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REHABILITATION: A GAME SIMULATION

Norman T. Uphoff
Edward J. Vander Velde
Piyasena Ganewatte
Douglas J. Merrey
D. Hammond Murray-Rust
M. Lakshman Wickramasinghe

The International Rice Research Institute
P.O. Box 933, Manila, Philippines

MATERIALS FOR GAME

FOR PARTICIPANTS

FOR GAMEMASTER

INTRODUCTION TO THE GAME OF REHABILITATION

Irrigation system rehabilitation should not be seen as an end in itself. Rather it is a means for improving and sustaining productivity and well-being over time. Crucial to attainment of this goal is improving system management by government personnel and water users. The way in which rehabilitation is conceived and carried out will affect the prospects for improved management.

"Rehabilitation" is too often regarded simply as reconstruction or restoration, rather than as something quite different from the original creation of the system. No system can be fully or perfectly known at the time of its design and construction. Morover, man-land-water relations will always change over time, so even correct initial assumptions are unlikely to remain valid.

The accumulated experience from years of operation should be incorporated into any rehabilitation effort to come closer to an "optimum" system. The many hydrological, topographical, sociological, economic, agronomic and other constraints (as well as possibilities) which exist in a system can be better appreciated for regarding it as an ever-changing socio-technical system.

Engineers, planners and policy-makers need to have a concept of rehabilitation which distinguishes such an undertaking from simply recreating a system as originally planned and which capitalizes on the opportunity to get a better "fit" between human and physical factors than could be achieved in even the best of initial designs.

The game of REHABILITATION has been designed to simulate many of the tasks and problems likely to be encountered in planning for and implementing the rehabilitation of an existing irrigation system. Its purpose is to assist those involved in irrigation development to appreciate better the knowledge needs and the process variables which are likely to affect the successful implementation of irrigation rehabilitation projects.

Participants in the game are challenged to anticipate and resolve (or provide a basis for resolving) as many problems as possible of the kind that may emerge in getting an irrigation rehabilitation project started. In so doing, they should improve their skills in identifying knowledge needs, formulating good plans and designs, and developing appropriate strategies for solving problems.

The operational objective is to come up with a plan for rehabilitating this D-channel command area (AB-99) which will have: (1) fewer problems in implementation because difficulties and resistances will have been identified and anticipated, (2) more favorable prospects for securing farmer cooperation and participation in the project, and (3) increased opportunities for farmer acceptance of responsibility for efficiently operating and maintaining their part of the system after project completion.

REHABILITATION incorporates many -- but by no means all -- of the real conditions and problems that could be encountered in rehabilitating an existing irrigation system. This game was designed on the basis of experience in working with rehabilitation-cum-farmer-participation in the Left Bank of the Gal Oya irrigation scheme in Sri Lanka, being rehabilitated by that country's Irrigation Department with assistance from USAID.

The distributary channel system and command area used in the game are hypothetical but realistic, in that they are a composite of conditions and problems that had been found in a variety of locations throughout the Gal Oya Left Bank system and which we know from field experience also exist to a greater or lesser degree in other gravity-flow irrigation systems, large and small, elsewhere in Asia. The variety of conditions created for AB-99 might not be found in most D-channel systems. However, they are combined here to give participants exposure to the range of field conditions that may be encountered in any irrigation rehabilitation project. Much more complicated hydrological problems could have been presented by a longer channel network.

In designing this game, we have attempted to generalize REHABILITATION so that it can be useful for various groups of irrigation engineers (from both the design and field operation sides), government officials (at both district and central ministry levels), and other professionals (consultants, development assistance project managers, researchers, etc.) who typically are involved in both planning and implementing irrigation rehabilitation projects.

REHABILITATION is designed to give participants a learning experience rather than to try to arrive at a "correct" answer. In this sense it is more a pedagogical game than a simulation. To provide something of a "game" setting however, there is an evaluation at the end for the groups to assess how many of the problems that exist in AB-99 were discovered and dealt with in the design. But there is no "winning" or "losing" in REHABILITATION, just as there is no single right solution in rehabilitation.

What "works" and what "doesn't work" will only be known from practice once the rehabilitation has been completed, and the complex of human and physical factors can be observed interacting over time, more or less productively and satisfactorily. Moreover, what appears to be a good solution now may become sub-optimal in a few years' time as conditions change.

The game is not a role-playing one, but rather a group problem-identification and problem-solving exercise. The interests and voices of farmers are represented in the game indirectly rather than directly, though it will help if participants try throughout the game, as in real life, to use the methodology of "empathy," trying to put themselves in farmers' positions and to view the situation through users' eyes.

