink is invariably located outside the latrine, except in bathrooms modeled after western examples. The sink outside the latrine is not commonly used for washing hands after using the latrine, but is commonly used to wash hands before eating. In some cases the same sink is used for washing and for kitchen needs. The water in a latrine facility, which can sometimes include the water from the tap, is not considered appropriate for such purposes as drinking, cooking and bathing.

### 4.2.5 Disposal of Excreta and Sludge

The two types of septic systems employed in rural Egypt are the cesspool and the septic tank, described under drainage systems in Section 4.1.4. The septic tank is not commonly found in the villages, especially in Assiut. The system requires a pump truck to periodically collect the sludge and haul it away. The average truck can haul approximately 1,000 gallons. They are equipped with up to 50 feet of a three-inch suction line to reach the tanks. The trucks observed, some manufactured in Czechoslovakia and some Bedford models, were equipped with high volume vacuum pumps, so the tank can be loaded quite rapidly.

The pump trucks are generally only available at the district level. In the district or Assiut there were five functioning pump trucks, all at least ten years old. At the maintenance center of the district there was also an old Czech pump truck, at least 30 years old, which needed spare parts. There were six drivers assigned to the sewage department. Actual operation was scheduled only about two days in advance with no regularly scheduled stops. The sewage department also contained 12 unskilled cleaners and laborers and three engineers. Two of the

engineers were mechanical and one was electrical. They said that they had to learn about sewage by experience. The problems cited by an official of the sewage department included lack of spare parts, the need for more trucks, the lack of tools and an inadequate budget.

The district of Assiut has more pump trucks than the other districts in that governorate. Manfalut, for example, only has one truck. Most of the trucks in Assiut service predominately the city of Assiut. If someone from a village in the district wants the truck to come to the village and clean a septic system, he must go to the city council and obtain the necessary permission from the sewage department and then take the paper to the maintenance center. The schedule is decided on a need basis, rather than a defined set of customers. The major customers in the villages are mosques, schools and health units. The average cost of sludge removal is about LE 3-5 per load. The cesspool systems in Assiut were said not to need pumping most of the time. This is due in part to their depth and volume and in part to the permeable soil and deeper water table.

In the district of Quaisna in Menoufia there were only three functioning trucks for a district population of over 205,000 inhabitants. One Czech truck was not functional due to lack of parts. There were four smaller tank trailers with pumps that were pulled by tractors and three barrel carts pulled by donkeys. Since this older equipment was slower to move and operate, the crews did not want to use it even though it was functional. They wanted new pump trucks. At the time of the visit some 17 men were standing around idle. The pump trucks were mainly used in the central city.

It is difficult to determine how often the septic systems are actually cleaned. Several systems observed were totally full and overflowing. There are no pump trucks at the village level and the district pump trucks primarily serve the main cities. An alternative is the private cleaner with a barrel cart pulled by a donkey. In Ustubari in Menoufia it was noted that a private cleaner working a normal work day will charge about 5 LE. In El Matiya in Assiut the charge per load was said to be less than 2 LE. In Menoufia, a load could cost as little as 50 piasters. Some of the informants said the cost had doubled in the past 20 years. The total price depends on the size of the pit to be cleaned. It can cost as much as 40 LE, according to one informant in Beni Adi in Assiut.

The men who contract to clean latrine pits are said to be from the outskirts of larger towns. They are called Sarati in Menoufia, and are considered as low class. None of the villages visited in Assiut had any private cleaners with barrel carts living there. In the survey from Menoufia, only two of 30 said they emptied the latrines themselves. In Assiut only one respondent cleaned his own latrine. In Menoufia it was necessary to clean the household pit latrine about every two to three years. In Assiut, where the cesspools are very deep and the soil is permeable, household latrines were rarely if ever cleaned out. Once removed the sludge was either deposited outside the village (often in a drainage canal), or mixed in with dung piles for fertilizer. In Beni Adi, which was near the desert, there was a hole outside the city. Pump trucks in Menoufia were observed to dump their loads outside the cities in drainage canals.

The use of human excreta for manure is found in the traditional culture of rural Egypt. The dried feces from the roof are removed with a hoe and a straw broom. In Assiut it is generally put in a clay chamber pot. In Menoufia the human excreta is composted like animal dung. Two-thirds of the respondents in the

Menoufia sample said they applied the sludge from their pit latrines to the piles of animal manure. Most villagers are aware of the agricultural use of human feces. Some informants in Assiut remembered that special men used to come around and buy feces for use in the cultivation of melons and other truck farm crops. There does not appear to be any opposition against the use of feces for manure in principle. A few informants considered it a potential health risk. There is, however, general opposition to the use of feces for dung cakes (fuel for traditional stoves).

### 4.2.6 Sanitation Problems and Human Wastes

The existing facilities and services to handle human waste in rural Egypt are both inadequate and under utilized and represent a health hazard to the local villager and his animals. First, there is a lack of sanitary facilities and a number of those facilities which do exist are inappropriately designed. Specific suggestions will be discussed here, but the option of a compost toilet as a possible intervention is treated in detail in Section 2. Second, the facilities or services for maintaining latrines and septic systems are limited. Disposal of sludge is especially problematic. Third, sanitation suffers because there is little perception of the health consequences due to contact with feces, water contaminated with human waste, and flies.

#### Problems with Latrines

The statistics on the availability of latrines are misleading in one sense — there is no indication of how sanitary these latrines are. After observations in both Menoufia and Assiut, it is possible to say that many latrines are more of a contribution than a solution to the sanitation problem. A big problem with the pit latrine is the lack of a cover for the hole. Flies can thus enter and breed. These same flies can land on bread and utensils, a direct disease vector. A practical solution is simply to add a cover to those pit latrines already builty. Some Chinese privys have a lid on a hinge that leans up against the door of the privy. A person cannot leave the stall without closing the lid — a practically fail-safe system. This would be a necessity for school latrines.

A common inadequacy of most pit latrines is the lack of a vent stack to vent off odors and exhaust gases. This not only can cause an unpleasant smell, especially with a pour-flush system, but attracts flies down the hole. A screened vent stack could be installed in many cases at minimal expense. Another common problem is that pit latrines with dirt floors are difficult to clean and disinfect.

In public buildings, such as schools and health units, flush toilets are always installed. This is the case whether or not the local public water system is functional on a daily basis. The use of flush toilets at the sites visited was characterized by two fundamental problems. First, most flush units were broken or disconnected. Second, water from the public water system was not always available to effectively operate the system. The result of either of these phenomena was that the feces did not get properly flushed, representing a direct health risk to those using the facilities. It should be recognized that an improperly operating flush system is not as sanitary as a simple pit latrine. The technology in many cases is inappropriate not only because of the lack of a public water system that operates throughout the day, but due to the amost total lack of maintenance of

the flush unit. The technology is too complex to be adequately maintained in many cases. A flush system is also an expensive undertaking for many households. Some of the units observed did not appear to have a water trap, but were connected to the drain pipe by a pipe elbow. The lack of a trap allows odors to escape from the drain pipe and permits flies to have access to the waste material.

The emphasis on building flush toilets in areas where they cannot or will not be properly operated or maintained should be seriously reviewed. The existing unsanitary conditions related to flush toilets in the public schools does not serve as a positive sample of a desirable sanitation option. To the contrary, it is a negative example that illustrates to the student that hygiene and sanitation are not possible options. It must be realized that the flush unit is not the only option available in the rural sector nor is it the most appropriate. Compost toilets should be given serious consideration particularly in schools where students can be taught sanitation and hygiene with a system that they can afford to use at home. Specific recommendations based on the potential and constraints of these alternatives have beeb presented in Section One.

Problems with Services

It is obvious from the results of this study in Menoufia and Assiut that sewage and sludge disposal is inadequately provided for in rural Egypt (as well as many urban areas). The number of pump trucks available is not sufficient in the districts to effectively cover either public facilities or private households. There is no scheduled system of collection, so that many people must make arrangements on short notice with local, specialized cleaners of septic systems and cesspools. Even if the sludge could be adequately collected, there is a problem of what to do with it. In practice, sludge is often dumped into drainage canals outside the village. This is an obvious source of contamination.

Many of the village council officials interviewed in Assiut were interested in a water-carriage sewage system. A hydraulic sewage system is not really a viable option in rural villages for a variety of reasons:

- There is not enough water available for flush toilets throughout the village.

- The initial cost and maintenance costs of a sanitary sewage drainage system would be exorbitant. Major cities in Egypt, which have a higher priority, do not have the funds needed for such systems. The cost of flush units and requisite plumbing is also prohibitive in most cases.

- Sewers would contribute to the proliferation of bilharzia and other water-borne diseases unless the sewage was properly treated. Sewage treatment is very expensive and requires considerable land area and/or electrical power. That is, lower cost low-tech oxidation ponds require more land area but less electrical power, while higher cost high-tech package plants use less land area and consume much more electricity. The latter also requires highly trained technicians for operation and maintenance.

### 4.2.7 Awareness of Health Consequences

The awareness of the link between excreta and health varies according to the level of education and profession of the person. Nurses working at a health unit in Menoufia were aware that human feces is a carrier of typhoid and bilharzia and that animal dung is a carrier for tetanus. One even mentioned a link between manure and tuberculosis. The nurses were also aware of the danger of flies, especially in transmitting eye diseases. The nurses have been trained for at least three years in health care diseases. Social workers in the same village were less aware of specific health consequences of feces, except for bilharzia and the danger of flies. They had not received any specific training on disease transmission in their courses at the School of Social Work.

The women interviewed in the same village could see no direct relationship between feces and health. They knew that flies could carry diseases to human beings. They were aware that bathing in canal water could cause bilharzia. In a study of 100 married women in the village of Babel,[1] 67% of those interviewed were aware that bilharzia results from contact with contaminated water, either by walking barefooted near canals, bathing in it, or drinking it. Some women were aware that drinking contaminated water caused intestinal problems. The essential fact that was not understood was that feces were a major source of contamination.

Despite the fact that there was little if any awareness of the health consequences of human feces, almost all villagers interviewed in Menoufia thought it important to have a latrine, if it could be afforded. In Beni Adi, however, several houses were observed with electicity and a water connection, but without latrines. In one case, where the house was located across from a mosque, the male head of the house did not see any need for a latrine. He had easy access to the mosque, and the women could use the roof. In rural villages, economic level may not in itself explain the desire to have a latrine.

