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THE LIVESTOCK ENTERPRISE ON SURVEY FARMS IN ABU-RAIA, KAFR EL SHEIKH: SELECTED IMPLICATIONS FOR WATER DISTRIBUTION AND FIELD MANAGEMENT

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SUMMARY

During the summer of 1981 the field staff of the Egypt Water Use and Management Project and Mr. Mohammed Haider of Colorado State University completed a farm survey of the Abu-Raia, Kafr El Sheikh area. The farm survey included information on crop area, inputs and production, as well as livestock numbers, feed and production. This statement develops from the survey information a concept of the farming system and selected analyses of the livestock enterprise as it relates to the field management and distribution of water. The livestock enterprise is depicted as depending, for the most part, on crop residues for feed energy. Example balances between feed energy required and that produced shows how the adoption of improved livestock is impeded by crop production, as well as on-farm work requirements. The livestock enterprise is a significant contributor to the value of products produced and benefits of water. Improved management of the distribution and field application of water enhances berseem and crop residue production as feed for livestock. In some cases, it could release livestock from the work of lifting water to be used for other productive means. This is of concern to the Egypt Water Use and Management Project because it is endeavoring to find the highest and most beneficial uses of irrigation water.

In the survey area it does appear possible that improved livestock could more easily be adopted if water lifting were not required. Also, specialization in livestock enterprises could be enhanced, since specific kinds of livestock would not be necessary for the related work activities--e.g., cows are not required for the sakia. However, the actual adoption of improved livestock appears to depend heavily on individual management initiative, and feed energy available from crop residues. For this reason, it is probably not valid to use the "potential loss of the opportunity of using improved livestock" in cost comparison calculations. In this case, though, for purposes of illustration, the potential loss of the opportunity of using improved livestock was estimated roughly in the magnitude of

14 L.E. per feddan. Such costs, when added to the incremental costs of running the sakia, cause the total cow-powered sakia costs to be higher than diesel pump irrigation when five or more feddans are irrigated. The total buffalo-powered sakia costs exceed diesel pump costs, except on one feddan or less.

The benefits to livestock of improved field management of water through land leveling were calculated by example since crop productivity from increased irrigation efficiency and land leveling have not yet been established. The example traces through how the movement of 50 cubic meters soil per feddan for land leveling could improve irrigation efficiency and, thereby, crop production contributing a potential of 45 L.E.-75 L.E. of added livestock production per feddan. At 4,596 cubic meters of water used per feddan, this represents an added product of .01 to .016 L.E. per cubic meter of water used.

Most of the calculations in the report are done by example, or scenario, so that similar analysis using the same framework can be used for other sites and other surveys. The purpose of the statement is to provide information on the Abu-Raia, Kafer El Sheikh area, as well as to develop a framework of analysis for other sites and other projects.

The Farm

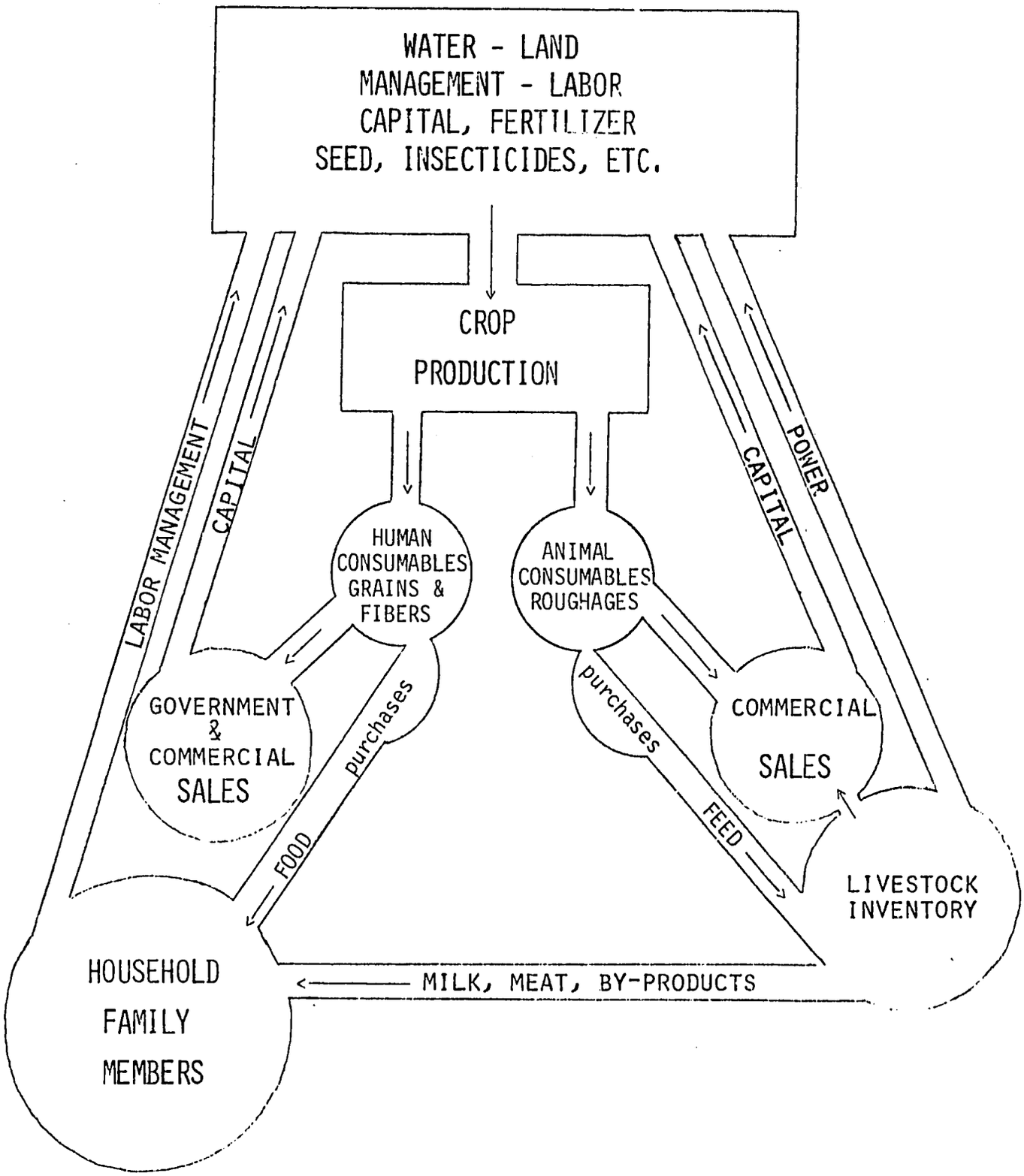
The farm operation in Kafr El Sheikh, as portrayed in the survey (4) and by on-site inspection, is a balance among four major elements: the water-land base, crop production, family size and livestock numbers. The water-land base largely determines crop production. The two important parts of crop production are human consumables (grains, fibers and vegetables) and animal consumables (green forage, straw and hay). The human consumables

portion is used for commercial or government sales as well as direct family member consumption. In the Kafr El Sheikh area a substantial proportion of the crop product is used for household (family member) consumption. Hence, there is a suggested balance between numbers of family members and commercial sales. The animal consumable portion of crop production is used to feed the ruminant livestock (buffalo, cows, sheep, goats and donkeys). The ruminant livestock are used for power to lift water, plow, cultivate and transport harvested crops and to produce milk and meat, hence, a suggested balance between crop production and livestock numbers. A more comprehensive description of the farm operation or system is shown in the following Illustration I.

In contrast to some conventional concepts of complementarity, there appears to be a competitive relationship between numbers of family members and numbers of animals on farms. In some cases, human consumables, as grains, are used as feed for livestock. In the longer run, seed varieties can be selected that produce more roughage, e.g., straw and less grain. To some extent, that is the case for maize in the Kafr El Sheikh. The maize crop there is largely produced from forage varieties--large stalks, numerous leaves and a single maize ear to each stalk. There also appears to be a basis for complementarity between numbers of family members and numbers of animals on farms. The milk, meat and by-products produced by livestock are, to a large extent, used in the farm household. On the other hand, household labor is used in the care and feeding of the animals. On the margin, though, the complementarity of family numbers to animal numbers is probably offset by the competitive relationship or the desire for maximum food energy. Generally, crop products produce more food energy directly consumed--as opposed to indirect consumption through livestock.

KAFR EL SHEIKH

THE FARM SYSTEM

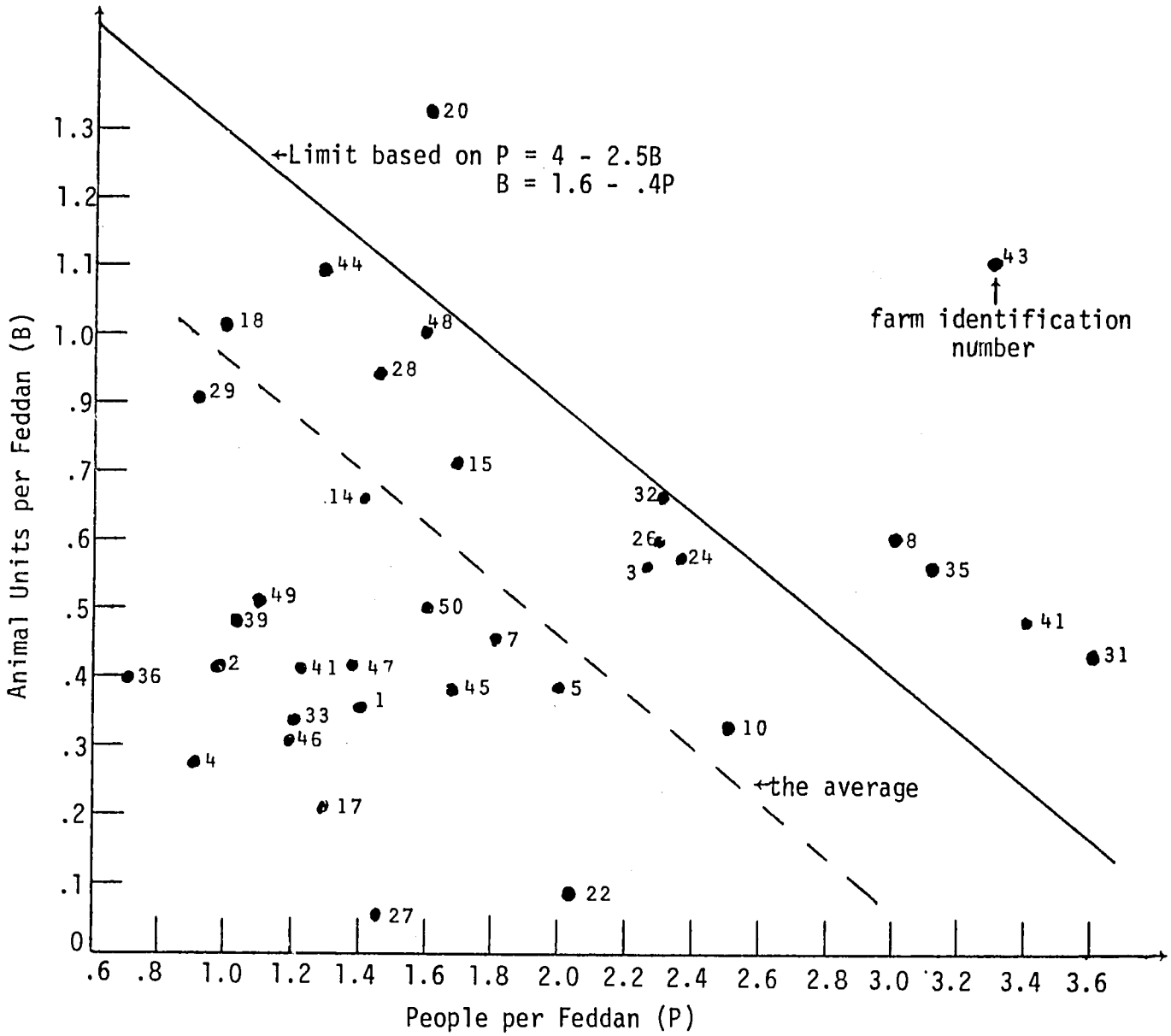


For example, there is more food energy in 100 kilos of grain than there is in the livestock products produced from 100 kilos of grain.