To have certain participants "play" farmers would have been interesting, but we want them to concentrate on developing an interdisciplinary, problem-oriented approach to rehabilitation, learning from each other, appreciating the extent to which rehabilitation is a group exercise by a varied set of professionals with the objective of creating conditions which will be satisfactory to farmer-users and in which the latter will take ever-greater responsibility. This is not only to increase production in the short-run but also to make the need for future rehabilitation more remote.

BACKGROUND INFORMATION: ANY BRANCH 99 (AB-99)

The distributary channel, Any Branch 99 (referred to as D-channel AB-99), and its subsidiary field channels (AB-99.1, 99.1.1, 99.1.1.1, 99.2, etc.) serve a small part of a large gravity-flow irrigation system constructed some 30 years earlier. The system is supplied by a large reservoir that stores run-off from a large catchment area, primarily during the monsoon rains. A map of the channels is presented in page 5.

Since its construction, the reservoir has spilled only twice, and water levels have dropped to near dead storage on two occasions. In general there is not enough water stored in an average year to provide irrigation water during the dry season for the entire command area. During the rainy season, some irrigation water is provided to the whole system on a supplementary basis to ensure a good crop.

In principle, water should be distributed throughout the whole system, but efforts to get farmers each to plant reduced acreage in water-short years to make this feasible have not been successful. Head-end farmers invariably draw as much water as they think they need, leaving those downstream to manage as best they can with what is remaining.

The farm families in the command area of AB-99 came from another district and were settled during the latter stages of system construction about three decades ago. Each family was granted 1.5 hectares of irrigable land on which to grow rice and was given in addition, near or within the AB-99 command area, an unirrigated piece of land for a homestead, provided with a standard house and suitable for a rain-fed garden which can contribute to family production and consumption.

The original number of allotments served by AB-99 was 46 and each was supplied with irrigation water through a 4" pipe set in the channel embankment at the proper elevation. In the original layout of AB-99, the Irrigation Department (ID) reserved areas of land on both sides of channels in order to have access for operation, maintenance and repair: 10 meters on either side of field channels and 20 meters wide along the D-channel (AB-99). No crops were to be grown and no structures were to be built in these areas, but these "reservations" have frequently been encroached upon by farmers with land adjacent to the reservation or by settlers' off-spring, the second generation, who are in dire need of land.

The original settlement policy provided that settler families could pass on their farms undivided to a single son or daughter. It was and remains illegal for farms to be subdivided among multiple heirs. No provision was made in the design of the system for expansion of irrigable area beyond the original commanded area. Nevertheless, the actual command area of AB-99 has been through various encroachments expanded beyond the original 69 hectares. Also, there are numerous allotments that have been subdivided.

Since this scheme was to support a class of independent peasant farmers, it was made illegal to lease or mortgage the land. This, however, has not prevented many less successful allottees from pledging use of their land as security for loans, sometimes then becoming tenants on their own land when they could not repay, or from renting the land out to smaller or to bigger operators.

Only original allottees are recognized by the government as legal cultivators, but these persons are sometimes not operating the land themselves. Or if they are operating it as "tenants," the de facto "owners" do not want them to be making decisions about operation and maintenance. But these persons are not themselves in a position to participate in such decisions. This makes planning and decision-making involving farmers difficult. In any case, it is the operators who have the most knowledge and stake in the system's operation and improvement.