## 4.3 ANIMALS, STABLES AND MANURE

Egyptian villagers are primarily farmers, depending for the most part on irrigation from the Nile. Despite widespread attempts at agriculture mechanization, the farmers are still very much dependent on domesticated animals. The most impor[illegible] draft animal is the water buffalo, which is used for work in the fields, lifting wa[illegible] with a waterwheel, transporting carts and providing milk for dairy products. It is estimated that there were about 2,150,000 water buffaloes in 1974 (FAO 1977:236). Also important is the Egyptian cow, which performs many of the same services as the buffalo. The donkey is used as a pack animal, especially for hauling dirt and manure and for individual transport. The camel is used as a pack animal and carries a heavier load. Many villagers own a few sheep, goats and poultry; some even keep a few pigeons.

[1] A study by Marie Assaad and Samiha El Katsha in 1981 on Formal and Informal Health Practices -- Babel wa Kafr Hamam.

The villagers is very protective of his animals, since they represent a substantial economic investment. The head of a local Agricultural Cooperative Society in Assiut governorate noted that the cooperative provides insurance for some villagers against the death of domestic animals. Several informants indicated that animals are so important that they are treated better than members of the family. During the day the buffalo and cow, when not being used, are tethered in the farmer's field or else outside the house in an open area. During the winter the main fodder crop is Egyptian clover (Trifolium alexandrium). During the summer straw and stalks of maize and sorghum make up the bulk of the diet. Cutting the clover and feeding it to the animals is a daily, time-consuming activity. Sheep and goats graze on stubble in the fields, feed on clover or sort through garbage.

### 4.3.1 The Stable

At night the domestic animals are safely placed in a stable. The stable is either located in the house or is attached to the side of the house. Make-shift stables are sometimes built in the fields, providing shelter for the animal and the farmer in the heat of the day. This practice appears to be more common in Menoufia than in Assiut. A partial explanation for this may be that the waterwheel pulled by the buffalo is not as common in Upper Egypt, where it is more common to see the hand operated lift. The stable is generally located on the first floor at the far end opposite the entrance. Animals kept in the stable daily walk through the length of the first floor, often going through the areas used for cooking and washing clothes. When the stable is cleaned, the dirt and manure must be taken out through this part of the house. The stable itself is dark and is often poorly ventilated, except in the poorer houses, where there is usually only a loosely thatched roof of cane and sorghum stalks. A manger, usually made of clay, is provided for each large animal. The fodder is stored outside in the main court of the first floor, or in a separate storage room in the wealthier households. Sorghum stalks are generally stored on the roof.

In a village the number of households with stables is often difficult to determine. In a house-to-house survey conducted by medical students of Assiut University in 1971, the results (Table 4.2) show variations due to the economic level of the village and the percentage of the population actively engaged in agriculture.

A previous survey, covering 293 households in three villages of Assiut district, concluded that 71.7% of the households had stables in the house, 16% had stables attached outside the house and 12.3% had no stables at all (Abd al Radi 1972:122). Not all of these were occupied. In El Matiya and Shaghaba stables were present in at least 75% of the houses, especially older ones. In some cases the household might have a stable and no animals, as might be the case when a widow is living alone. In the village of Dronka, located near to Assiut and with less of an agricultural population, only about 40% of the houses had stables.

Table 4.2

Households with Stables in Five Villages
of Abnub District, Assiut Governorate
(Assiut University 1972: Table VI)

| Village | Stables Present | | Stables Not Present | |
|---|---|---|---|---|
| | Number | Percent | Number | Percent |
| El Wasta | 456 | 36.9 | 777 | 63.1 |
| Awlad Sirag | 124 | 51.4 | 117 | 48.6 |
| Beni Murr | 367 | 91.6 | 034 | 08.4 |
| Beni Zeid & El Akrad | 726 | 97.1 | 021 | 02.8 |

### 4.3.2 Animal Dung

Besides providing important services to the villager, his animals also provide important products. One of these products which pays daily dividends is animal dung. Different types of animal dung are distinguished, sometimes for different purposes. Among the general terms for animal dung are gilla (jilla), miska, and ba'ar. In Assiut the term gilla is usually applied to dung which has been dried. The dung of chickens, ducks, geese, and pigeons is referred to as zibl. Chicken dung is called rasmal.

Not all of the dung can be saved. That which falls in the streets was generally considered unowned and anyone could take it. In the survey in Assiut seven people said people cleaned up dung from the street in front of the house themselves, 23 said that street cleaners of the village council had that responsibility and 11 said no one cleaned it up. That which accumulates in the stable belonged to the household. The dung is used by the villager for two main purposes: fertilizer and fuel. It should be noted that animal urine is highly valued by the Egyptial farmer as fertilizer.

### 4.3.3 The Traditional Compost Process

The utilization of animal dung as fertilizer involves a dry compost process. The stable floor is always covered with dry soil to absorb the animal urine. Additional soil is thrown over the excreta as a daily chore. This mixture of soil and dung is periodically removed from the stable. This can be done daily, once or twice a week, or even once a month. In winter when the excreta does not dry easily, the stable needs to be cleaned more often. Several informants indicated that the animal can be irritated if they do not have cleaned, dry stable grounds. The manure is removed by hand, using the traditional hoe to fill up baskets or leather pouches. This is either piled in front of the house or is transported directly to a large pile in the fields. It is technically illegal to pile the manure in front of the house. If the sanitarian finds a household piling manure in front, he can fill out a summons form

issued by the Ministry of Health, which has to be signed by the doctor of the local health unit. This form is given to the police, who can enforce a fine. In the village of Ustabari in Menoufia the local health unit only issued 13 summons for a population of 10,000 people. Most of these were for a single village described by the doctor as "troublesome" and no longer in the area served by the health unit. In practice, as many sanitarians admit, it is difficult to enforce the bar against manure piled in front of the house. The health people have no alternative to suggest. If all the manure is stored in the fields it reduces the total area available for cultivation.

The pile of manure is privately owned. In Menoufia and Lower Egypt it is common to see these piles in the fields. The villages visited in Assiut, however, tended to have piles at the edge of the village or along a canal but not on the field plots per se. Here the manure is transported to the fields by donkey or camel in leather pouches and applied in small piles to the field itself at the appropriate time. Mixed in with the dung and soil may be some crop waste, but this is generally minimal. Sludge cleaned from household latrines is sometimes added to the manure piles. The manure pile generally stands about four to six months.

It is difficult and even dangerous to pass judgment on a system of agriculture that has been successful for several thousand years. However, a preliminary analysis would suggest that the traditional method of animal waste collection is an inefficient use of the farmer's time and labor and is wasteful of nitrogen. By having to haul soil into the stable and then periodically remove it, a great deal of effort must be expended. Some informants noted that a farmer could spend almost a half of his time in this labor intensive manure process. The urine soaked soil and dung is dried out before being applied to the fields. The nitrogen in urine is unstable and tends to break down into amonia and volatize (being lost to the atmosphere) as it dries. Studies by Scott (1948) in China demonstrated that night soil that was dried to make fertilizer lost over 50% of its original nitrogen content. The nitrogen content was 25% higher when the night soil or manure was mixed with household garbage, straw and soil and composted under moist conditions (50-65% moisture) in large piles (2m x 2m x 1.5m). If kept moist, after composting the pile could be kept up to six months without additional loss of nitrogen. It could be that the organic content in the farmers' top soil is adequate to capture the nitrogen in the urine and stabilize it. A field study of different composting methods in Egypt with comparative laboratory analysis of nitrogen content would be useful. The rate of nitrogen loss may not be sufficient in itself to argue for change of an age-old practice. However, composting of the manure with household garbage in large piles would provide for sanitary disposal of garbage and reduce the incidence of fly breading in the manure pile. It would be a refinement of an existing method, rather than it's total replacement by a new procedure. The compost pile could be built inside a bin of adobe blocks alongside the outside wall of the house.

### 4.3.4 Agricultural Value of Manure

Manure is applied to the fields at the time of planting. There are generally three planting seasons in Egypt: summer, winter and the time of the flooding of the Nile in the spring. However, crop selection and crop rotation vary. Some types of animal dung are considered better than others as fertilizer. For example, an informant in Menoufia noted that sheep dung is stronger than cow or buffalo dung. Pigeon dung is used for melon and grapes. Poultry dung is used for a variety of

vegetables and melons. Human excreta has been traditionally applied to certain truck farming crops, especially melons and strawberries.

The amount of manure needed depends on the crop, the fertility of the soil and the supplemental use of artificial fertilizers. In general, farmers in Menoufia responded on the survey that it takes 300 to 500 donkey loads of manure per feddan (.42 ha.). All of those responding in the Assiut survey indicated it would take 200 or less loads per feddan (.42 ha.). A few informants noted that in Upper Egypt there were not as many draft animals and not as much manure was used. In Menoufia the most demanding crop was said to be the Egyptian potato, which needed 500 to 700 donkey loads per feddan. Maize and sorghum required 400 to 600 loads; cotton from 200 to 600 loads; vegetables from 200 to 500 loads and wheat from 100 to 200 loads. Manure is very rarely applied to Egyptian clover, since it is a leguminous plant.

Manure was not sold in the village markets, but it was possible to purchase it from a neighbor. According to the survey results in Assiut, the cost of a donkey load was about 10 piasters and that of a camel was about 25 piasters per load. In Menoufia respondents generally said that a donkey load could cost 10 piasters and a camel load 20 piasters. It is important to note that this does not include the price of transport, which can double the cost. It should also be made clear that the whole process of the use of manure occupies perhaps as much as half of the villager's schedule of activities.

It is generally said by the villagers that natural manure and chemical fertilizers should both be applied to the fields. Some farmers noted that chemical fertilizers produced faster results, but natural manure was better and safer in the long run. One villager said that chemical fertilizer acts on a crop like penicillin on a human being. It was difficult for the farmer to determine the percentage of natural manure used to that of chemical fertilizer, since they are measured differently.

The local Agricultural Cooperative Society determines the amount of artificial fertilizer a farmer is entitled to. Cropping patterns and rotation are determined to a large extent by the government, and the cooperative provides a variety of agricultural services to the villager other than making artificial fertilizer available. In Beni Adi of Assiut, the head of the cooperative said there were six kinds of chemical fertilizers available. Urea cost LE 4.5 per 50 kg. bag. Fertilizer bought on the black market could cost up to twice as much. There is a fertilizer factory in Mankabad of Assiut governorate, but it only produces phosphate fertilizer. The nitrogen fertilizers are said to be imported from a factory in Alexandria.* In general a farmer is provided with 200 kg. or four bags per feddan (.42 ha.).

### 4.3.5 Pigeon and Poultry Manure

Throughout Upper and Lower Egypt it is possible to see pigeon towers. These towers are found in crowded villages or on individual estates. A visit was

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* Fertilizer processed out of sludge from the Cairo sewer system is said to be manufactured near Cairo in the Jebel Asfar factory.

made to a large pigeon tower in Nukheila of Abu Tig District in Assiut. Constructed over a series of old buildings, mostly abandoned, were rows of clay pots cemented next to each other. Each clay pot was a home for several pigeons. This particular site had about 200 small towers with about 25 clay pots in each. The keeper said there were 5,000 pots, but he declined to disclose the number of pigeons, which must have been upwards of a several thousand. A keeper and his family lived here, but it was all the property of one wealthy man.