Neither of the conflicting complementary or competitive relationships between family size and numbers of livestock on the farm are evidenced or dominate in the Kafr El Sheikh area. Graph 1 shows, by individual farm, the animal units per feddan plotted against people per feddan. If the relationship between family size and numbers of livestock were complementary, the plotted points would show a general rise in the numbers of animal units per feddan as the number of people per feddan increases. On the other hand, if the competitive relationship between family size and numbers of livestock dominated, a general decline in the number of animal units would ensue as the number of people per feddan increased. As can be seen in Graph I, neither of these relationships are observed in the survey data by farm in the Kafr El Sheikh area. The animal units per feddan plotted against people per feddan for the survey farms in the Kafr El Sheikh area appear to cluster about the mean, without a specific formation. There is not an apparent formation indicating complementary or competitive relationships.

Graph I and other survey information appears to indicate that the survey farms in Kafr El Sheikh area are, for the most part, self-contained, self-sufficient units. That is, the plots of the animal units per feddan against people per feddan fall at or below the limits of the food and feed energy available per feddan. Calculations of the limits are based on roughly 40,000 mega kilo calories of metabolizable food and feed energy available per feddan, with one buffalo cow or one animal unit of feed energy requirement being equal to the food energy requirement for 2.5 people. A more detailed explanation of the calculations will follow. The few farms that exceeded the limits appeared to have family members with off-farm

Graph I. Animal Units per Feddan in Relation to People per Feddan on Survey Farms in Kafr El Sheikh (4)



(1) Limit of P = 4 - 2.5B, where P = people (family members) per feddan and B = animal units (buffalo-cow equivalents) per feddan. Also, the coefficient 2.5 = $\frac{\text{6,205 ME for buffalo}}{\text{1,650 ME for human consumption}}$ x .64 (the proportion of human edible food produced).

The proportion, .64 = $\frac{\text{25,350 ME of human edible crop energy}}{\text{39,866 ME of total crop energy}}$ and

the constant 4 ≈ $\frac{\text{(¼ food energy above input requirements) (25,350 ME of human edible crop energy)}}{\text{1,650 ME for human consumption}}$

(2) Buffalo cow equivalent units are:

buffalo (female)	= 1	goats (doe)	= .21	donkey (jinny)	= .5
buffalo (male)	= 1.1	goats (buck)	= .24	donkey (jack)	= .5
cow	= 0.76	sheep (ewe)	= .14		
bull	= 0.9	sheep (ram)	= .15		

employment. Wages were used to purchase additional food or animal feed. In one case, the farmer is keeping bulls from which he evidently collects fees for breeding services -- income that is used to purchase additional animal feed.

Livestock on the Farm (3, 4, 12, 13)

Most farms in the Kafr El Sheikh survey (4) kept one buffalo, one cow, one or two sheep and one donkey. This is consistent with the on-farm needs for livestock. Buffalos are used for puddling in the rice fields and cart pulling. Cows and buffalos are used for furrowing and smoothing. Donkeys are used for hauling harvested crops and manure as well as family transportation. Cows and buffalo are used to turn the sakia in the water-lifting operation. Sheep are slaughtered during the holidays for religious festivities. Besides power, both buffalo and cows produce milk and meat, mostly for family consumption. Buffalo, cows and donkeys in the Kafr El Sheikh area appear "poor" by U.S. standards due to the lack of "fat" or "finish." However, from at least cursory inspection, they are in excellent working condition. They are well muscled with little evidence of physical deterioration from under-nutrition, except for the aged and diseased animals. Livesotck are, for the most part, fed feeds made up of crop residues, except for the annual berseem crop and relatively small quantities of feeds purchased. Livestock information obtained from the farm survey is summarized in Table 1.

As shown by Table 1, milk production varies widely. Milk production is heavily affected by the low calving rates as well as by feeding and genetic differences. Although calving rates per se were not part of the survey, by inspection of live calving rates and milk production by cow, it

Table I. Summary of Livestock-Related Information on Survey Farms in Kafr El Sheikh[1/]

	Farms Within[1/] The Limits But Exceeding the Average	Farms That[1/] Exceed the Limits	Farms Below[1/] the Average
Number of Farms	10	6	19
Average Farm Size (Feddans)	4.5	4.3	6.3
Family Member/Farm (Numbers)	9	14	8
Buffalos/Farm (Nos. Head)	1.2	1.2	1
Cattle/Farm (Nos. Head)	1.4	.7	1.2
Sheep and Goats/Farm (Nos. Head)	.4	.7	.4
Donkeys/Farm (Nos. Head)	1.5	1.3	1.0
Buffalo Milk Production/Farm (Kilos/Annum)	500	466	288
Buffalo Milk Production/Cow (Kilos/Annum)	500	399	288
Cow Milk Production/Farm (Kilos/Annum)	337	90	165
Cow Milk Production/Cow (Kilos/Annum)	259	109	142

[1/] The limits based on potential food energy produced are shown in Graph I. The average is based on the average animal units and people per feddan.

is evident that calving rates are also low. Live calving rates ran around 44 percent for cows and 47 percent for buffalo.

Crop-Livestock Feed Energy Balance (5, 6, 7, 8, 9)

To demonstrate the crop-livestock feed energy balance the "average" farm in the survey (2, 4) was constructed from the average feddans per farm for each crop. Most farms will not have all crops, but the "average" farm does represent the typical feeds that are available through purchases or "in-kind trades." Nearly all farms produce a substantial area of berseem, which is the major feed crop, accounting for over half of the feed energy available on farms. Most of the remaining livestock feed is made available from crop residues and roughage from the non-cultivated areas. Small amounts of livestock feeds are purchased in the form of wheat bran and mixed feeds. The total potential feed energy on the average farm is around 42,000 mega kilo calories as shown in Table II. Most of the potential energy is used for family consumption as food or for commercial sales. A smaller portion of a little over 16,000 mega kilo calories is available to livestock in the form of crop residues, berseem and purchased feeds.

Table III shows a detailed breakdown by crop of the feed energy available from crop residues, as well as berseem. The total mixture of crop residues, berseem and purchased feed yields about .8 of a mega kilo calorie per kilo--"a rough rule of thumb" that can be used by economist fieldmen to check for the need to purchase feed.

Table IV shows the per annum feed energy requirements of the typical array of livestock on a farm in the survey. In this case, one buffalo, one cow, two sheep and one donkey have cumulative feed energy requirements of 15,733 mega kilo calories--almost the same as the available feed energy of

Table II. Farm Crop Production and Metabolized Feed Energy Equivalent on the "Average" Farm in the Survey (2, 4)

Crop	Planted Feddan[4]	Production		Kilos/ Unit	% Dry Matter	Metabolizable Feed Energy Equivalent		
						Per Kilo	Per Farm	Per Feddan
		Unit	Amount			- -	Mega Kilo Calories	- -
Family Food or Commercial Use								
Wheat	1.284	Ardeb	9.9	150	.89	3.18	4,203	3,273
Flax[1]	.377	Ton	.2	--	--		1,392	3,692
Broadbeans	.206	Ardeb	.8	160	.9	3.0	346	1,680
Cotton	1.598	Kerat	8.3	--			5,899	3.692
Rice	2.266	Ton	4.1	1,000	.89	2.90	10,582	4,670
Maize	.588	Ardeb	5.2	140	.86	3.29	2,060	3,692
Vegetables[1]	.235	--	--	--	--		868	
					Subtotal:		25,350	
Livestock Feed								
Berseem	2.311	Ardeb	101.9	157	.30	2.17	7,446[2]	3,222
(Roughage & by-products from wheat, flax, broad-beans, rice and vegeta-bles 4.946)[3]		--	--	--	--		6,670[2]	1,349
(Roughage from non-cultivated area, [.5x2])		--	--	--	--		400[2]	400
Purchased feed							1,782	
				Livestock-feed subtotal:			16,298	
					Total:		41,648 mega kilo calories	

1/ Converted to the equivalent maize production

2/ Excludes field, feed and storage loss

3/ Estimates by crop are shown in Table III.

4/ Total planted feddans are 8.855. Farm size is 4.418 feddans.