The pigeons are fed maize kernels. A sack of half an ardabb costs LE 10 and about a quarter of this is used everyday. Sorghum grain is used for the younger birds. The pigeon is an Egyptian delicacy, although rarely is it found on a villager's table. The main economic value of the pigeon is for its dung. This is cleaned out of the clay pots by hand twice a year, February and June. It is sold for LE 8 per ardabb (5.62 U.S. bushels). This dung is especially valued for melons and grapes. However, only the wealthy can afford to buy it. Sometimes poor village families will own a few pigeons, but little dung can be collected from such a small selection.

Due to recent development projects resulting in the creation of poultry farms, there is now a small supply of poultry manure available in some areas. A professor in the agricultural division of Assiut University indicated that 500 broilers can produce about 40 kg of dung in one and a half months. This is especially valued for truck farming of vegetable crops, particularly watermelons and cucumbers. At the chicken farm project in Nukeila of Abu Tig District in Assiut, the poultry dung is sold by the cubic meter for about LE 8.

### 4.3.6 Dung Cakes as Fuel

In Egypt, as in many parts of the world, dung is used as a fuel. Women make a dung cake, which is used for the traditional stove. Fresh animal dung is gathered. For Assiut the women generally gathered animal dung for making cakes from the areas outdoors where the animal was tethered, rather than using the night soil from the stable. The percentage of dung used for cakes compared to that used for fertilizer varied. It was generally a small proportion of the total. This was mixed with water, straw and twigs and then shaped by hand into cakes about 30 cm. in diameter. The cake is called a qursa al-gilla because it resembles a loaf (qursa) of bread. A woman may make as many as 15 cakes in a day, depending on availability and needs. These cakes must be dried in the sun for at least 10 days, generally on the roof or on a wall. In winter it takes longer for the cakes to dry. A girl is taught to do this chore from about age 8. The dried cakes are stored on the roof, often becoming part of the wall. A variety of insects takes up residence in each cake.

According to the results of the survey from Menoufia and Assiut, human excreta is never used in making dung cakes. A few informants in Assiut indicated that it might get unintentionally mixed, since the roof is often used as a latrine. The best dung for this purpose appears to be that of buffalo, cattle and donkeys. Dung with a high percentage of undigested fodder is best for fuel. Women usually take what they need for making the dung cakes, but it is probably less than an eighth of the amount available. Some informants noted that in the past, the very poor would take the animal dung from the streets and use it for dung cakes.

The dung cake is primarily used in the traditional open stove in Egypt. This generally consists of a few stones arranged in circle or square, with the dung cake and other fuel placed between. This stove is generally used once a week for the main meal on Thursday, at least in Assiut. During the week the stove may also be used for cooking fava beans, making tea or heating water. An average family may use around 15 cakes per week in Beni Adi, a village in Assiut. The traditional stove is gradually being replaced in some areas with kerosene stoves, especially for heating water. In the rural sector buta-gas is only found in new houses and with wealthier families. The dung cakes are not marked, but sometimes a woman may sell some to a neighbor. In Bani Adi it was said that five cakes might be sold for a single piaster (less than 2¢). Women in both Menoufia and Assiut tended to look on making dung cakes as a natural process and not as a filthy thing to do.

### 4.3.7 Sanitation and Animal Wastes

There are two fundamental health consequences of the traditional relationship between the villager and his animals. One is the proximity of the villager to his domestic animals. Having the stable located in the house results in the introduction of insects and compromises the cleanliness of the basic living and working area of the household. In many cases the animals are kept near a central court or room, where cooking and washing are done. From a health perspective it would be advisable to have separate entrances for people and the major domestic animals. This should be combined with an appreciation of the villager's concern for safeguarding his animals. Sheep, goats and chickens sometimes have the run of the house, making it difficult to keep the living and working area clean. This is even the case in some newer houses with cement floors. In some places pigeon feathers and other wastes were observed in the water jar which had a loosely fitted cover. It is difficult to improve sanitation conditions of the village home when man and animal essentially share much of the same living space.

A second major sanitation problem results from the animal manure and urine, particularly the piles kept near the entrance of the house. It is clear that these piles represent a major breeding ground for flies. As noted by Weir (1952:71) almost 30 years ago, the problem of fly control is one of the most serious found in the Egyptian village. The fly population peaks in the summer months, particularly May through June and August through September. The health problems from flies are well-known, particularly the high incidence of trachoma. It is not uncommon to see young children in the village with a clustering of flies literally crawling in and out of their eyes. When the manure pile is kept near the house, it is close to where the children sit or play. Flies also play a role in contamination of foodstuff. Since only the most modern houses have screening, it is almost impossible to prevent flies from entering the house.

Although the manure piles are not the only mechanisms for increasing the fly population, this is a problem which can be addressed. The Egyptian government has recognized the problem by prohibiting the storage of manure outside the house. However, until the villager is given a feasible alternative, it is difficult to see how this law can be enforced. One possibility is to switch to a wet composting process, such as is used in China. If the compost pile is kept moist, the heat generated in the compost process can kill off the fly larvae. In China they even plaster the pile with a layer of mud to prevent flies from being attracted by the manure and saturated soil.

The making of dung cakes as an ordinary domestic activity of village women represents a potential health hazard. It increases the chances of contamination of the water and food for the household, the control of which is also in the hands of women. It is to be expected that the availability of alternative fuels and facilities, particularly kerosene stoves and buta-gas, will eventually help replace the dung cake. It is entirely possible, however, that economic considerations, such as the removal of present price controls on buta-gas, could force many of the rural poor to rely on animal dung when it is available.

## 4.4 GARBAGE AND SOLID WASTE

Compared to the pressing problems of water supply, water contamination and excreta disposal, the issue of litter and garbage is not as high a priority. It is important to note that traditionally the Egyptian villager utilized the solid wastes that were generated in the village. Branches, wood, crop waste, paper and anything that could be burned provided a source of fuel. Food by-products and organic matter could be thrown to the villager's animals, particularly sheep, goats and poultry. Even bones left over from butchering or a meal were gnawed hungrily by dogs in the village. In the past there were few if any items of glass, metal or plastic. Cups and bottles are valued for containers, or for making children's toys. Litter in the modern sense of the word is basically a modern problem in the rural sector.

### 4.4.1 Domestic Level

Women are responsible for cleaning and sweeping their homes. Sometimes the litter is swept into the street. In Assiut and Menoufia most of the respondents in the household survey indicated they swept the area in front of their houses every day. Others, such as a widow living alone, may only sweep once a week or even once a month. Some of those interviewed in the surveys indicated sweepers from the village council cleaned the main streets, but it is difficult to determine how frequently this is actually done. In Assiut some 27 of the 40 respondents placed the sweepings on the roof. It was stored here, and burnable items were used as fuel. Eleven of the respondents swept the cleanings into the street. Most of these latter either had no permanent roof or lived in a new house. Since the animals had the run of most houses, the organic remains were often consumed on the floor.

### 4.4.2 Village Level

The village council has very limited facilities for garbage collection and disposal. In the village of Beni Adi in Assiut there are eleven sweepers specifically for that village. According to an official of the council, five cleaned the major streets, three cleaned the village council building, one had responsibilities mainly for mosques and two were assigned to clean up after the open market. There were several old donkey carts owned by the council. The garbage was dumped outside the city, generally along the side of the main road where it would be periodically burned. There were no trash collectors for the six other villages served by the village council.

### 4.4.3 District Level

At the district level the trash collection facilities are focused on the central city of the district. In Assiut district the only garbage collection facilities are under the direction of the city council. According to officials in the cleaning department, there are four old and "tired" lorries for collecting the trash. There are also about ten wooden donkey carts. These two modes of transport are housed in different centers. The total number of sweepers and drivers for garbage and street cleaning is about 250 workers. A sweeper receives 30 piasters per day in salary. The main duty is to clean the streets, which is usually done at dawn. There did not appear to be any consensus as to what was done with dead animals. Some of those interviewed said they were burned. In practice, dead animals appeared to be simply thrown with the rest of the trash, not surprisingly helping to attract a substantial rat population when the garbage was dumped.

There are said to be two special hollows where the city garbage is dumped. Paper is said to be sorted out and recycled as fuel for local factories. In practice the garbage is simply dumped along the side of the road or along a drainage canal on the outskirts of the city. Urban sprawl is rapidly advancing on the so-called "outskirts." Periodically, the accumulations are set on fire. It is clear that garbage and litter is a far greater headache in cities than it is in the villages.

### 4.4.4 Re-cycling

One of the results of garbage collection in Cairo has been a very successful re-cycling process of domestic waste. Dr. El Hakim (1976) has recently described the collection system of the Zabbalin. The Zabbalin are said to number about 40,000 and live on the outskirts of the city. They negotiate collection rights with middle-men for apartment buildings in Cairo. Using small donkey carts, the garbage is taken to the squatter settlements of the Zabbalin, where it is sorted out. Organic materials are fed to hogs, so that some ten tons of hogs are sold daily. Paper products are recycled into the paper industry. There is a small-scale version of similar scavengers in the city of Assiut. However, the collection of garbage and solid wastes by such scavengers is not found in the villages. It is only the urban context which can generate enough garbage to justify the process.

One of the positive aspects of village sanitation is the household re-cycling of trash and the use of organic wastes. However, there appears to be no consciousness of litter as a problem. Although there are laws on the books about littering, these are not enforced. Paper wrappings, cans, bottles, etc., are simply tossed away if not useful. The problem of litter is acute in urban areas, where it is indiscriminately thrown and there are inadequate public services for collection. Those services available are often not garbage collection, but garbage redistribution. There is no concept of the whole process of garbage disposal. The amount of energy currently being expended on sweeping and carting of trash is not resulting in improvement of the sanitary environment. One area is littered with the waste of another. With the increase of consumer goods in the rural sector, the problem of litter can be expected to eventually rival that of the other sanitary problems.