Table III. Feed Energy Available to Livestock from Crop Residues and Purchased Feed on the "Average" Farm in the Survey (4, 2)

Crop Residue	Kilos Per Unit	Kilos Produced	% Dry Matter	Mega Kilo Calories of Feed Energy Available: Per Kilo	Per Farm	Per Feddan
Maize (.558 x 11 ardeb)	157	723	87	2.13	1,339	3,400
Wheat (1.284 feddans x 6 camel loads)	100	1,480	90	1.74	2,318	1,878
Broadbeans (.206 feddans x 3 tons straw)	200	618	87.9	2.00	1,086	5,272
Rice (2.266 feddans x 4 camel loads)	200	1,813	87	2.10	3,313	1,462
Vegetables (.235 feddans x 1 ton)	1,000	235	60	2.00	282	1,200
Roughage from non-cultivated area (.5 feddans)					500	1,000
Roughage Crop						
Berseem (2.311 x 39.4 ardebs)	157	14,296	30	2.17	9,307	4,027
Purchased Feed						
Wheat Bran (allocation from Co-op)		250	89	2.50	556	-
Mixed Feed (allocation from Co-op)		500	88	3.00	1,320	-
		Total ME Available			20,021	

TOTAL ME AVAILABLE	20,021
-(Field, feed and storage loss of feed residues .2 x 18,145)	-3,629
-(Feed and storage loss of purchased feed .05 x 1,876)	- 94
	16,298

Table IV. Typical Livestock Enterprise (5, 6, 7, 8)

No.	Livestock	Requirements Per Head Per Year	Cumulative Total
		- - - - - - - Mega Kilo Calories	- - - - - - - -
1	Buffalo (17 x 365)	6,205	6,205
1	Cow (13 x 365)	4,745	10,950
1	Donkey (8.5 x 365)	3,103	14,053
2	Sheep (2.3 x 365 x 2)	1,680	15,733
		Total 15,733 ≈ 16,298	

16,298 mega kilo calories. Of course, the feed energy needed and the amounts available can only be roughly approximated. Animals have substantially different needs based on the amount of work performed, stages of lactation and gestation, physical condition of the animal, etc. In addition, crops provide different levels of energy based on the plant condition, variety, fertilizer and water applied, length of storage, dryness of harvesting conditions, etc. The yields of crop residuals in these calculations were taken from crop enterprise budgets and farm records kept by the Egypt Water Use and Management Project in the Kafr El Sheik area. The feed energy requirements or needs of individual animals were taken from National Academy of Sciences Standards and materials from the Egypt Ministry of Agriculture.

The Alternatives That Include Improved Livestock

There are differences in the productivity of farm livestock as indicated in Table I, where buffalos on "above average" farms produced 500 kilos of milk per year as compared to 288 kilos for the "below average" farms. In addition, per cow milk production was 259 kilos on the "above average" farms and 142 kilos for the year on "below average" farms. The higher productivity appears to be related to the quality of livestock as well as their management. Above average farms had higher live calf weaning rates and, in most cases, purchased additional supplemental feed. In addition, there is some evidence that farms using livestock heavily for power in the farming operation tend to produce fewer livestock products. However, the relationship between livestock power use and animal products produced is also affected by the amount of feed available. Further, management plays a role--the survey team observed farmers trading cow labor. Farmers traded non-lactating cows

for plowing to a farmer with lactating cows for milk and made some vague arrangements to use the current lactating cows for plowing in the coming season. In a general sense the fellahs' (farmers') alternatives are limited by the feed available, the quality of livestock available and the animal power needs of their farms--as well as their own management abilities.

The crops produced tend to dictate the species of livestock required. For example, in the Kafr El Sheikh area rice production requires buffalo for the heavy plowing and seed preparation in wet and water-covered soils. Balady cows are more useful for light plowing for wheat and maize--because they are quicker and more agile than the slow but more powerful buffalo. Both balady cows and donkeys are faster on the sakia than the buffalo. The donkey is convenient for human transportation and light loads of manure or crop products. As a result, there are rather limited alternatives for improved livestock.

The following four alternatives are calculated to show the possibilities. Alternative I shows the typical numbers and kinds of livestock on the "average" farm. Alternative II shows the energy requirements for replacing all the livestock with improved animals available in the area. This alternative is probably not possible because the feed energy requirements exceed the amounts of feed that can be produced or purchased. Fellahs cannot purchase unlimited amounts of feeds from the Cooperative. Alternative III shows the feed requirements and total value of physical products when all the livestock are replaced with improved species--except sheep are eliminated. Alternative IV shows the energy requirements and the value of physical products when two improved cows are used to replace the cow and buffalo. This would be possible only if rice were not planted or a means devised to eliminate the buffalo in the rice field. As shown by

Illustration II, when improved livestock are used, within the limits of the feed available, an increase in the value of products produced can occur.

Another possibility not included in Illustration II is the possibility of substituting goats. Goats yield more milk than sheep and are more efficient converters of feed to milk than are cows. Apparently, the lower requirement for body maintenance accounts for the conversion efficiency. However, goat's milk and meat are not as preferred as cow or buffalo milk, causing goat's milk to sell for about half the price of cow's milk. In addition, goat meat is not preferred for the religious festivities. If sheer quantity of product is desired, goats can be substituted into the livestock scheme. Currently, goats are kept in the Kafr El Sheikh area. A herdsman gathers the goats from individual fellahs and drives them to canal banks and unplanted areas for grazing. They are, on occassion, grazed in cotton fields as are sheep. An example scheme follows.

Illustration III. Substitution of Improved Cows and Goats and Eliminating the Buffalo (9)

No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year		Value of Physical Product L.E./Year
2	Improved Cows	11,680		344
1	Improved Goat	1,387		37
1	Donkey	3,103		8
		16,170 ≈	16,298 available mega kilo calories of feed energy	389

The feed energy requirements for goats vary considerably. In the example above the Nubian breed was used as representative of the goats for the average farm. Most of the goats in the Kafr El Sheikh area appear to be

Illustration II. Selected Livestock Schemes

Alternative I — Current Livestock Scenario on an "Average" Farm (without work energy considered)

No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value of Physical Products L.E./Year
1	Buffalo	6,205	124.5
1	Balady Cow	4,745	82.0
2	Sheep	1,680	40.2
1	Donkey	3,103	8.0
		15,733 ≃ 16,298 available mega kilo calories of feed energy	Total 254.7

Alternative II — Direct Substitution of Improved Livestock Requires Feed Energy Beyond That Available on the "Average" Farm (without work energy considered)

No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value of Physical Products L.E./Year
1	Improved buffalo	8,030	186
1	Improved cow	5,840	172
2	Improved sheep	1,752	72
1	Donkey	3,103	8
		18,725 > 16,298 available mega kilo calories of feed energy	438

(continued)

Illustration II. Selected Livestock Schemes (continued)

Alternative III. Substitution of Improved Livestock and Eliminating Sheep (without work energy considered)

No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value of Physical Products L.E./Year
1	Improved buffalo	8,030	186
1	Improved cow	5,840	172
1	Donkey	3,103	8
		16,973 ≈ 16,298 available mega kilo calories of feed energy	366

Alternative IV. Substitution of Improved Cows, One Improved Sheep and Eliminating the Buffalo (without work energy considered)

No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value of Physical Products L.E./Year
2	Improved cows	11,680	344
1	Improved sheep	876	36
1	Donkey	3,103	8
		15,659 < 16,298 available mega kilo calories of feed energy	388

(continued)

Illustration II. Selected Livestock Schemes (continued)

Alternative	Difference in Value of Physical Products: Value of Products in Current Scenario	Value of Products Under Example Alternatives	Difference
	- - - - - - - - - - L.E./Year - - - - - - - - -		
I	254.7	254.7	0
II (not possible)	254.7	438.0	183.3
III	254.7	366.0	111.3
IV	254.7	388.0	133.3

generated from the Nubian breed. However, there are also much smaller goats from the desert breeds that are available and would require much less feed energy than the Nubian breed.

As shown by the previous illustration, goats can fit into the livestock scheme without impinging heavily on the feed energy available. However, they are not as preferred as sheep and prices of their product reflect that circumstance.

In both Illustration II and III requirements for improved animals were calculated from higher producing animals that were available in the Kafr El Sheik area--as evidenced from the farm survey and by on-site inspection. Calculation of the feed energy requirements and the value of the physical products are shown in the Appendix, Tables III, IV, V, VII, VIII and IX. Calculations on the requirements of exotic breeds and crossbreds would have been more difficult and less realistic. It is difficult to predict how new breeds and crossbreds perform under Egyptian farm conditions, much less the more specific conditions in Kafr El Sheikh. In addition, as just demonstrated, important improvements can be made with the livestock at hand.

Loss of Livestock Alternatives Due to Cow-Powered Sakias--An Additional Cost

Based on results of the survey and crop enterprise summaries, the sakia absorbs the largest amount of livestock working time and power. The following calculations show the estimates of metabolizable feed energy absorbed by field work, water lifting and crop transportation in the Kafr El Sheikh area.

Work Description	Hours Per Feddan	Horse Power Per Hour	Horse Power Hours
Field Work	5½	.7	4
Water Lifting	81	.3	25
Crop and Manure Transportation	20	.3	6
	107½		35 horsepower hours per feddan

35 X 4.418 feddans = 155 horsepower hours

155 X 2.08 mega cal. = 322 mega calories of metabolizable feed energy

As shown above, over 75 percent of the time and power is associated with pulling the sakia. However, this is specific to the Kafr El Sheikh survey area and probably is not the case for Egypt in general. In addition, a heavy portion of the feddans are in rice which requires much higher levels of water than other crops. Also, in this case, a large portion of the heavy field work was done by custom tractor power, especially for cotton, rice and wheat. As a result, the survey may be atypical and not representative of other farming areas in Egypt where larger amounts of field work are performed by animals.

Despite what appears to be a rather low estimate of feed energy consumed to perform animal work, two forms of important alternatives in livestock production are impeded. The limits of feed energy makes for difficulty in adapting a full configuration of improved animals that perform the required power tasks on the farm. In addition, the use of animals for power impinges on the ability of the farmer to specialize in smaller ruminents, as sheep or goats, without power potentials. As shown in

Illustration IV, the typical array of livestock on an average farm with the work energy added meets the feed energy available from crop residues and purchased feeds. However, the substitution of both improved buffalos and cows (Illustration II, Alternative III) is ruled out because energy needs far exceed energy available. On larger farms this alternative is still possible. In addition, the alternative of specializing in sheep or goats is ruled out because of their low power potential.

At least two arguments can be made concerning the sakia and the work energy it absorbs. One is that all four forms of livestock (buffalo, cow, sheep and donkey) are needed for specific activities or purposes on the self-sufficient subsistence farm. Consequently, the energy expended running the sakia--since it is the only work activity absorbing major amounts of work energy--is preventing the adoption of improved animals such as those shown in Alternative 2. In this case, the opportunity cost or the return given up is 417 L.E. (value of products from Alternative 2) - 305.7 (value of products from Alternative 1) - 51 L.E. (value of work energy) or 60.3 L.E. In this case, 60.3 L.E./(4.418 feddans) or 13.6 L.E. per feddan would be added to the cost calculations of using the sakia shown in Staff Paper No. 21, "Water Lifting by Sakia: The Incremental Cost of Cow Power," (11) and the following cost comparisons would ensue.