# APPENDICES AND SUPPORTING DOCUMENTATION

## APPENDIX 1

## PEOPLE AND ORGANIZATIONS CONSULTED IN EGYPT

### A. IN CAIRO

#### 1. USAID/CAIRO

| | |
|---|---|
| John Roberts | -- DRPS/LAD, BVS project |
| Ray McGuire | — BVS project officer |
| Magdi Sidarous | -- Architect, assistant to McGuire |
| Fred Guymont | — Civil engineer, Cairo sewer project |
| Dr. Merrill Shutt | -- Director of Health office |
| Dr. Rose Britanak | — Health Office Project Manager (SRHS) |
| Dr. Janice Weber | -- Science and Technology |

#### 2. CONSULTANTS AND ANTHROPOLOGISTS WORKING IN EGYPT

| | |
|---|---|
| Dr. Robert Fernea | -- Anthropologist (University of Texas, Austin), ARCE fellow |
| Dr. Iliya Harik | — Political Scientist (Indiana University), ARCE fellow working on agricultural development |
| Dr. Nicholas Hopkins | — Anthropologist, (Social Research Center, AUC), ARCE fellow on agricultural project |
| Dr. Cynthia Nelson | — Anthropologist (AUC), Appropriate technology project for NSF |
| Dr. Peter Reiss | — Anthropologist; Agricultural Mechanization Project |
| Dr. Nancy Gallagher | — Historian (University of California), ARCE projects of health services in recent Egyptian history |
| Dr. Soheir Morsey | — Anthropologist |
| Dr. A. A. Kielmann | -- Project Manager (SRHS) |

3. UNICEF

| | |
|---|---|
| Dr. Ulf Krueger | -- Director of Egypt office |
| Ibrahim Jabr | — Senior Programme Officer |
| Vladimir Panich | -- Senior Project Officer for Water Supply |

4. NATIONAL RESEARCH CENTER

| | |
|---|---|
| Dr. El Halwagi | -- Principal Investigator for Bio-gas Project |

5. ORDEV

| | |
|---|---|
| Dr. Ahmed Difrawi | -- Director of ORDEV office |

B. IN ASSIUT

1. ORDEV

| | |
|---|---|
| Ramzi Seifein | — Director of ORDEV office for governorate |
| Mohamed Talat Ali | — Local project officer |

2. DIRECTORATE OF HEALTH

| | |
|---|---|
| Dr. Rashad | — Director of Health Services |
| Dr. Amil | — Deputy Director of Preventive Services |
| Dr. Munir Rizk | — District Health officer |
| Dr. Hoda El Attar | -- Director of the Health Training Center |

3. FAMILY PLANNING ASSOCIATION

| | |
|---|---|
| Sami Assar | — President of the Family Planning Association |
| Mohamed Fahmy | — Director of the UNFPA Population and Development Project |
| Alim El Din Sabat | — Official from the Ministry of Education dealing with social services |
| Hasan Abu Saghir | — Supervisor of social workers |

5. ASSIUT UNIVERSITY

| | |
|---|---|
| Dr. Fath Allah | -- Dean of the Medical School |
| Dr. El Fatah | — Professor of Public Health |
| Dr. Ginaini | — Professor of Medicine |
| Dr. Zarzar | — Professor of Medicine |
| Dr. Gamel Rashad | -- Professor of Rural Sociology |

(various professors in the faculty of agriculture)

C. IN MENOUFIA

| | |
|---|---|
| Mohamed Tahun | -- General Director for Housing in governorate |
| Sharaf Sallam | — Deputy of Housing Department |
| Farag Hamdan | -- Chief Engineer for Water Supply |
| Dr. Abd El Monem Abu El Fatah | — Director of Environmental Sanitarians -- in governorate |
| Sayed Sallam | — District officer responsible for environmental sanitarians |

(various other officials)

## APPENDIX 2

## INTERVIEW SUMMARIES WITH HEALTH OFFICIALS RESPONSIBLE FOR RURAL SANITATION

A. Sanitarian from Toukh Dalaba, Tala District (February 28, 1981), Menoufia Governorate

B. Sanitarian at Babel in Shebin El Kom, District, Menoufia Governorate

C. Sanitarian for Tala District, Menoufia Governorate (March 3, 1981)

D. Health Educator from Shebin El Kom District, Menoufia Governorate

E. Health Assistant in Toukh Dalaba, Tala District, Menoufia Governorate (February 29, 1981)

F. Dr. Hoda El Attar, Director of the Health Training Center (Markaz al Tadrib) in Assiut (February 24, 1981)

A. Interview with a Sanitarian from Toukh Dalaba, Tala District, Menoufia Governorate, (February 29, 1981)

The Sanitarian has responsibilities in the rural sector relating to environmental sanitation. The inspector interviewed was a graduate of the Technical Health Institute in Imbaba, Giza. As far as he was aware, this was one of five health institutes training health inspectors; the other locations were Tanta, Alexandria, Mansoura and Assiut. The Institute at Imbaba offered six different training specializations:

1) Sanitarian
2) Lab technician
3) X-ray technican
4) Maintenance of medical equipment

After high school the man interviewed entered the two year training course at Imbaba, graduating in 1973. During his studies to become a Sanitarian, he attended the following courses.

1) Parasitology;
2) Bacteriology;
3) Pathology;
4) Nutrition;
5) Food inspection (both sanitary conditions and if food has been doctored, e.g., dilution of milk);

6) Immunization and diagnosis of epidemic diseases, including taking of blood and urine samples. Knowledge of disease symptoms, and disinfection of unsanitary households;
7) Anatomy;
8) Forensic medicine;
9) Quarantine and innoculations for travelers;
10) Public relations (from the villager to the highest officials);
11) Social Studies (General world history);
12) Environmental sanitation (cleanliness mostly geared to public facilities and standards of cleanliness); and
13) Preventive medicine, especially inspection of foods.

After graduating he spent one month in the health unit of Shebin El Kom receiving practical experience on the taking of blood and urine samples, testing foods, and the administrative procedures for the medical health certificates issued to those who sell food items.

This Sanitarian is responsible for two health units spending four days in the larger one and ten days in the other. His duties involve both clerical and technical office work and field work. The office work involves three main tasks. First, medical health certificates must be administered for all those involved with the sale of food. This certificate must be renewed every two years. Anyone involved in the handling of food is brought to the clinic. Here injections for immunization against cholera and typhoid are given. The lab technician takes stool and urine analyses. The doctor gives a complete medical check-up. If the person is physically fit, more samples of urine, stool and saliva are sent to the governorate hospital in Shebin El Kom for analysis for dysentery and tuberculosis. The Sanitarian also issues a summons to anyone violating the law regarding sanitation, such as the selling of doctored food and the indiscriminate throwing of sullage in front of a house. In 1980 he noted that 40 summons were issued for people throwing sullage in the street. This waste water should be thrown in an uninhabited area, he tells the people. He noted that the situation is difficult to enforce because there is a need for a pump truck to collect the sullage and take it far away from the village. Finally, the Sanitarian administers immunizations, especially against cholera for food handlers during the summer months. All those going on the pilgrimage to Mecca are checked to make sure they have been properly immunized.

The Sanitarian said that he tries to visit the grocery stores in his area at least twice a year. The butchers are to be inspected once a week. Once a month he takes water samples from the local wells and sends these to the central hospital of the governorate capital of Shebin El Kom for analysis. Once every three months he takes water samples from public service areas, to specifically test for cholera, rotating between mosques, schools and health units.

The Sanitarian admitted that very little is done in the area of health education. During a time when it is necessary to innoculate villagers, a car is sent equipped with a microphone to inform the villagers to come to the health unit. The household latrines of the villagers and their sanitary conditions were not in the area of his responsibility. Primarily, his duties were oriented toward the public sector, especially the inspection and education of those who handle or sell food.

B. Interview with the Sanitarian at Babel in Shebin El Kom District, Menoufia Governorate

The Sanitarian interviewed divided his time between Babel and another village, spending three days in each village during the week. His main task consisted of inspecting food stores to enduce health standards for the store itself, equipment and food items, and ventilation. For this respect he defines his role as more of a nutrition assistant. He can be effective only by enforcing regulations for food handlers. Every owner of a food store or peddlar must have a health certificate before obtaining a license. This license is renewed biannually. Each renewal is dependent on the handler having been examined for all contagious and venereal diseases, particularly tuberculosis. Innoculations are given for cholera, diptheria and smallpox. In practice the villagers have found effective ways to protect themselves from what appear to them as severe regulations. Upon hearing of an inspection visit, a storekeeper may close shop and disappear from the village. This can leave the inspector helpless, since he must schedule inspection tours to many stores.

The inspector also regularly takes samples of water for analysis and checks on general cleanliness and sanitation in the village. In his personal judgement a street that is littered with garbage, puddles of stagnant water and piles of manure is considered dirty and a health hazard. In theory, people should be fined if they litter, but in reality the village streets are daily littered with garbage and sullage. However, it is the responsibility of the village council to find a solution to the garbage and water problems. It is possible to exert pressure on villagers to store manure in the fields, but he cannot enforce the regulations. According to the Sanitarian, manure is an important commodity and must be guarded. Thus, it is best kept near the house.

C. Interview with the Sanitarian for Tala District, Menoufia Governorate (March 3, 1981)

The Sanitarian for the district of Tala is responsible for health education in all the villages of Tala district, in addition to his regular duties of food inspection, supervision of standards of sanitation, seeing that the streets are clean, and drawing attention to problems with sullage and sewage. The district has no responsibilities for water samples, which are sent directly from the village health unit to the governorate capital of Shebin El Kom. The district health office has recently purchased its own sewage disposal truck, which is used for the hospitals and local health units. This service was so new that the inspector did not know the exact procedures for use of the truck.

The Sanitarian in Tala district designates one day a week for health education. Since transportation is limited, he either walks or takes a bus to get from one village to another. He makes use of audio-visual equipment, put the projector dates back to 1940. A film on bilharzia produced in 1950 is shown in the schools. There are two films to show to nurses in training on the practical aspects of making up a patient's bed, etc. A few pamphlets are available, however there are no funds in the budget allocated for audio-visual materials. There is no educational material dealing with hygiene and sanitation, especially in relation to defecation and urination. The inspector feels that this is not part of his responsibility in health education.

D. Interview with a Health Educator from Shelvin El Kom District, Menoufia Governorate

This health educator, a type of Sanitarian at the district level, was observed and interviewed at the village health unit of Babel. He has been working with the Health Ministry in Shebin El Kom for the last five years. He was trained at the Health Education Institute of Shebin El Kom, from which he graduated in 1968. There are four health educators for the governorate of Menoufia.

The main duty of the health educator is to visit the village health units and give lectures on health problems. He tries to talk on various subjects, such as eye diseases and how they are transmitted, innoculations and immunizations against childrens' diseases, and general hygiene. Posters from the Ministry of Health are distributed and sometimes films are shown. In view of the large number of units to be visited and problems with transportation, these visits are not as frequent as desired. Some units may not be visited more than twice a year. Concentration is on those units with special problems.