Water Lifting Cost Comparison, EWUP (10) with Adjustments for Incrementalized Energy Costs on the Three-Meter Sakia (11)

Number of Feddans	3-Meter Sakia Using Balady Cows	Cost of Lost Opportunities To Use Improved Livesotck	Total Incrementalized Costs	9-Horsepower Diesel Pumps
1	53.97	13.6	67.57	90.70
2	33.11	13.6	46.71	55.07
3	26.16	13.6	39.76	43.20
4	22.68	13.6	36.28	37.26
5	20.60	13.6	34.20	33.70
6	19.21	13.6	32.81	31.32
7	18.21	13.6	31.81	29.63
8	17.46	13.6	31.06	28.35
9	16.89	13.6	30.49	27.36
10	16.42	13.6	30.02	26.57

Illustration IV. Selected Livestock Schemes

Alternative 1 — Current Livestock Scenario on an "Average" Farm (with work energy considered)

No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value of Products L.E./Year
1	Buffalo	6,205	124.5
1	Balady cow	4,745	82.0
2	Sheep	1,680	40.2
1	Donkey	3,103	8.0
Work energy		322	51.0
		16,055 ≈ 16,298 available mega kilo calories of feed energy	305.7

Alternative 2 — Substitution of Improved Livestock and Eliminating Sheep (with work energy considered)

No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value of Products L.E./Year
1	Improved buffalo	8,030	186
1	Improved cow	5,840	172
1	Donkey	3,103	8
Work energy		322	51
		17,295 > 16,298 available mega kilo calories of feed energy	417

(continued)

Illustration IV. Selected Livestock Schemes

Alternative 3		Substitution of Improved Sheep for All Livestock Except the Donkey (without work energy considered)	
No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value pf Products L.E./Year
15	Improved sheep	13,140	468
1	Donkey	3,103	8
		16,243	476

Alternative 4		Substitution of Improved Sheep and a Mule (with work energy considered)	
No.	Kind	Feed Energy Requirements Mega Kilo Calories/Year	Value of Products L.E./Year
13	Improved sheep	11,388	468
1	Mule	4,500	8
Work energy		322	51
		16,210 ≈ 16,298 available mega kilo calories of feed energy	527

In this case, when the opportunities for adopting improved livestock are considered, the results are changed substantially. Without using the "improved livestock" argument, costs of lifting water by sakia are generally less than for the 9-horsepower diesel pump. This contrasts to the case when opportunity costs of improved livestock are considered. Sakia costs are less than diesel pump costs until five feddans are irrigated, thereafter, sakia costs are higher than diesel pump costs. In addition, the addition of opportunity costs for improved livestock to the buffalo-drawn sakia increases costs above diesel pumps except for the irrigation of a single feddan.

The other argument that the fellah is being prevented from specializing in one type of livestock, and thus losing revenues from the residual feeds, may not hold. For example, if all species of livestock were not needed, but work activity were necessary, a mule could be adopted to perform both the transportation and heavier tasks, allowing the fellah to use the remainder of the feed as he saw fit. For example, Alternative 4 shows the adoption of 13 improved sheep and one mule--the result is the highest value for products of all alternatives shown in both Illustration II and IV.

In the development of gravity-flow irrigation (1) the work requirement restraints on the adoption of improved livestock and specialization are largely removed. In that case, nearly all the alternatives in Illustration II and IV are available, and they would appear to represent the potentials for using feed more effectively, and thereby, water more beneficially. However, preferences and traditional patterns of production do take long periods of time to change.

Gains from Added Feed Energy Production Associated with Land Leveling

The gains to added feed production can very roughly be approximated from the alternatives shown in Illustration II and IV. For example, in Illustration IV, Alternative 1, almost 19 L.E. in value of product are generated for each 1,000 mega kilo calories of feed energy--which represents the current product value without adoption of improved livestock or more than average management techniques. If both specialization and improved livestock are adopted, as in Illustration IV, Alternative 4, 32 L.E. in value of product are developed for each 1,000 mega kilo calories of feed energy. Just in the few alternatives shown in this report there is a range of 19 to 32 L.E. of product value produced from each 1,000 mega kilo calories of feed energy produced.

In the case of land leveling there is a general relationship which may or may not hold in Egypt that suggests that land leveling increases field irrigation efficiency, which increases crop production. The relationship on a feddan basis is as follows:

$$\begin{array}{l}\text{percentage point}\\ \text{change in crop}\\ \text{production}\end{array} = 2.5 \left[-52 + 34 \left(\begin{array}{l}\text{Lay of the cubic}\\ \text{meters of soil moved}\\ \text{per feddan}\end{array} \right) \right],$$

when the cubic meters of soil moved is >50 and >350.

As an example, if 50 cubic meters of soil were moved per feddan on the "average" farm, a 14.4 percent increase in overall crop production would occur. On the "average" farm around 2,350 mega calories of new feed energy would be produced, allowing for the potential of 45 L.E. to 75 L.E. of livestock products to be produced.

A relationship similar to that above has not been developed for the Kafr El Sheikh area. However, the development of a similar relationship for

selected areas would be useful in evaluating the benefits to livestock of land leveling activities and other related on-farm water management techniques.

Some Ending Comments

The calculations shown in this report are an attempt to develop a framework for analysis of the indirect impacts of water distribution and field management on the livestock enterprise. The calculations are based on data derived from relatively few observations but, nonetheless, collected with with a great deal of care and questioning. In addition, the author makes some very broad assumptions in formulating the calculations. The calculations do indicate general magnitudes and are considerably more useful than the information gained if the analysis were voided.

As a general description it does appear that the livestock enterprise survives on production of crop residues and berseem. As a result, increases in crop production from more efficient field water management leads to increased crop residues and enhanced livestock production. Livestock production can be enhanced through added products from current management techniques or through alternative forms of improved livestock made possible by the added feed energy produced. In addition, management of the water distribution system so that livestock are not necessary for water lifting could make work energy available for other production purposes as well as loosen the restrictions on the forms of livestock held. However, it should be noted that most fellahs indicate that they will keep livestock even if they are not needed for power. So, the alternative of eliminating livestock and using the current feddans in berseem for food production was not considered.

Without water lifting the fellah is free to practice specialization in the livestock enterprise. This simplifies management as well as in some cases netting addition product value. Specialization seems possible with the animals already present in Egypt, since, according to the farm survey results, there are considerable differences in productivity of animals. In my opinion the buffalo and balady cows in the Kafr El Sheikh area are in excellent working condition and through selection and management can be made productive. Their body size and conformation fits the kinds of feeds available, the climate of Egypt and the work requirements. Such characteristics are not apparent for crossbreds that might be introduced to improve production. Newly introduced crossbreds would have to compete with balady cattle selected by ability to survive u r Egyptian conditions, as they have for thousands of years.

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APPENDIX

Appendix Table I. Livestock-Related Information on the Farms in the Survey at Kafr El Sheikh (4)

Farms That Exceed the Limits:

Farm Number	Farm Size	Family Members	Animal Units: Buffalo	Animal Units: Cows	Animal Units: Sheep & Goats	Animal Units: Donkeys	Farm Number	Milk Production: Buffalo Per Farm	Milk Production: Buffalo Yield/ Cow	Milk Production: Cow Per Farm	Milk Production: Cow Yield/ Cow	Animal Units Per Farm	Animal Units Per Feddan	People Per Feddan
20	1.25	2	1	0	0	1	20	582	582	0	0	1.5	1.2	1.6
43	3.00	10	1	2 1-cow 1-bull	0	1	43	388	388	247, 1-cow 1-bull	247	3.15	1.05	3.33
35	4.50	14	1	1	2	1	35	465	465	291	291	2.54	.56	3.11
41	3.25	11	1	0	0	1	41	582	582	0	0	1.5	.46	3.38
31	7.50	27	2	1	0	1	31	776	388	-	-	3.26	.43	3.60
8	6.00	18	1	1	2	3	8	-	-	-	-	3.54	.59	3.00
$\bar{X}$ = 6	4.25	13.7	1.2	.7	.7	1.31	$\bar{X}$ = 6	466 (per farm)	399 (per cow)	90 (per farm)	109 (per cow)		.72	3.00

Farms That Fall Within the Limits but Exceed the Average:

Farm Number	Farm Size	Family Members	Animal Units: Buffalo	Animal Units: Cows	Animal Units: Sheep & Goats	Animal Units: Donkeys	Farm Number	Milk Production: Buffalo Per Farm	Milk Production: Buffalo Yield/ Cow	Milk Production: Cow Per Farm	Milk Production: Cow Yield/ Cow	Animal Units Per Farm	Animal Units Per Feddan	People Per Feddan
44	4.50	6	2 1-cow 1-bull	2 1-cow 1-bull	1	1	44 1-cow 1-bull	776	776	494, 1-cow 1-bull	494	4.4	.98	1.33
48	2.50	4	1	1	0	1	48	780	780	360	360	2.26	.90	1.50
28	5.50	8	2 1-cow 1-bull	2	0	2	28 1-cow 1-bull	275	275	275	138	4.26	.84	1.45
26	7.00	16	1	2	1	3	26	800	800	1,020	510	4.16	.59	2.29
3	5.75	13	2	1	0	1	3	349	175	349	349	3.26	.57	2.26
24	3.00	7	1	0	2	1	24	700	700	0	0	1.78	.59	2.33
18	3.00	3	1	1	0	2	$\bar{X}$,18	-	-	-	-	2.76	.92	1.00
15	6.50	11	2	2	0	2	15	1,320	660	-	-	4.66	.72	1.69
10	4.00	10	0	1	0	1	10	0	0	291	291	1.26	.32	3.50
32	3.00	7	0	2	0	1	32	0	0	582	291	2.02	.67	2.33
$\bar{X}$ = 10	4.48	8.5	1.2	1.4	.4	1.5		500	500	337	259	3.08	.73	[illegible].9

(continued)

Appendix Table I. Livestock-Related Information on the Farms in the Survey at Kafr El Sheikh (continued)

Farms That Fall Below the Average:

Farm Number	Farm Size	Family Members	Animal Units: Buffalo	Cows	Sheep & Goats	Donkeys	Farm Number	Milk Production: Buffalo Per Farm	Buffalo Yield/ Cow	Cow Per Farm	Cow Yield/ Cow	Animal Units Per Farm	Animal Units Per Feddan	People Per Feddan
29	3.25	3	2	0	1	1	29	582	291	0	0	2.64	.81	.92
14	5.00	7	2	1	0	1	14	58	29	233	233	3.26	.65	1.4
45	6.00	10	1	1	0	1	45	600	600	255	255	2.26	.38	1.67
7	5.00	9	1	1	0	1	7	600	600	255	255	2.26	.45	1.80
5	6.00	12	1	1	0	1	5	-	-	-	-	2.26	.38	2.0
50	5.00	8	0	2	0	1	50	0	0	-	-	2.5	.50	1.6
36	6.00	4	1	1	1	1	36	436	436	349	349	2.4	.4	.67
49	6.50	7	1	2	1	1	49	720	720	-	-	3.3	.51	1.1
13	6.50	8	1	1	3	1	13	600	600	582	582	2.68	.41	1.23
47	3.66	5	1	2	0	1	47	460	460	300	150	3.02	.83	1.37
1	11.50	16	2	2	0	1	1	1,050	525	325	163	4.02	.35	1.39
4	9.71	7	1	1	0	2	4	19	19	10	10	2.76	.28	.72
39	4.66	5	1	1	0	1	39	-	-	-	-	2.26	.48	1.07
33	6.00	7	0	2	0	1	33	0	0	466	233	2.02	.34	1.17
46	7.50	9	1	1	1	1	46	-	-	-	-	2.40	.32	1.20
17	10.00	13	1	1	0	1	17	-	-	-	-	2.26	.23	1.30
2	9.50	9	2	2	0	1	2	349	175	356	178	4.02	.42	.95
27	2.75	4	0	0	1	0	27	0	0	0	0	.14	.05	1.45
22	6.00	13	0	0	0	1	22	0	0	0	0	.5	.08	2.17
$\bar{X}$ = 19	6.34	8.2	1.0	1.2	.4	1		288	288	165	142	2.47	.41	1.32