On one occasion the health educator was observed talking to a group of four women, an old man and two school children. The lecture consisted of a lesson about inoculations, their administration and their importance as preventive measures. He also talked about endemic diseases such as bilharzia and ascaris. The age at which children should be innoculated against various diseases was routinely run through. All the well-known rules on how to avoid bilharzia were referred to, but no practical suggestions were offered on how to apply these. The women listened with a puzzled look. When asked later if they understood what had been said, they said no. When the educator was asked whether he could tell if his lecture was understood by those present, he answered that it was impossible for him to do anything with follow-up. His job was to repeat instructions, distrubute pamphlets and posters, and show films. No discussion followed his talk.

F. Interview with Dr. Hoda El Attar, Director of the Health Training Center (Markaz el Tadrib) in Assiut (February 24, 1981)

The Health Training Center is located on Jumhuriya Street in Assiut and was constructed in 1978. The facilities at the center are impressive, including class rooms, training laboratories, a nutritionist's room, an audio-visiual room equipped with a projector and screen, a small library, and offices. There is a dormitory next to the center that can house some 50 students mostly from other governorates. The school is open year-round and trains health workers for all of Upper Egypt. Most of the students, however, are from Assiut governorate. At the center training courses are held the health assistants (mulahiz al saha), lab technicians, emergency medical technicians, family planning assistants, and other short training needs in the health field.

At the time of the visit there was a two-week training program for 70 emergency medical technicians. The health assistant and the lab technician share more or less the same three-month curriculum, except that the lab technician is trained in blood sample analysis. The curriculum is established in Cairo by the ministry of Health for all the training centers. The latest revision of the curriculum includes the study of tropical infectious diseases, diagnosis of diseases, food inspection, health education, and clerical work. Only two days are allotted for

environmental sanitation and this is mainly theoretical. Lectures are given by professors of the medical faculty of Assiut University and by special lecturers, including previously trained Sanitarians. Following the classroom study there is a 15-day pre-service training period when field trips are made to local health units in Assiut district. Every two years a refresher course is given. If a doctor is not satisfied with the work of a health assistant, he can be sent back to take the course again.

Health assistants have been trained in Assiut since 1972, previously in an older building before the present training center was built. At the time of the visit, about halfway through the training course, a lecture was being delivered on the clerical responsibilities of the health assistant. There were four females in a class of about 25 students. Dr. El Attar noted that it was more difficult for women to become health assistants, because movement in a village can be restricted.

## APPENDIX 3

## EXISTING LATRINES IN EGYPT

The diagrams in this section are taken from an Arabic source circulated in the governorate of Menoufia by the Ministry of Health, Directorate of Rural Public Health. This reference is entitled "Preparatory and Necessary Measure for Construction and Installation of Sanitary Latrines." It includes instructions for constructions for constructing latrine cesspools.

Included here are:

A. Pit Latrine in Clay Soil

B. Pit Latrine in Sandy Soil

C. Latrine with a Septic Tank

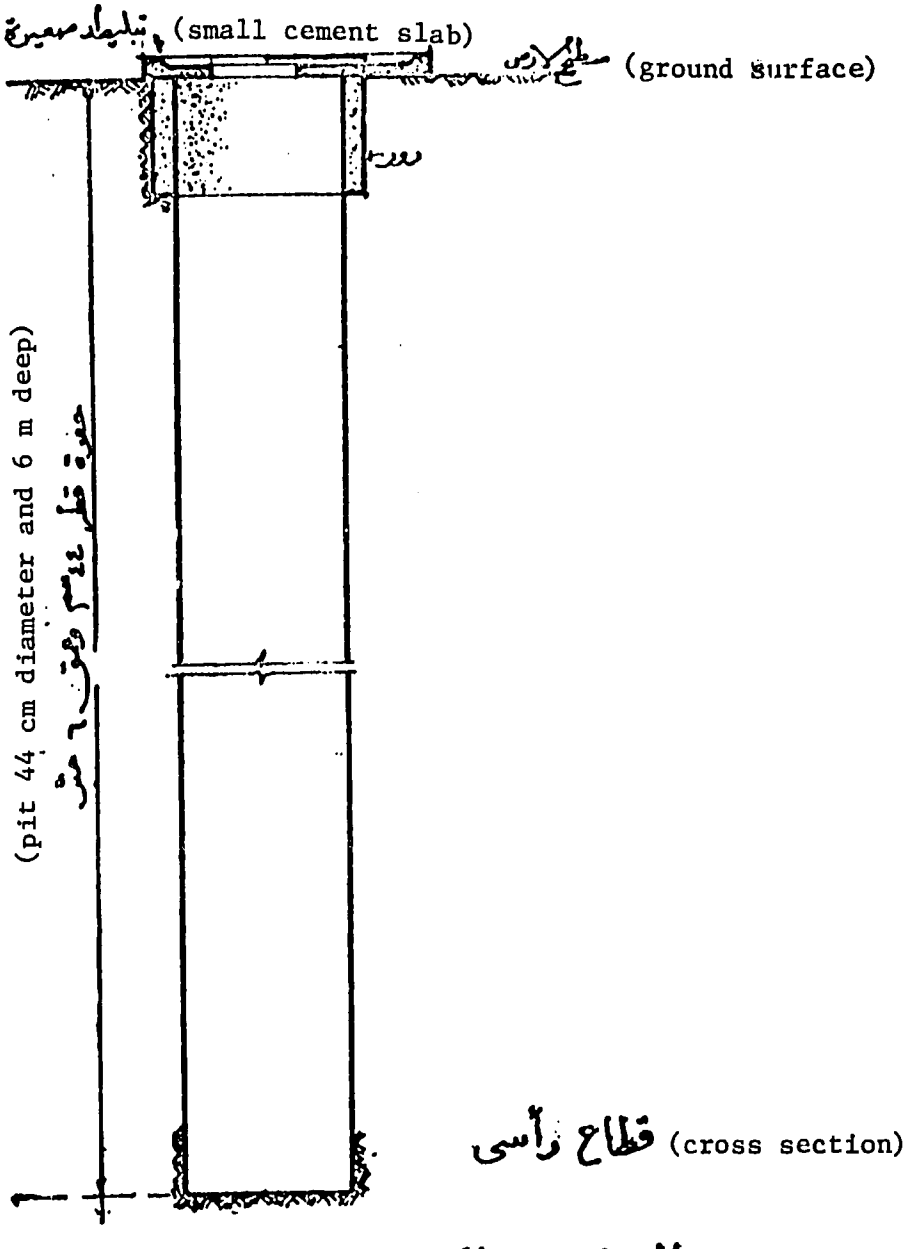
D. Compost Toilet

A. PIT LATRINE IN CLAY SOIL

— ٧٢ —

## ١ — المرحاض ذو الحفرة :

وهو مكون من ثقب فى الأرض اسطوانى الشكل فى حفرة قد يصل عمقها إلى ٦ م تعمل بريمة أرضية .



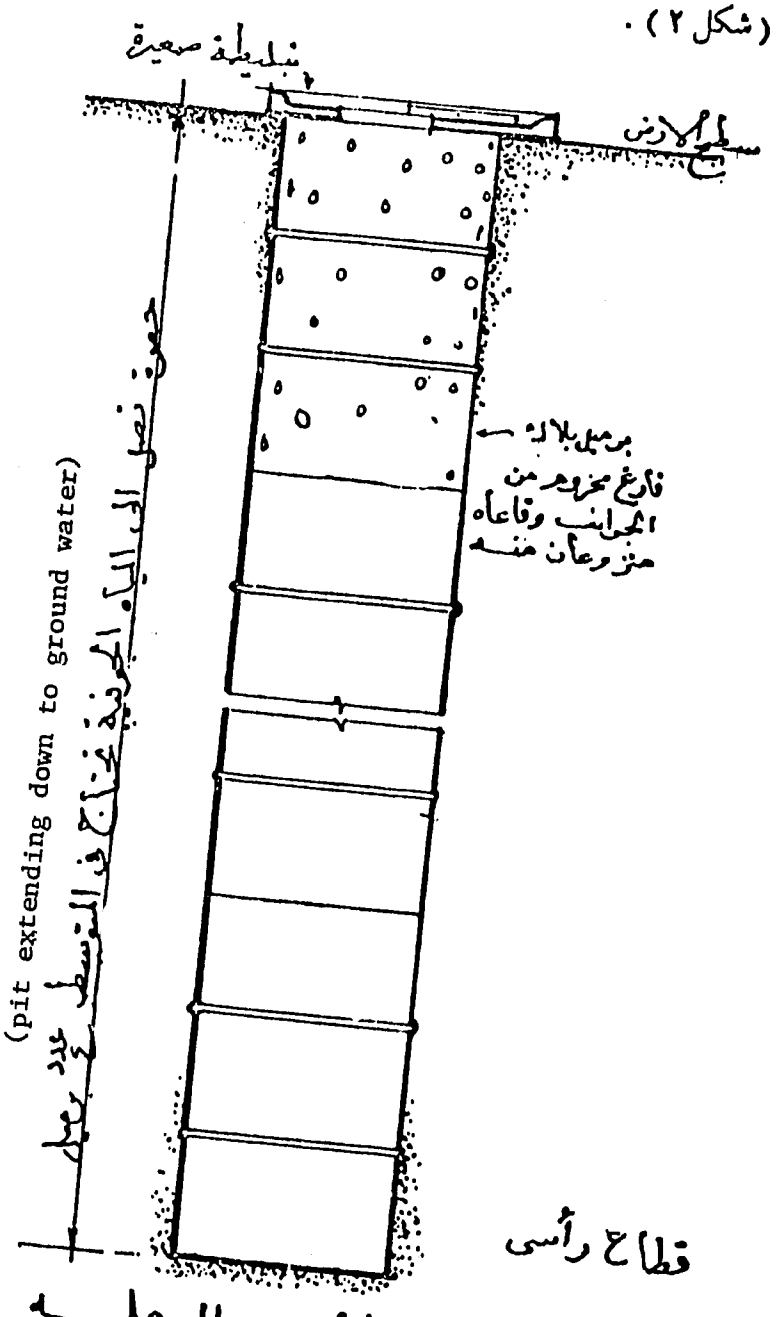

المرحاض ذو الحفرة فى الأرض الطينية المتماسكة

(شكل رقم ١)

B. PIT LATRINE IN SANDY SOIL

— ٧٣ —

ويعلو الحفرة ويكسوها زور من الأسمنت والخراسان بطول ٥٠ سم يعلو هذا تبليطة من الأسمنت للأرض (شكل ١) وفى الأرض الرملية يحتاج المرحاض ذو الحفرة لصندقة من براميل صاجية فارغة تمنع انهيار الجوانب (شكل ٢).