Appendix Table II. Approximated Animal Unit Equivalents for Egyptian Livestock (Based on Feed Energy Requirements)

Buffalo cow	1.0
Balady cow	.76
Goat (doe - female)	.21
Sheep (ewe - female)	.14
Donkey	.5

Appendix Table III. Approximated Body Weight of Egyptian Livestock

	Female (Weight, Kilograms)	Male (Weight, Kilograms)
Buffalo[1/]	390	430
Cattle[3/]	318	350
Goats[2/, 3/, 4/]	55	70
Sheep[3/, 4/]	65	90
Donkey	210	220

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Appendix Table IV. Daily Metabolizable Energy (ME) Requirements of Egyptian Livestock

	ME Requirements	Description
Buffalo[1/]	- 17,000 kilocalories,	cow with suckling calf or average milk production
Cow[1/]	- 13,000 kilocalories,	cow with suckling calf or average milk production
Goats[2/]	- 3,600 kilocalories,	with 200 days lactation and 270 kilograms of milk
Sheep[3/]	- 2,300 kilocalories,	suckling a single lamb
Donkey[4/]	- 8,500 kilocalories,	with light work

1/ Approximated from National Academy of Sciences, Nutrient Requirements of Beef Cattle, Fifth Revised Edition, 1976 and Nutrient Requirements of Dairy Cattle, Fifth Revised Edition, 1978.

2/ Approximated from George Stoddard, Nutrition and Feeding Dairy Goats, Western Regional Extension Publication No. 14, United States, 1979.

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4/ Approximated from National Academy of Sciences, Nutrient Requirements of Horses, Third Revised Edition, 1973.

Appendix Table V. Improved Livestock: Feed Energy Requirements

	Livestock	Mega Kilo Calorie Requirements Daily	Annual
(1)	Buffalo (400 kilos) superior milking ability--producing 2.5 kilos of 7% milk per day for 240 days (600 kilos)	22	8,030
(2)	Dairy cow (350 kilos) producing 1.8 kilos of 6% fat milk per day for 250 days (460 kilos)	16	5,840
(3)	Sheep (70 kilos) live suckling twin lambs	2.4	876
(4)	Dairy goat (36 kilos) doe producing 1.5 kilos of 5% milk per day for 200 days	3.8	1,387
(5)	Donkey (210 kilos) doing light work	8.5	3,103

Appendix Table VI. Current Livestock on Farms in Egypt: Feed Energy Requirements

Livestock	Mega Kilo Calorie Requirements Daily	Annual
(1) Buffalo (390 kilos) average milking ability--producing 2.0 kilos of 7% milk for 195 days (390 kilos)	17	6,205
(2) Balady cows (318 kilos) producing 1.0 kilos/day of 5% milk 210 days (210 kilos)	13	4,745
(3) Sheep (65 kilos) suckling a single lamb	2.3	840
(4) Goats (30 kilos) producing 1.0 kilos of 5% milk for 200 days (200 kilos)	3.6	1,300
(5) Donkey (210 kilos) doing light work	8.5	3,103

Appendix Table VII. Improved Livestock Production

		Calf Production Live Weaning Rate	Calf Production	By-Products	Annual Milk Production	Value of[1/] Production L.E.
			- - - - kilograms - - - -			
(1)	Buffalo, 400 kilos, superior mil ability--producing 2.5 kilos of 7% milk per day for 240 days	60%[2/]	36	-	600	186
(2)	Dairy cow (350 kilos) producing 1.8 kilos of 6% fat milk per day for 250 days	80%[3/]	80	-	460	172
(3)	Sheep	100%	18	9 L.E.	-	36
(4)	Goats	100%	3	4 L.E.	300	37
(5)	Donkey	16%	-	-	-	8

1/ Prices include buffalo milk @ .25 L.E./kilo, cow milk @ .2 L.E./kilo, goat milk @ .10 L.E./kilo, veal @ 1.00 L.E./kilo, lamb wool @ 1.00 L.E./kilo, skin @ 1.00 L.E. per piece, ruminants @ 3.00 L.E. per piece and donkeys at 50 L.E./head.

2/ Sale weight of 57 kilograms.

3/ Sale weight of 90 kilograms.

Appendix Table VIII. Current Livestock on Farms in Kafr El Sheikh

		Calf Production Live Weaning Rate		By-Products	Annual Milk Production	Value of[1/] Production L.E.
		- - - -	kilograms		- - - -	
(1)	Buffalo, 390 kilos, average milking ability--producing 2.0 kilos of 7% milk for 195 days	47%	27	-	390	124.50
(2)	Balady cows, 318 kilos, producing 1.0 kilos/day of 5% milk, 210 days	44%	40	-	210	82.00
(3)	Sheep (65 kilos)	60%	15	6.5 L.E.	112	40.20
(4)	Goats, 65 kilos, producing 1.4 kilos of 5% milk	60%	3	4.0 L.E.	200	27.00
(5)	Donkey	16%	-	-	-	8.00

1/ Prices include buffalo milk @ .25 L.E./kilo, cow milk @ .2 L.E./kilo, goat milk @ .10 L.E./kilo, veal @ 1.00 L.E./kilo, lamb wool @ 1.00 L.E./kilo, skin @ 1.00 L.E. per piece, ruminants @ 3.00 L.E. per piece and donkeys at 50 L.E./head.

Appendix Table IX. Livestock Product Prices

Milk	L.E./Kilo
Buffalo	.25
Cow	.20
Goat & Sheep	.10
Meat	**L.E./Kilo**
Veal	1.00
Lamb	1.50
Goat	1.00
By-Products	**L.E./Unit**
Wool (kilo)	1.00
Stomach, rumen	3.00
Skins, Sheep & Goat	1.00

Appendix Table X. Crops: Labor Requirements Per Month Per Feddan[1/], (2)

	Wheat	Flax	Berseem Long Term	Berseem Short Term	Broad Beans	Cotton	Rice	Maize	Vegetable Crops (Onions with Cotton)
	hours per feddan								
January	6	8	6	6	0	0	0		13
February	9	6	9	9	5	40	0		10
March	5	6	18	38	5	41	0		13
April	5	0	12		78	16	0	-	8
May	39	75	9		17	18	24	36	38
June			38			12	48	30	82
July						13	47	27	3
August						6	47	22	0
September						106	22	87	0
October	0	0			0	140	41		0
November	14	34	6	6	111	0	0		0
December	5	12	6	6	127	0	0		39
Total:	83	141	104	65	343	392	229	202	206

1/ Approximated

Appendix Table XI. Crops: Irrigation Labor Requirements per Month per Feddan

	Wheat	Flax	Berseem Long Term	Berseem Short Term	Broad Beans	Cotton	Rice	87.5/ Hour Maize	Vegetable Crops (Onions with Cotton)
	- - - - - - - - - - hours - - - - - - - - - - -								
January	0	4	5	5	0				13
February	5	4	7	7	4	6			10
March	5	4	18	16	5	4			13
April	5	0	10			4			0
May		4				4	17	4	6
June						4	28	3	0
July						4	45	3	3
August						4	45	18	
September						4	22		
October						4	0		
November	4	7	4	4	5		0		
December	5	4	5	5	4		0		
Totals:	24	27	49	37	18	38	157	28	45

Appendix Table XII. Crops: Planting, Cultivation, Pest Control and Harvesting Labor Requirements per Month per Feddan

	Wheat	Flax	Berseem Long Term	Berseem Short Term	Broad Beans	Cotton	Rice	Maize	Vegetable Crops (Onions with Cotton)
	- - - - - - - - - - hours - - - - - - - - - -								
January	6	4	1	1	0	0			0
February	4	2	2	2	1	34			0
March	0	2	0	22	0	37			0
April	0	0	2		78	12		32	8
May	39	71	9		17	14	7	27	32
June			38			8	20	24	82
July						9	2	4	0
August						2	2	87	0
September						102	0		0
October			0			136	41		0
November	10	27	2	2	106		0		0
December	-	8	1	1	123		0		39
Totals:	59	114	55	28	325	354	72	174	161

Salt River Project - Ministry of Irrigation

Professional Employee Exchange

Program

Sponsored by

U.S. Agency for International Development

Executed by

Consortium for International Development

Through the

Egypt Water Use and Management Project

Approve

GOE Ministry of Irrigation	U.S. Agency for International Development
Salt River Project	Consortium for International Development

Letter of Agreement Between MOI/GOE

SPR and USAID

A. General

For some time the Ministry of Irrigation (MOI/GOE) through the Egyptian Water Use and Management Project (EWUP), the Salt River Project (SRP) and the United States Agency for International Development (USAID) have been in communication with each other through the training program of the EWUP project. During the first training tour to the SRP in the fall of 1977 Salt River Project management had indicated an interest in passing on some of the management and water scheduling techniques they had developed over the past seventy five years to MOI/Egypt. It is proposed here that an understanding between the parties concerned be signed and that the initial exchange be initiated in 1982. This exchange program will be for a two year period to coincide with the CID contract completion.

The purpose of the exchange program is to increase the capability of Ministry of Irrigation Staff to schedule irrigations according to crop needs, to manage the delivery of water to the farmer, to maintain the irrigation delivery system and to gain an understanding of American surface irrigation techniques, farmer organizations and management.

Salt River Project is a self governing and unique organization in Central Arizona. The Project is composed of two separate organizations, the Water User's Association, which operates and maintains the irrigation facilities, and the Power District, which operates and maintains the electrical generating, transmission and distribution facilities. The Project is an electric and water utility, and municipality, a non-profit

project organization, a cooperative association and Federal Reclamation Project. Its purpose is to serve approximately 250,000 acres (feddans) with dependable water supply for agriculture, municipal and industrial use and electric energy for Central Arizona.