قطاع رأسى

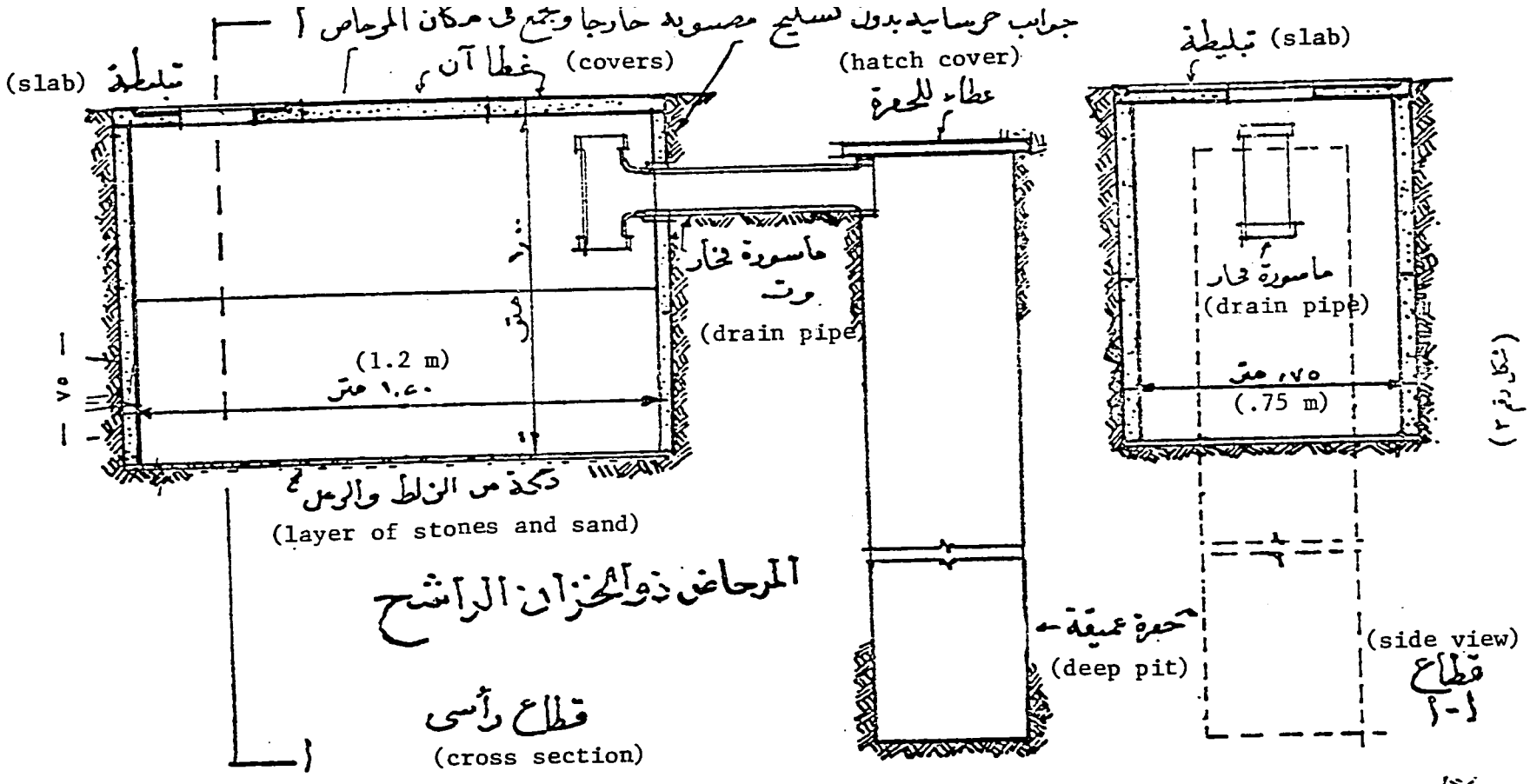
المرحاض ذو الحفرة فى الارض الرمليه

(شكل رقم ٢)

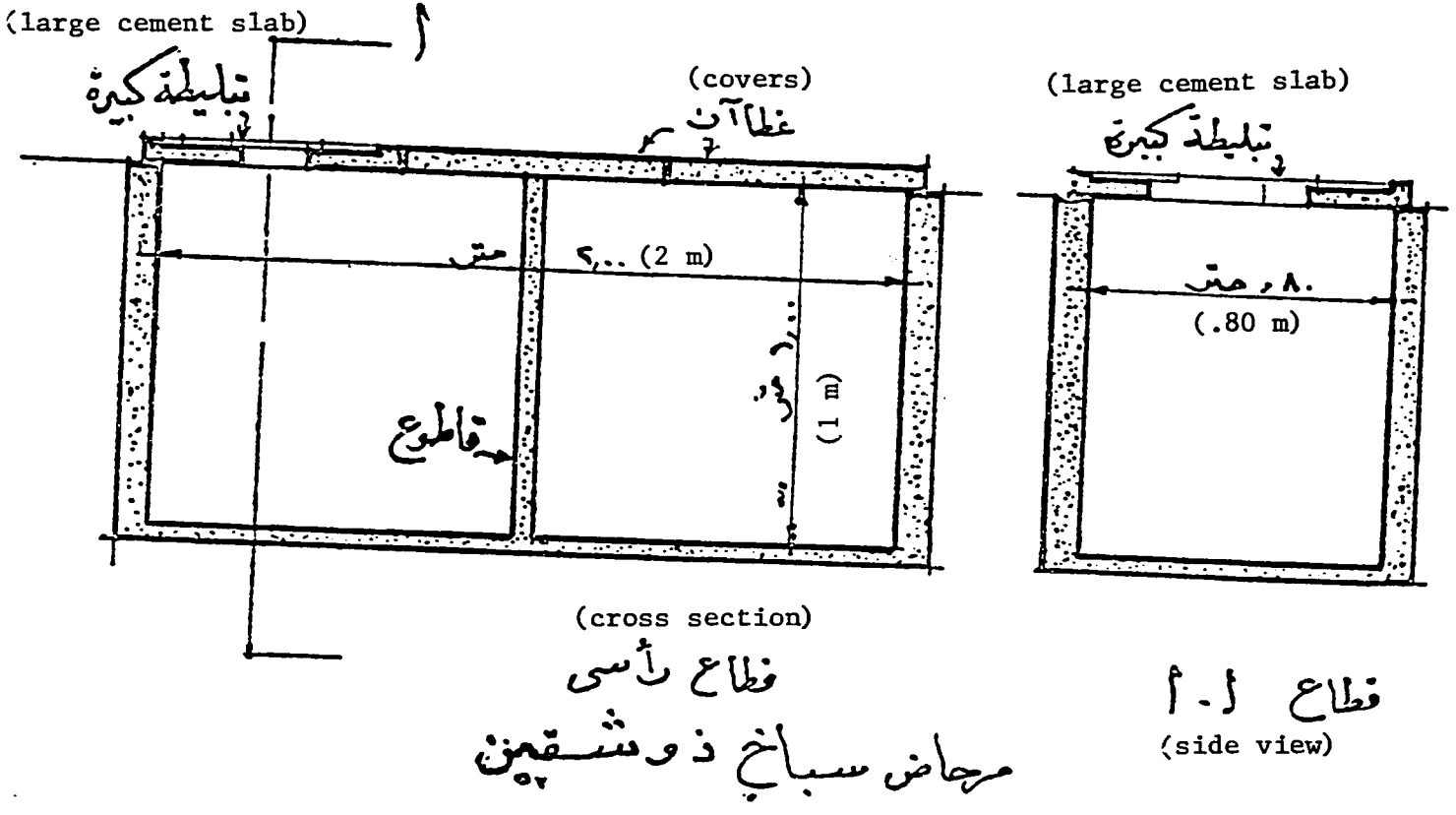
4

C. LATRINE WITH SEPTIC TANK

(شكل رقم ٢)



## D. COMPOST TOILET




(شكل رقم ٤)

## APPENDIX 4

## RURAL SANITATION IN DEMOCRATIC YEMEN

### Background

In the light of Basic Services strategy, the Government of Democratic Yemen, in cooperation with UNICEF, has been trying to improve the sanitation condition in the rural areas. While the rural population is scattered among small hamlets, the cultural background behind traditional habits of waste disposal differs from one governorate to another. If one attempts to compare methods of waste disposal in agricultural areas of Laheg and Hadramaut governorates, one would find the following basic differences: in Hadramaut, villagers dry in the open air excreta collected from traditional pits and use them at a later date as fertilizers. In Laheg, villagers go to the field for defecation and they do not use human refuse as fertilizer. In both cases, traditional practices provide optimum conditions for the breeding of mosquitoes and flies.

### UNICEF assistance to rural sanitation

Based on the above mentioned set of realities, UNICEF adopted two courses of action. Since Hadramaut is already using family latrines and giving high value for fertilizer from human excreta, UNICEF would be assisting in improving the condition of existing latrines to transform them into continuous compost ones. This takes into consideration the fact that the availability of water is limited and therefore the chances for overuse of water are rather slim. Such an improvement will help discontinue the habit of sun-drying human refuse which is a major health hazard. In Laheg, where the first phase of the primary health care programme is being implemented, three experimental family compost latrines are being constructed in the houses of three health guides. It is important here to mention that the health guide is a part-time voluntary PHC worker selected by the village council and he is a farmer as well. His responsibilities consist of keeping record of births and deaths and reporting them, providing simple drugs and rehydration salts, giving first-aid care, helping villagers protect their drinking water sources and ensure that all villagers bury their excreta and burn their garbage. Should these health guides get convinced to use the decomposed refuse as fertilizer, this situation is expected to attract other villagers to follow suit.

## APPENDIX 5

## ASSESSMENT OF BIO-GAS PROJECTS IN EGYPT

### Background

Biogas is a natural by-product of bacterial decomposition of organic matter in the absence of free oxygen (anaerobic fermentation or digestion). It is a potential energy source in rural areas which have a warm climate and an abundance of organic waste material (like rural Egypt). The basic technology of bio-gas is well reported in the literature; with the most notable developments having been in India and China.

Conditions of rural India are similar in some respects to rural Egypt. Dung cakes are widely used for fuel. Large quantities of animal manure are also used for fertilizers, but organic wastes in general and human wastes specifically are not highly regarded as agricultural resources. There is a laissez-faire attitude towards wastes in general.

There has been minimal success in improving rural sanitation conditions by programs designed to "dispose" of wastes (i.e., destroy them — remove them from the environment and therefore from human contact).

Bio-gas programs have been tried in several provinces of India primarily in the north where there are few trees and dung cakes are used extensively for fuel. Minimal animal manure is returned to the fields as fertilizer as a result of its use as fuel. Bio-gas plants were conceived of as a technology to release the fuel value of dung without destroying its fertilizer value. The reason behind the failures of the bio-gas programs in northern India are varied and complex, both technological and socio-cultural.