B. Exchange Program

It is agreed that 16 staff from the MOI will be sent to Arizona to work in the SRP and 8 staff members from the Salt River Project will be sent to Egypt to work in the MOI over a two-year period. The first exchange will be two staff from the MOI and two staff from the SRP. The tour of duty in each country will be about eight weeks. The tour for the Egyptians will start with an orientation at the EWUP project in Fort Collins, Colorado then six weeks working in the SRP in Phoenix, Arizona and one week to briefly study specific irrigation equipment, suppliers, districts or related facilities in Arizona and southern California. The Egypt tour for the Americans will start with an orientation program at Ft. Collins, Colorado, a visit to the EWUP project in Cairo then six weeks working in the MOI in Egypt and one week to briefly study specific irrigation areas in upper, middle and lower Egypt.

C. Criteria for Selection of Exchangees

1. For selection of MOI exchangees:

   (a) Persons working at the operational level of water distribution and maintenance in the Irrigation Directorate will be given highest priority.

   (b) They should exhibit a fair level of English language proficiency (Min. of 70 on Aligu or TOFFEL)

   (c) Capable and willing to work on-the-job with SRP personnel in the office and field.

2. For selection of SRP exchangees:

(a) Highly skilled in a particular area, such as, water scheduling, canal maintenance, water operation and management, telemetering, communications, etc.

(b) Capable and willing to work on-the-job with MOI personnel in the office and field.

D. Termination of Exchange Person

Any exchangee, either SRP or MOI, may be terminated or program reduced for cause by the host institution. Any person and his institution will be informed of the reasons for program termination or reduction.

E. Travel and Transportation

International and interstate transportation will be furnished through the EWUP project from funds provided from this project according to USAID regulations.

Local transportation during official duty will be furnished by the respective host agency. Official travel to areas which require transportation will be furnished or reimbursed by EWUP. However, private transportation is the responsibility of individual participants.

F. Per Diem

Per diem will be paid by EWUP according to USAID government regulations. These regulations will be furnished to both parties.

G. Salaries

MOI/GOE and SRP are to pay salaries of their own personnel and maintain them on job status as though they were working full time.

H. Insurance

The MOI employees will be covered under AID's health and accident coverage (HAC). EWUP will enroll the exchangees and pay for the cost.

SRP Employees

SRP employees will maintain their own health and accident insurance.

I. The Designated Coordinator/Contact Person

The following are the designated coordinator/contact persons:

SRP	Mr. Reid Teeples	Telex 668-443	A Tel. 602-273-5371
MOI	Dr. M. Abu Zeid	Telex 94014 EXWAPUN	Tel. 760474
USAID Cairo	Mr. Niel Dimick	Telex 93773	Tel. 28219,774 666 Ex. (423,206)
EWUP Cairo	Dr. G. Quenemoen	Telex 93773	Tel. 759674
EWUP Fort Collins	Dr. E. V. Richardson	TWX 910-930-9000	Tel. 303-491-8655

J. General Provisions and AID Regulations

All participants are governed by the General Provisions of EWUP contract, AID regulations and Standard Government Travel Regulation as they relate to accountability, travel, use of medical facilities, U.S. Embassy facilities, etc.

K. Orientation

Up to one week of orientation will be provided to the MOI personnel in Egypt and to SRP personnel in Fort Collins prior to departure.

L. Termination of Program

This exchange program can be terminated by any one of the four parties (CID, USAID, SRP, MOI) by giving 30 days notice.

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EXCHANGE PROGRAM

SRP

MOI/GOE

USAID

Salt River Project
WATER & POWER

DRAFT
OCTOBER 1981

PREFACE

The purpose of this program is to present Salt River Project's perception for implementing the Exchange Program concept and its Agreement between the Ministry of Irrigation of Egypt (MOI/GOE) and the Salt River Project (SRP) of Arizona under the auspices of the United States Agency for International Development (USAID). This document is intended to be used as reference material for planning, and for use by the participants during the Exchange Program. This is an introductory outline, and is not intended to be a complete text.

We, at Salt River Project, certainly recognize the value of water in a semi-arid region, and also appreciate the complexity of water and power operations. We look to this program as a new era of cooperation between MOI/GOE, USAID and SRP.

The purpose of the Exchange Program is not financial reward to Salt River Project, (there will be none), but the satisfaction of sharing our experiences and know-how with America's good friend, Egypt. Hopefully this program will produce new opportunities and challenges in water management and operation concepts, as well as long-lasting understanding and friendship between Egyptians and Salt River Project personnel.

Our goal is to acquaint selected personnel from Egypt in the administration, and operation and maintenance of a modern irrigation system during a six-week period at the Salt River Project so that <u>specific action programs</u> can be implemented by the MOI of Egypt. Our motto will be "Keep it Simple - Stick to the Basics." This will give the participants an understanding of the basic requirements to modernize existing irrigation systems, as well as to construct and operate new irrigation systems.

The objective of every participant should be clearly defined and the realistic goal should be set to achieve that objective during the exchange program.

Every participant will be given an opportunity at the end of the program to share comments and experiences on the Program so improvements can be made.

Finally, I personally welcome and look forward to meeting every participant of this Exchange Program.

Reid Teeples
Associate General Manager-Water

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SALT RIVER PROJECT PARTICIPANTS

The following SRP personnel are listed to acknowledge their efforts in the preparation and development of the Exchange Program at SRP.

Karl Abel	President
Jack Pfister	General Manager
Reid Teeples	Associate General Manager - Water
Don Weesner	Assistant General Manager - Water
Don Womack	Executive Engineer
Ed Kirdar	Supervisor - Special Studies
Don Davis	Management Specialist
Al Risinger	Operations Coordinator

EIGHT WEEK SCHEDULE
IN UNITED STATES

1st Week:

Orientation - Colorado State University, EWUP
Fort Collins, Colorado

2nd and 3rd Week:

Orientation - Salt River Project, Phoenix, Arizona

All Egyptians will be given an extensive orientation to acquaint them with the overall purpose and functions of the Water Group at the Salt River Project. Interrelationships between Engineering, Operations and Construction and Maintenance functions will be reviewed prior to beginning specialized program.

4th, 5th, 6th and 7th Week

Specialized work programs will be offered in Water Operation, Water Construction and Maintenance, or a combined program in Water Operation and Water Construction and Maintenance.

8th Week:

Colorado State University to coordinate tour of other Irrigation Projects in Southwest United States.

ORIENTATION PROGRAM AT SRP

For All Egyptian Participants

Subject: Orientation to SRP

Duration: Two Weeks

Objective: Obtain an understanding of SRP management, function, and operations.

First Week	Description
1st Day	Special Studies Orientation to SRP Review SRP Table of Organization Overview of Management's Responsibilities Meet with Management Review Total Program
2nd & 3rd Day	Water Operations Overview of Water Operations, Field Offices, facilities and communications
4th & 5th Day	Civil Engineering Overview of irrigation Design of pipeline slipform, headgates, weirs and radial gates
Second Week	
1st & 2nd Day	Water Construction and Maintenance Overview of maintenance of canals, laterals and pumps.
3rd & 4th Day	Water Resource and Services Overview of accounting, collecting, customer service and watershed.
5th Day	Special Studies Overview of special studies, evaluation of training to date and final selection of program to be followed for remainder of training.

SPECIALIZED WORK PROGRAM #1

Subject: Water Operations

Duration: Four Weeks

Objective: Obtain understanding of Water Operations Mission and Functions at SRP including Water Measurement, Scheduling, Accounting, automatic gate controls, pump operations and other related Irrigation management procedures.

First Week

1st & 2nd Day	Hydrology - water measurement procedures in all types of water measurement including estimating.
3rd, 4th & 5th Days	Western Irrigation - Superintendent to explain Table of Organization, water delivery areas, mission & function of Northside Distribtuion. 1/2 day with Chief Clerk to review accounting procedures, direct entry, and daily audit procedures - 1/2 day with Zanjero water scheduling - ride with Zanjero on area scheduled - measure gates, pump operation, trouble calls, etc.

Second Week

1st Day	Southside Irrigation - ride with Superintendent
2nd, 3rd, 4th Days	Ride with each Watermaster, area audits, maintenance problems, construction problems, water orders
5th Day	Ride with Zanjero, observe pump operation, gate measurement, trouble calls, and scheduling process

Third Week

1st Day	Superintendent of ADC - explain Table of Organization, mission and function of Transmission & Communication Sections, Supervisory Control System Operation
2nd Day	Tour Horseshoe Dam and Bartlett Dam
1/2 of 3rd Day	Tour to Granite Reef Dam, Arizona and South Canals, Low Head Hydrogeneration Unit.
1/2 of 3rd Day	Tour Valley supervisory control sites - explain in detail, maintenance problems, etc.
4th Day	Ride with gate operator - maintenance patrol of system
5th Day	In ADC with Watermaster - explain console operation, scheduling and pump operation

Fourth Week

1st & 2nd Day	Agriculture Division - Irrigation management procedures, soil analysis, etc.
3rd & 4th Days	Reserve for special emphasis in desired area
5th Day	Special Studies - Final day wrap-up and evaluation

SPECIALIZED WORK PROGRAM #2

Subject: Water Construction and Maintenance

Duration: Four Weeks

Objective: Obtain understanding of Water Construction and Maintenance Mission and Functions at SRP, including budget restraints, Weed control on land, and in water, Equipment used, Construction and Maintenance practices and other related management procedures.

First Week

1st Day

Manager Water C&M.

Review mission and function in depth.

(a) O&M Budget.

(b) Key indicators used for management.

(c) Storm control responsibilities.

(d) Normal activities of manager.

2nd & 3rd days

Superintendent Southside or Western.

Review mission and functions in depth.

(a) Division budget.

(b) Key indicators used for management.

(c) Storm control activities.

(d) Personnel requirements and job classifications.

(e) Normal activities of superintendent.

4th & 5th Days — Weed Control Supervisor.

Review aquatic and terrestrial weed control program in depth.

(a) Visit field locations where weed problems are evident and results of previous maintenance can be seen.

(b) Provide mock acrolein setup if none actually being used.

(c) Review all Chemicals used - method of application.

(d) Observe mower in operation.

(e) Normal activities.

Second Week

1st thru 5th days — Maintenance Foreman. Southside or Western

Review in depth of Maintenance Programs.

(a) Budget constraints.

(b) Daily, monthly, quarterly reports used.

(c) Crew make up.

(d) Equipment available.

(e) Trouble crew duties.

(f) Repair crew duties.

(g) Construction crew duties.

(h) Trash truck.

(i) Lateral and canal cleaning.

(1) Purpose.

(2) How we determine need (Inspection, Water Master, Users, Flooding, etc.)

(3) Equipment used - limitations and advantages of each.