A discussion of the success of the Chinese bio-gas programs will help to clarify the problems encountered in India. China has a long history of recycling organic waste for agricultural fertilizer, which has been reported by many observers, most descriptively B.F. King in his "Farmers of Forty Centuries." However, the practices were neither sanitary nor truly conservative of resources (see "Health and Agriculture in China," F.C. Scott, 1950). Chinese agricultural research since 1948 has focused on optimizing nutrient conservation during treatment and storage of organic wastes. Agronomists have focused on the role of organic matters in soil fertility and crop production. Mechanization has been introduced to augment and enhance human labor in agriculture, not to replace it. Traditional methods have been a cultural base to build on, not a neolithic heritage to be stamped out and replaced by "modern methods."

The introduction of bio-gas plants in rural areas has been a logical step in a series of local and national government policies that have encouraged maximum local self reliance. Years of pragmatic investigation and applied research have demonstrated that anaerobic fermentation of specific organic wastes resulted in the highest conservation of nitrogen in a form immediately available to plants (primarily aqueous ammonia). Experimental stations at the commune level have been encouraged to develop methods of utilizing liquid manure slurry as fertilizer that are both compatible with local cultivation practices and beneficial to local crops.

Chinese bio-gas plants are constructed by their individual users from local materials at minimal cost. An average family digester uses one sack of industrial cement, (often burnt at a local village kiln) in addition to stone, rock, sand and clay from the surrounding countryside. Expensive iron or steel is rarely used. Biogas programs are coordinated on a commune level by a research group that investigates the most suitable local designs, construction methods and operating procedures. In addition, one or several cottage industries are established to manufacture gas lights and burners for local use, again from local materials (ceramics). The decentralized nature of the programs allows them to be custom tailored to local conditions and needs.

It cannot be emphasized strongly enough that the focus of the Chinese bio-gas program is the maximization of fertilizer production. Even the fuel value of the gas can be viewed from this standpoint because it frees other organic wastes such as straw or maize stalks from use as fuel and allows their use as fodder or compost material. Without the institutional support for research into organic fertilizer use and its beneficial effects on crop production, the bio-gas program in China would not have its present success.

In stark contrast to China, India's bio-gas program has not had the broad based institutional support needed for success. Here again, there are many parallels with Indian and Egypt. Agricultural research is performed by scientists (quite often from upper class urban families) and not by farmers. The agricultural theory and philosophy is Western with its focus on chemical salts for plant nutrition, mechanization at the expense of laborers, and cash crops to the detriment of subsistance economy. Manure use and organic fertilizers are not investigated nor encouraged. Chemical fertilizers are recommended by government extension workers and are sold at subsidized rates through government run cooperatives. The bio-gas programs in India have government run cooperatives. The bio-gas programs in India have emanated from university centers far removed from the farm. The design most often used is too expensive initially and too costly to maintain. The metal gas holder can cost $500 U.S. which is more than a year's income for most farmers. If not scraped and repainted regularly, the metal rusts out in a few years due to the highly corrosive nature of manure slurry. Numerous digesters have been built under government sponsored programs, but few survive more than a few years. Most working digesters are owned by richer farmers and operated by their employees (generally of a lower social caste) or are at an institution such as school or mission.

## Bio-Gas Potential For Rural Egypt

Theoretically, there is great potential in rural Egypt for bio-gas. Certainly the need is there in terms of the fuel, the fertilizer, and the effects on sanitation. However, there are several major constraints to successful implementation of the technology:

1) The largest single impediment is the lack of a nationwide governmental policy to encourage the maximum use of organic waste materials as fertilizers. In fact, government policy encourages the reverse of this by subsidizing the sale of chemical fertilizer salts at great national expense.

2) A second major obstacle is the government subsidy of bottled butane which cost Egyptians L.E. 85 million in 1980 and is projected to cost L.E. 102 million in 1981, according to a recent news clipping. In contrast, an L.E. 102 million yearly subsidy of bio-gas plants would certainly facilitate the introduction of the technology.

3) The third set of obstacles comprises the university research, agriculture ministry policies and foreign assistance programs that focus on destroying traditional agricultural practices and replacing them with Western methods. (This topic could take up volumes of specifics but that is not the purpose of this paper).

4) The main socio-cultural obstacle is the traditional practice of using dried composted manure for fertilizer. The traditional practice is to carry dry soil from the fields to the home stable and return the urine soaked soil mixed with manure to the fields to compost. This is done on a regular basis by one donkey or camel load at a time. There appears to be no cultural heritage of using liquid manure, such as digester slurry, in Egyptian agriculture. Transportation would be a tremendous problem. The weight and quantity of material would be more than doubled. Water tight containers would have to be employed at additional expense. It would also be a messy operation. Extensive research would have to be done in collaboration with numerous farmers to develop a completely new manure handling methodology. Drying the manure slurry for reuse by traditional methods would waste the preserved nitrogen and negate one of the major advantages of the anaerobic process.

5) The major physical constraint is the crowded spacial conditions of most Egyptian villages. There is hardly any space in an Egyptian house that is not completely used, particularly the floor space. In the final analysis, this physical constraint may be the dominating factor.

## Potential Applications

Bio-gas generation should be considered for centralized facilities, but only if all three of the following conditions could be met:

1) There is adequate organic waste on a continuous and regular basis;

2) There is more or less continuous usage for the gas generated; and

3) The facility has adequate land to utilize the digested effluent or there are nearby farmers willing to collaborate in the use of the effluent and an efficient method of slurry management can be developed to justify the labor input.

Potential bio-gas sites include schools, particularly agricultural high schools which keep some animals and are actively engaged in farming, and confined animal rearing operations such as chicken factories (for example, the Abu-Gandir project and the five more proposed DDI chicken factories for Fayoum). Food processing industries that have sufficient quantities of wastes are another potential area. A fruit drying operation may generate adequate wastes in combination with latrine wastes from workers facilities and be able to use the gas as supplemental fuel for drying.

## Existing Bio-Gas Technology in Egypt

Two different bio-gas projects are currently being funded by USAID. The Abu Gandir project in Fayoum is being funded through the BVS. A research project at the Egyptian National Research Center in Cairo is funded by the Science and Technology Program.

## General Assessment of the NRC Bio-Gas Research Project

This consultant has interviewed Dr. M.M. El Halwagi (the principal investigator) briefly on two separate visits to the project site. Based on those interviews visual inspection of the project prototypes and facilities and information gathered from two written reports, the following assessment can be made:

### Positive Aspects of the Project

1) Preliminary field status studies were done to determine the type and availability of organic wastes and laboratory examinations performed to determine basic chemical characteristics, biodegradability, etc.

2) Two low cost digesters based on Chinese designs were built from materials locally available in most Egyptian villages. One digester was operated for approximately six months and extensive performance data was recorded for analysis.

3) Several methods of slurry handling were investigated for agricultural reuse of the effluent. Several bio-assays were performed.

4) Social studies have been planned to investigate the cultural problems and obstacles to integration of bio-gas into the Egyptian villages.

5) The integration process has a reasonable time table. The project is actively and consciously attempting to avoid the negative example of a failed project due to an unreasonably short time frame.

## Project Weaknesses

1) A more elaborate hybrid design digester has been developed and is being proposed in an attempt to maximize gas production and several other operating parameters.

2) The design is too expensive because of the metal gas holder, and also is more prone to failure due to lack of maintenance (a common problem with the Indian digesters).

## Conclusions and Recommendations

The project represents the current state of the art in Egypt. It should be given maximum encouragement and support. However, the use of anaerobic digesters (Bio-gas plants) cannot at this time be recommended as a sanitation alternative for Egyptian villages because of the numerous constraints.

APPENDIX 6: TRANSLATION OF SURVEY QUESTIONAIRE

INTERVIEW SCHEDULE
AT
VILLAGE LEVEL

Water its source and use

1. Do you have water faucets in your home? — Yes — [ ] Pump [ ] Piped water — No

2. Are you thinking or would you like to have piped water? (Record verbatum respondents' answer)

_____

_____

3. From where do you get your drinking water? _____

_____

4. And the water for cooking? _____

5. Where do you wash your dishes and kitchen utensils? _____

6. Do you use soap in washing kitchen utensils and dishes? _____

_____ Yes _____ No

7. Do you use anything else besides soap in washing the dishes and kitchen utensils? (specify) _____

_____

8. Where do you wash your clothes? _____

_____

9. What do you use for washing your clothes? _____

_____

10. Are there any stand pipes in your village?

—— Yes —— No—— (17)

11. How far is the stand pipe from your home?

_____

12. What are the problems connected with the stand pipe?

_____

_____

13. Is there water leakage from the stand pipe?

_____ Yes _____No

14. Who Looks after its maitenance and repair?

_____

15. Where and to whom do you complain when there is water shortage or repairs to be done? _____

_____

16. How often is the water supply cut out from the stand pipe? _____ _____

17. What do you do when there is no water in the stand pipe, where do you get the water? _____

_____

18. Where do you store the water you use for drinking and cooking?_____

_____

19. What are your views on the religions practices & beliefs related to self cleanliness? (Record verbatum respondents' answer)

_____

_____

_____

20. How do the people dispose of "washing", or "cleaning" water? _____

_____

21. Is there anyone in the village who works as a washing woman? _____

_____

22. Would the women here like to have public washing facilities, where you could go to wash and have a bath? (Record verbatum respondents' answer)

_____

_____

23. What should these facilities be like? _____

_____

24. Where should they be located? _____

_____

**Food preparations - place & storage**

25. Where do you cook your food? In what part of the house?

_____

26. What do you do with left overs - In what and where do you store the food? _____

_____

27. Where do you store the grains & rice, butter, cheese etc.

_____

28. Are there mice, rats of foxes that eat or destroy your crops? How have you faced this problem?

_____

_____

| Latrines, description, use, & disposal of sludge |
|---|

N.B. Have any Governmental agencies recently constructed latrines in your village?