(4) Observe all equipment used (preferably when in use).

Third Week

1st Day	Canal structure maintenance. Groundwater/Bldg.
2nd Day	Weed Spray crew one day or weed spray crew 1/2 day Acrolein Demossing Crew 1/2 day. Southside or Western
	(a) Mix chemicals.
	(b) Observe spray truck.
	(c) Daily reports - explain and make out.
	(d) Set up and monitor acrolein demossing.
3rd Day	Repair crew. Southside or Western.
4th Day	Construction crew. Southside or Western.
5th Day	Trouble crew. Southside or Western. Choose area for special emphasis during last week.

Fourth Week

1st thru 4th Day	Reserved for special emphasis in desired area of Water C&M
5th Day	Special Studies - Final day wrap-up and evaluation

SPECIALIZED WORK PROGRAM #3

Subject: Combination Water Operation and Water Construction and Maintenance

Duration: Four Weeks

Objective: Obtain understanding of Water Operations and Water Construction and Maintenance mission and functions at SRP. Program will combine main features of Work Programs 1 and 2.

First Week

1st Day	Hydrology - water measurement training - all types including estimating.
2nd, 3rd & 4th Days	Western Irrigation - 1/2 day with Superintendent. Cover Table of Organization, mission & function Northside Irrigation - 1/2 day with watermaster area audits, construction problems, water orders. 1/2 day, with Chief Clerk - office procedures, accounting, audits, direct entry, etc., - 1/2 day with zanjero - scheduling one day with zanjero on area which he observed being scheuled. Emphasis on gate operation, measurement, pump operation and trouble calls
5th Day	Southside Irrigation - ride with Superintendent

Second Week

1st & 2nd Days	Ride with watermaster, - explain area audits, maintenance problems, enchroachment, water orders, etc.
3rd Day	Superintendent - ADC - explain Table of Organization, mission & function of Transmission and Communications Sections - supervisory control system.
4th Day	Field tour - Stewart Mountain Dam, Granite Reef Dam, Arizona & South Canals, Low Head Hydro Unit, supervisory sites, etc.

5th Day	ADC with watermaster - explain console operation, scheduling, pump operation, etc.

<u>Third Week</u>

1/2 1st Day	Manager Water C&M. Review mission and function in depth. (a) O&M Budget. (b) Key indicators used for management. (c) Storm control responsibilities. (d) Normal activities of manager.
1/2 1st Day & 2nd Day	Superintendent Southside or Western. Review mission and functions in depth. (a) Division budget. (b) Key indicators used for management. (c) Storm control activities. (d) Personnel requirements and job classifications. (e) Normal activities of superintendent.
3rd Day	Weed Control Supervisor. Review aquatic and terrestrial weed control program in depth. (a) Visit field locations where weed problems are evident and results of previous maintenance can be seen. (b) Provide mock acrolein setup if none actually being used. (c) Review all Chemicals used - method of application. (d) Observe mower in operation. (e) Normal activities.

4th Day	Spray area one day or spray area 1/2 day Aerolein Crew 1/2 day.
	(a) Mix chemicals.
	(b) Ride spray truck - operate spray.
	(c) Daily reports - explain and make out.
	(d) Set up and monitor acrolein demossing.
5th Day	Trouble crew 1/2 day canal structure maintenance 1/2 day.

Fourth Week

1st, 2nd & 3rd Days	Maintenance Foreman.
	Review in depth of Maintenance Programs.
	(a) Budget constraints.
	(b) Daily, monthly, quarterly reports used.
	(c) Crew make up.
	(d) Equipment available.
	(e) Trouble crew duties.
	(f) Repair crew duties.
	(g) Construction crew duties.
	(h) Trash truck.
	(i) Lateral and canal cleaning.
	(1) Purpose.
	(2) How we determine need (Inspection, Water Master, Users, Flooding, etc.)
	(3) Equipment used - limitations and advantages of each.
	(4) Observe all equipment used (preferably when in use).

4th Day	Repair crew.
5th Day	Special Studies - Final day wrap-up and evaluation

GENERAL INFORMATION
FOR
EGYPTIAN PROGRAM PARTICIPANTS

WORK HOURS & DAYS

Normal SRP work days are Monday through Friday. The office work hours are from 8:30 a.m. to 5:00 p.m. The field work usually starts and ends one or two hours earlier than the office work hours.

TRANSPORTATION

Each host department of SRP will be responsible for transportation between SRP offices and Egyptian participants' hotel during the work days.

PERA

(Project Employee Recreation Association)

Egyptian participant will be given the opportunity to use SRP recreation facilities at PERA Club during the Exchange Program. The PERA Club, located about 2 miles from the main office of SRP, is a fine complex with athletic, recreation, tennis, picnic and hobby facilities for SRP employees and guests.

HOSTING & LODGING

Every Egyptian participant will be treated as an honored guest at SRP. Every reasonable effort will be made to make the program a success. Hopefully lasting friendships will be established.

A luncheon meal on the first day of the program will be paid by SRP. During the rest of the time every participant is responsible for his/her meal.

CONCERNING THE SALT RIVER PROJECT

Salt River Project, named for the major river that supplies water to the Phoenix metropolitan area, is a self-governing and unique organization in Central Arizona. The Project is comprised of two organizations - the Salt River Valley Water Users Association (the Association) and the Salt River Project Agricultural Improvement and Power District (the District).

The Association is a private Arizona corporation. The Association administers water rights of the Project's 250,000 acre (feddan) area and operates and maintains the irrigation transmission system which carries water to agricultural, municipal, industrial and residential users.

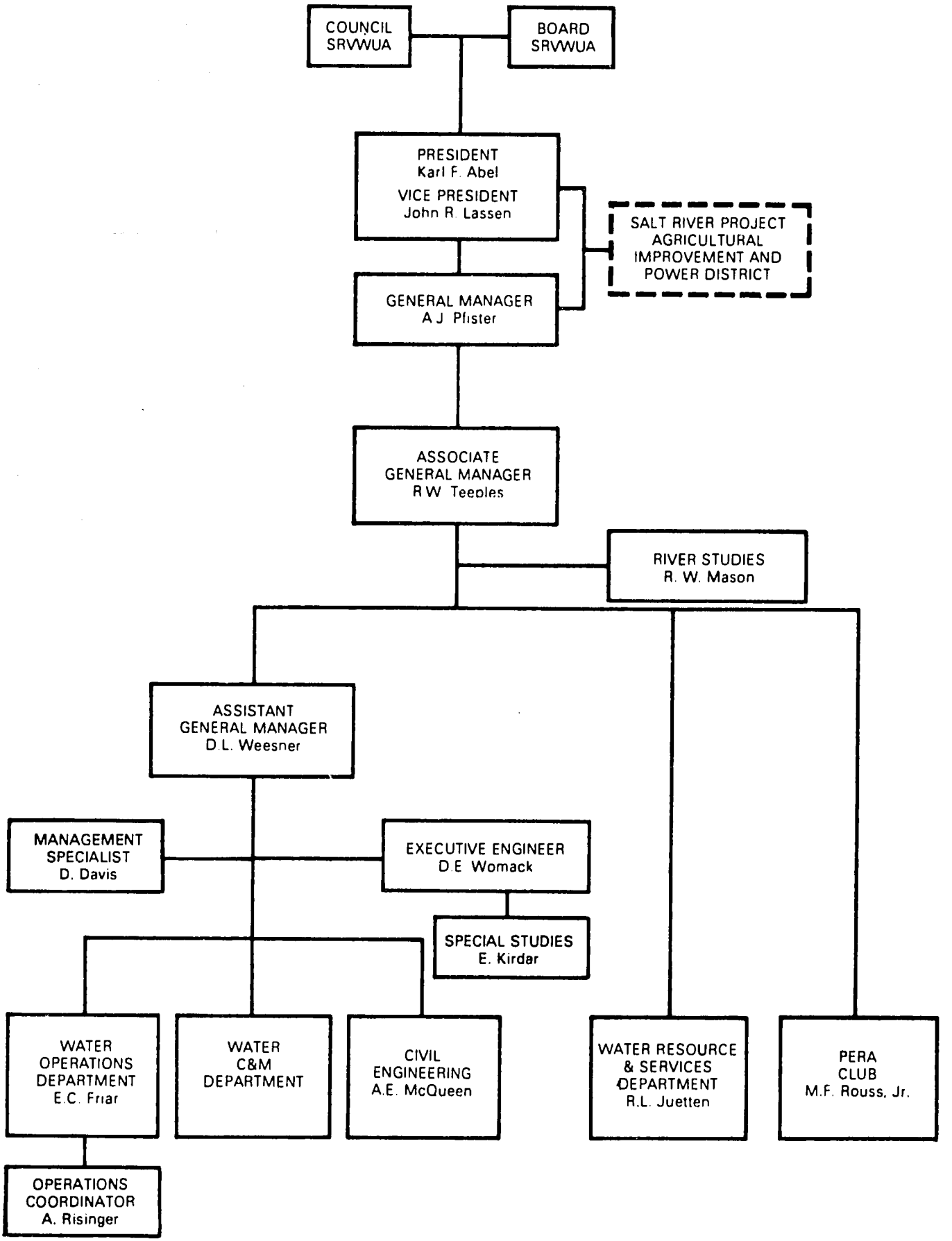
The District, a political subdivision of Arizona, operates under contracts with the United States of America and provides electricity to residential, commercial, industrial and agricultural power users in 2,900 square miles (7511 square kilometers).