____Yes ____No

29. Do you have a latrine in your home?

____ Yes ↓ ____No ____ (44)

30. When did you build it? _____

31. Does it have running water, i.e. (septic tank)?

____ Yes ____No ↓

32. Do you take water with you when you use the latrine ? in what type of container do you put it?

_____

33. What type is it? (Describe, its type and cleanliness)

_____

_____

34. Does every member of the household use the latrine? i.e. who uses it?

_____

_____

35. Where did you defecate before you built the latrine?

_____

_____

36. Does the latrine smell?

——— Yes ——— No

37. Does the smell (stink) from the latrines cause any problems in the house? If yes, what are these Problems? _____

_____

38. What is used for cleaning - is water used?

——— Yes ——No

39. How much does it cost per load to empty the latrine?

_____

40. How much did it cost 2 or three years ago?

_____

41. Where was the sludge from the latrine dumped?

_____

42. Who empties the latrine? _____

_____

43. Was the sludge used to make fertilizer or dung cakes?

_____

_____

44. Where do the people, who do not have a latrine in their home, defecate? i.e., husband, wife, children, adults.

_____

_____

_____

_____

45. Where is the excrement disposed of and with what is it removed? _____

_____

_____

46. Is it used for anything? (Specify)? _____

_____

47. What about the excrement or the manure in the streets, does anyone remove it? _____

_____

_____

48. Do you think that the people who do not have latrines in their homes would like to have one? (cite verbatum reponse)

_____

_____

_____

| |
|---|
| Animals, the stable, dung cakes, and chemical fertilizer. |

49. How often do you collect manure from the stable? (i.e., every day, once a week, once every two weeks)

_____

_____

_____

50. Where do you store the manure? in the fields, streets etc...? _____

_____

51. How much fertilizer do you need per feddan? _____

_____

52. If a peasant has an extra supply of fertilizer, what does he do with it? For how much he sell it?

_____

_____

53. What are peoples' opinion of chemical fertilizers? (cite verbatum response)

_____

_____

_____

_____

54. Is human excrement used in making dung cakes? What percentage? _____

_____

_____

55. What percentage of animal manure is used in making dung cakes? _____

_____

_____

56. Who decides what amount of manure is to be used in making dung cakes? (The husband or wife) _____

_____

_____

57. Where do you throw the garbage? _____

_____

58. How often do you sweep in front of your house?

_____

_____

Basic Information

59. Who lives with you in this house, do you share household arrangments?

| M | relationship to head of household | age | sex M | sex F | education | occupation |
|---|---|---|---|---|---|---|
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| | | | | | | |
| | | | | | | |

_ area of house:_____

_ no. of rooms :_____

_ no. of livestock:_____ own ___

| | |
|---|---|
| | gamoosa |
| | cow |
| | donkey |
| | camel |
| | sheep/goats |

doesn't own ___

## APPENDIX 7

## VOCABULARY OF ARABIC SANITATION TERMS

The following is a listing of some of the Arabic terms used in Egypt for sanitation. The terms are listed according to a standard transliteration scheme. Pronunciation in Egyptian can be found in Elias (1976) and Spirto (1973). Ms. Ann Royal assisted in the initial preparation of this listing.

The words are listed under the following categories:

A) Excreta, Manure and Urine
B) Latrines and Sewage Facilities
C) Garbage and Solid Waste
D) Water
E) Miscellaneous

### A) Excreta, Manure and Urine

| | |
|---|---|
| ba'r | sheep and goat dung |
| bawl | urine |
| birāz | human excrement (polite term) |
| gha'it | excrement |
| jilla (pronounced gilla) | animal dung |
| kharā | human excrement |
| ḥittāt al-baha' im | cattle and buffalo dung |
| mazbala | pile of manure |
| kawm al-sabākh | pile of manure |
| miska | animal dung |
| mukharajāt al-insān | human wastes |
| naqla | load of dung |
| qasabiya | pile of manure (Menoufia) |
| qursat al-jilla | dung cake |
| sabākh | manure |
| samād | manure or fertilizer |
| shukhākh | human excrement or urine |
| sibla | dung of horse and donkey |
| wasakh | excrement, filth |
| zibl | pigeon dung |
| rāsmāl | poultry dung |

### B) Latrines and Sewage Facilities

| | |
|---|---|
| awsākh | sewage |
| bait al-adib | rest room |
| bait al-rāḥa | rest room (literally) |

| | |
|---|---|
| balā'a | sewer drain |
| barbakh fakhkhār | clay pipe |
| dawrat al-miyāh | water closet (literally) |
| ghitā' al-ḥufra | hatch cover |
| ḥufra | pit or hole |
| kasḥ | emptying of latrine pit |
| khazān | tank or vault |
| kabāniya | latrine (polite term) |
| kinīf | water closet (lower-class usage) |
| mabwala | urinal |
| magārīr | septic tank |
| marḥāḍ | latrine |
| marḥāḍ al-sabākh | compost toilet |
| marḥāḍ al-sulṭāniya | throne toilet |
| māsūra | pipe |
| mashakhkha | public latrine |
| saifūn | flush |
| rashḥ | sludge |
| sarātī | latrine pit cleaner (Menoufia) |
| shishma | water closet (lower-class) |
| tabaa | clay chamber pot |
| tabliṭa | slab |
| transh | cesspool (from French) |

C. Garbage and Solid Waste

| | |
|---|---|
| ḥitta | small bit |
| qaṣūṣa | scrap, small bit |
| qishr | peel, rind, shell |
| zabbāl | garbage collector |
| zibāla | garbage |
| ballāṣa | water jar (carried on head) |
| burma | small clay water jar |
| ḥanifiya | water faucet |
| ḥawḍ | basin or tank |
| mā' (pronounced may) | water |
| marawwā' | clean or filtered |
| mayḍā | ablution lavatory in mosque |
| naḍīf | clean |
| najis | unclean, impure |
| qulla (pronounced olla) | small water jar |
| ṣāfī | pure, clean |
| ṣarf | drainage |
| ṭāhir | pure |
| ṭurumba or ṭulumba | hand pump |
| wuḍū' | religious ablutions |
| zīr | water jar |
| 'amaliya al-miyāh al-naqiya | potable water system |

E. Miscellaneous

| | |
|---|---|
| ardabb | measure = 198 liters or 5,62 US bushels |
| 'adwa | contamination, contagion |
| burj al-ḥammām | pigeon tower |
| dhubbān (pronounced dubban) | flies |
| dūda | worm |
| fār | rat or mouse |
| faddān | land measure = 1.038 acres or .42 ha |
| fās | hoe |
| furn | traditional Egyptian oven for baking bread |
| ghaiṭ | field |
| iskān | housing or population |
| kānūn | traditional Egyptian open stove |
| majlis al-madina (pron. maglis) | city council |
| majlis al-qarya | village council |
| maraḍ | sickness, illness |
| markaz | district |
| muḥāfaẓa | governorate |
| nashafa | to dry (e.g., dung) |
| qādūs | clay pot used in pigeon tower |
| qirāṭ | measure = 1/24 of a faddan |
| sabākh kūfrī | fertilizer from old ruins |
| samād kimāwī | chemical fertilizer |
| saqiya | water wheel |
| shadūf | hand lift for raising water |
| ṣirṣār | cockroach |
| tisht | basin for washing and bathing |
| ṭub al-aḥmar | fired brick |
| ṭūb al-ṭin<br>ṭūb al-nai<br>ṭūb al-akhḍar | mud brick, adobe |
| waḥda maḥaliya | village unit |
| waqīd | fuel for oven, etc. |
| zariba | stable |

## APPENDIX 8

## BIBLIOGRAPHY


Assad, Marie and Samiha El Katsha. 1981, Formal and Informal Health Practices — Babel Wa Kafr Hamman. MEAWARD. Population Council.

'Abd al Radi 'Abd al Da'im Aziz. 1978, 'Amat wa 'awamil al taghir fi al usra al rifiya bi mahufaza Asyut (Characters and Factors Affecting Changes in Rural Society in Assiut Governorate) M.S. thesis, Faculty of Agriculture, University of Assiut.

Elias, Edward E. 1976, Practical Dictionary of the Colloquial Arabic. Cairo: Elias Publishing House.

FAO. 1977, The Water Buffalo. Rome: FAO Animal Production and Health Series, #4.

Gadalla, Saad. 1978, Is There Hope? Cairo: AUC Press.

El Hakim, Dr. Sherif Mahmoud. 1976, Social Policy and the Environmental Issue: the Case of Cairo's Domestic Waste (paper).

El Halwagi, Dr. M.M. 1980, The Development and Application of Biogas Technology in Rural Areas of Egypt. Summary Report. Applied Science and Technology Project (#263-0016).

Ibn al 'Awwam. 1802, Libro de Agricultura. Madrid. (Translation of Kitab al Filaha).

Institute of Medicine. 1979, Health in Egypt: Recommendations for U.S. Assistance. Washington, DC: Institute of Medicine and the National Academy of Sciences.

Jama'iya al abhath wal khidimat al ijtima'iya bil Minya wa Asyut (Association for Social Research and Services in Minya and in Assiut). 1974, Taqwim tijarib tanmiya al qarya (An Appraisal of Experiments in Village Development). Mimeo.

Johnson, Pamela. 1980, Sanitation and Hygiene in the Near East. A Draft Report to the Office of International Health, H.H.S.

Kalbermatten, John M. et al. 1980, Appropriate Technology for Water Supply and Sanitation. A Sanitation Field Mamual. Washington, D.C.: World Bank.

Khattab, Dr. Hind. 1981, Male Labor Migration and its Impact on Women's Roles and Status. (SRC Research Study).

MacMillan, S.A. 1981, The Visual Learning System. Environmental Hygiene (Water). Instruction Notes. Switzerland.

Middleton, Richard. 1979 (Jan.), Demonstration Projects in Low-Cost Water Supply and Sanitation. UNDP Project Paper.

Miller, DeWolfe. 1980 (Nov.), Training Plan for Environmental Health Workers. Strengthening Rural Health Delivery Project. Westinghouse.

Mobarak, A.B. et al. 1979, Strengthening of Health Services for Rural Egypt (paper).

Morsey, Soheir. 1977, Illness Concepts and Structural Constraints: Health Care in an Egyptian Village (paper presented at annual meeting of MESA).

Oxfam. 1978, Oxfam Conference of Rural Sanitation. Oxford.

Rockefeller Foundation. 1933, Soil Pollution, in Archives of the Rockfeller Foundation, Annual Report for 1933.

Scott, Francis. 1948, Health and Agriculture in China. London: Faber and Faber.

Shanawani, Haifa. 1970, Dirasa 'an thalatha qura fi muhafaza al Minufiya (Studies on Three Villages in the Governorate of Menoufia). Cairo: AUC Press.

Spiro, Socrates. 1973, An Arabic-English Dictionary of the Colloquial Arabic of Egypt. Beirut: Libraire du Liban.

El Togby, H.A. 1976, Contemporary Egyptian Agriculture. Cairo.

University of Arizona. 1980 (May), Draft Environmental Report on Arab Republic of Egypt. University of Arizona, Arid Lands Information Center.

University of Assiut. 1972, Annual Report, Department of Preventive Medicine. Field Training of Final Year Medical Students 1971. Faculty of Medicine.

USAID. 1980 (June), Project Paper. Basic Village Services Project 263-0103.

Weir, John M. et al. 1952, An evaluation of health and sanitation in Egyptian Villages, in Journal of the Egyptian Public Health Association, Vol. 25, No. 3, pp. 55-114.