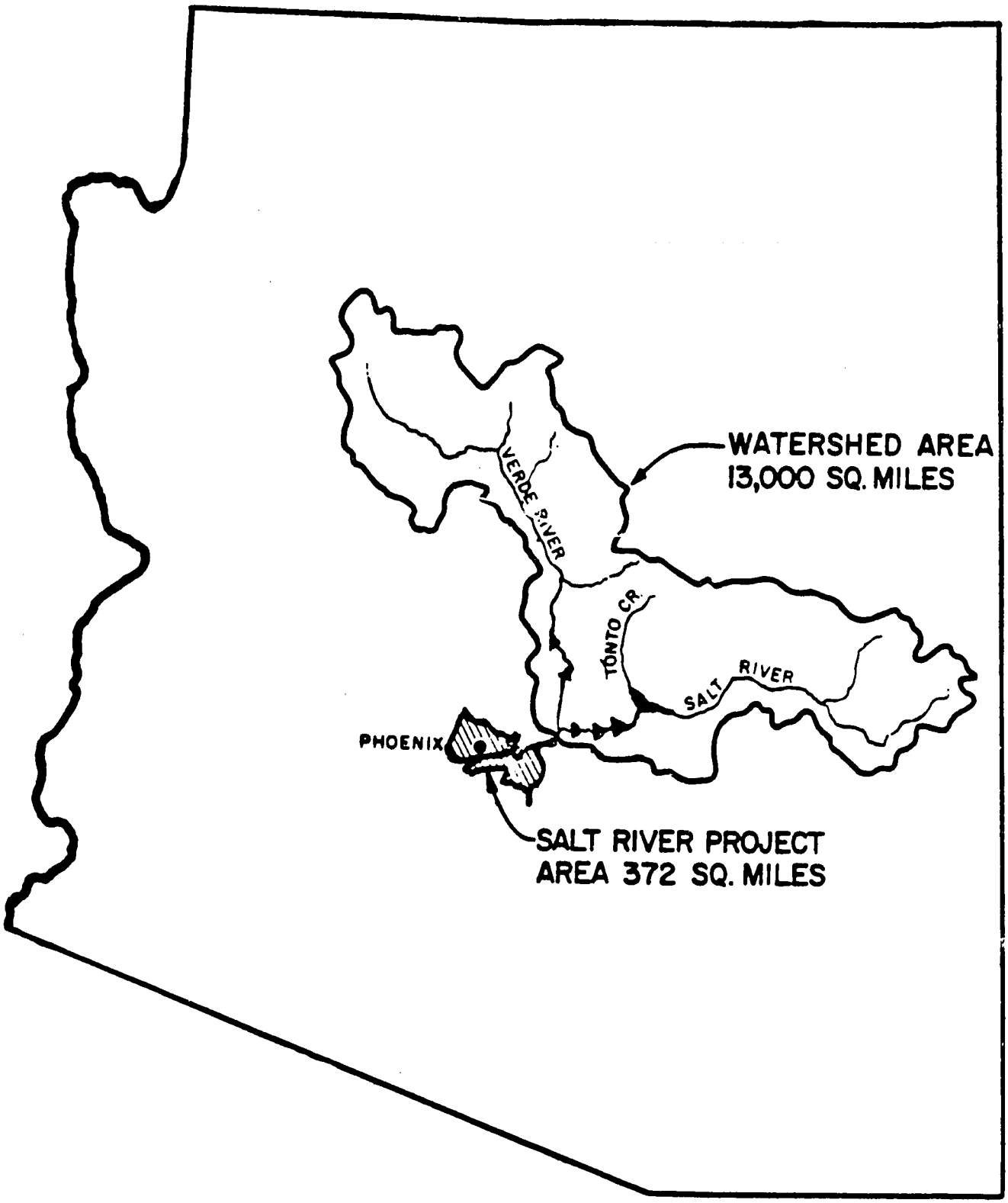
The Salt River Project provides annually an average 1.2 million acre-feet (1.48 cubic kilometers) of water for irrigation, municipal and industrial uses. About 76% of the Project's total annual water supply comes from its multi-purpose reservoir system, while the remaining 24% is produced from its 255 deepwell pumps. The reservoir system is composed of six dams, with a total storage capacity of 2.07 million acre feet (2.55 cubic kilometers). The six lakes are the major source of water and provide recreation for thousands of Arizonans.

The Salt River Project is the nation's oldest and most successful multi-purpose reclamation development. Income from the sale of the electricity is used to reduce the cost of water. Low-cost water and power have, in turn, made the Salt River Valley one of the most productive agricultural areas in the nation, and have enabled the spectacular economic development of this once desert valley.

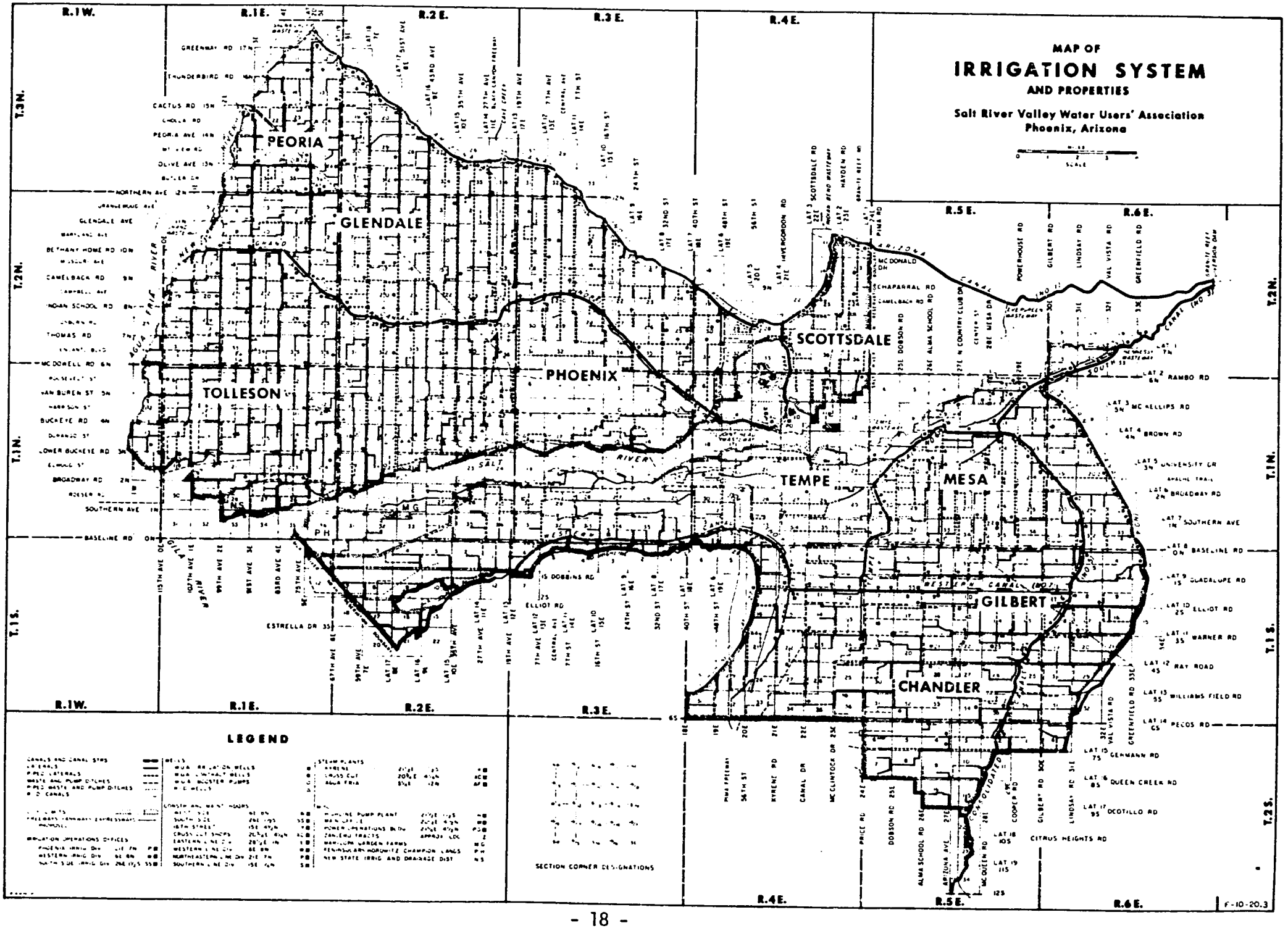
The Salt River Project has been recognized throughout the world as a leader in irrigation practices and power development. Approximately 250 foreign visitors, including many leaders, visit the Project every year. The Project is willing to share its experience in the irrigation water and power generation fields with other countries.

SRP WATER GROUP
ORGANIZATION CHART





Map showing the Salt and Verde Rivers and the Tonto Creek basins that supply water for the Salt River Project, Arizona


MAP OF
IRRIGATION SYSTEM
AND PROPERTIES
Salt River Valley Water Users' Association
Phoenix, Arizona
PEORIA
GLENDALE
TOLLESON
PHOENIX
SCOTTSDALE
TEMPE
MESA
GILBERT
CHANDLER
SALT RIVER
GILA RIVER
AGUA FRIA RIVER
ARIZONA CANAL
SOUTH CANAL
WEST PH CANAL
R.1W.
R.1E.
R.2E.
R.3E.
R.4E.
R.5E.
R.6E.
T.3N.
T.2N.
T.1N.
T.1S.
T.2S.
LEGEND
SECTION CORNER DESIGNATIONS
F-10-20.3

Report
On Farm Water
Management Training Program

Utah State University
August 17 - September 18, 1981

M. Naguib, Sociologist
Abdel Fattah Metawie, Engineer

I. Purpose of the Training:

1. Increasing knowledge and skills of our trainers staff in the aspect of on-farm water management.

2. Practical preparation for the training staff for future training programs in Egypt.

3. Studying other similar training programs held in other United States of America universities to know how do they operate - procedure and content.

4. Improving skills, experience of the role of project field team members.

5. Making evaluation and recommendations for future training programs in Egypt.

II. Description of the Program:

1. Procedure

The program was divided into class lectures starting:

8:30 a.m. to 12:00 noon

1:30 p.m. to 5:00 p.m.

and once a week evening lectures, 8:00 p.m. to 10:00 p.m. includes tea and coffee breaks, using some slides and projector. The practical part of the program was held in Utah State University labs and experiment stations, also some field trips to watch irrigation systems and methods, also land leveling operations by soil conservation service.

Housing for trainees was near to the lecture classes. Thirteen trainees attended. Six trainees were from Sri Lanka, two from Bangladesh, one from Iraq, one from Siralion and one from Giana (Latin America).

2. Contents:

Program following

III. Staff Activities in Program

- Attending class lectures day time and night
- Flumes (different kinds) weir's installation also using tensiometers and gravimeteric methods to determine soil moisture content theoretically and practically in experimental stations.

- Making simple and full evaluation for furrow and sprinkling irrigation systems. Also in experimental station.
- Working some home problems and assignments.
- Studying the calculator HP 34C programs and its usage for field and water measurement formula.
- Visiting different irrigation systems and methods around the state also some dams and water stations

IV. Evaluation:

Compared with other training programs we've attended "on farm water management" in CSU and in Egypt we came up with the following:

1. Lectures time was enough to cover the materials theoritically but field time was not enough and there were no farmer input or involvement only even farmers visit once.
2. Evening lectures were excellently given by old experienced retired and nonretired profficers who had been working in many third world countries before as team members or consultants, telling enormous amount of valuable information, knowledge and experience on farm water management.

- Sufficient and rich number of slides on different irrigation systems and methods and its technique in some countries with enough explaining and information.

V. Recommendation:

1. Having some evening lectures in EWUP training is given by experienced people and profficers from Ministry of Ag and Irrigation or the project directors and staff.
2. Making field trips to ag and irrigation experiment stations such as El Tahrir and El Salhia to see how do irrigation systems and methods operate.
3. Showing enough number of the project slides and achievement in Egypt training.