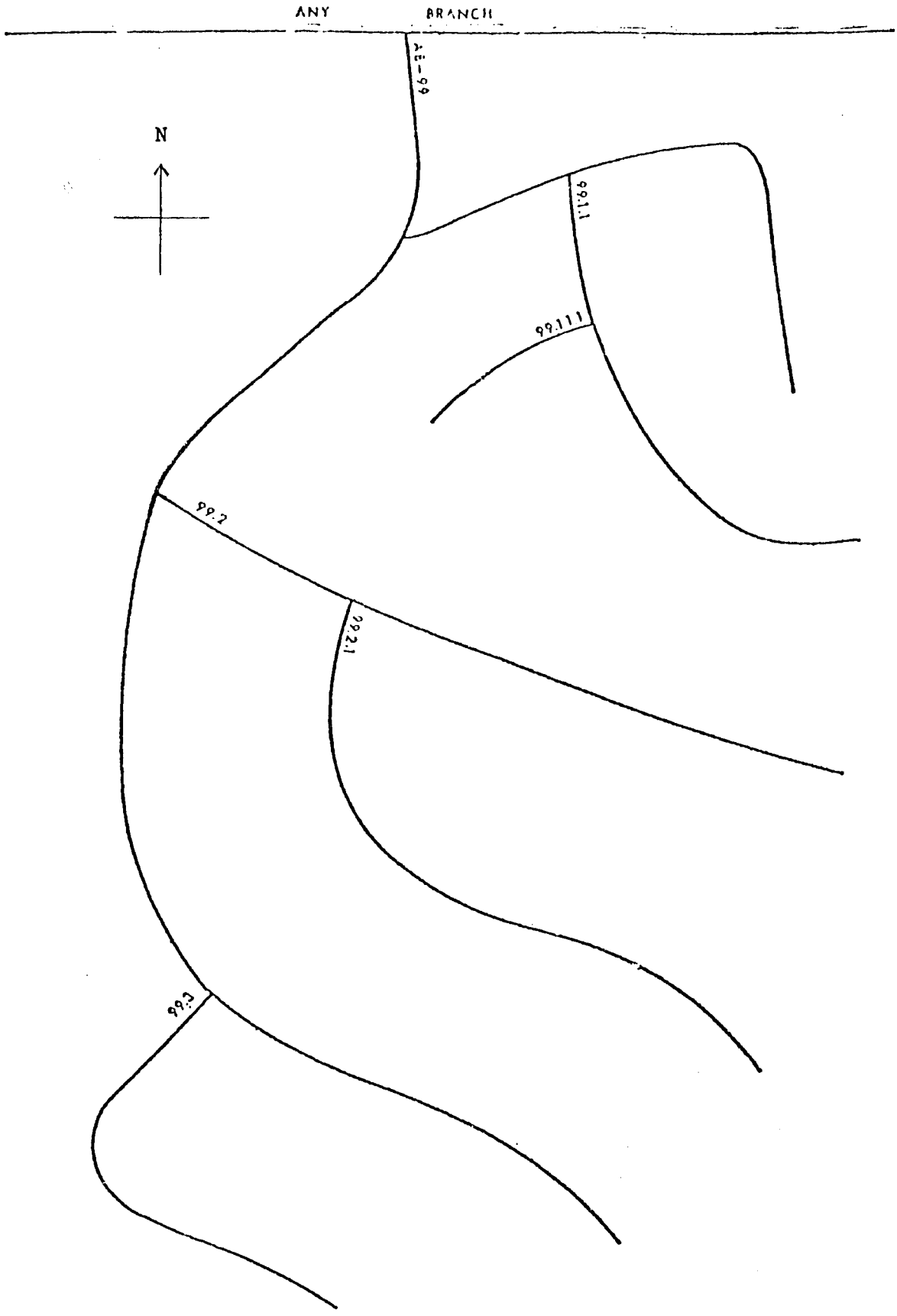
Rice is the predominant crop in both seasons. During the wet season, irrigation water is issued only to supplement a usually substantial rainfall, though if the rains are inadequate or not timely, irrigation supplies are crucial for a successful rice crop. In the dry season, the rice crop is completely dependent on the irrigation system for its water requirement.

Individual holdings (allotments) are terraced on the relatively gentle to moderate slopes in the area. A typical farm will have about 10 individually bunded paddies, with irrigation flowing from the highest to the lowest paddy before entering the drains, which are natural or in some cases man-made channels.

In those channels where lack of water control leads to excess run-off in the drains, some farmer have "encroached" upon the drainage areas by cultivating where water supply is ample and can be diverted by check structures (anicuts). Such cultivation can interfere with the drainage flow and cause problems for upstream farmers, but especially when the encroachers are second generation settlers, there is a disposition to accomodate them. Since funds and farmer effort have been inadequate to de-silt and maintain the D-channel and field channels, it is understandable that drainage channels have been neglected.

Overall, the general physical condition of this irrigation system, including AB-99, is now very poor. Rehabilitation is clearly necessary. Channel beds are typically higher than designed because of accumulated silt, and channel embankments are significantly eroded from their original profile, in part the result of human and animal traffic seeking access to water for non-irrigation purposes.

Many channel structures are severely deteriorated, and most channel offtakes cannot be used to regulate water flows because their gates are either broken or missing. Farmers increasingly complain about inadequate water supplies, blaming the ID for failing to maintain the system as well as "other farmers" who take more than their authorized share of water.



MAINTENANCE DIAGRAM

THE GAME: AN OVERVIEW

There are four sequential phases to the game of REHABILITATION. Briefly summarized they are as follow:

(I) PRE-DESIGN: Planning the acquisition of information about AB-99, deciding what information will be sought, and how? During this phase, information will be given to design teams, within time and budget constraints.

(II) DESIGN: Making decisions about what should be done to rehabilitate AB-99, taking account of the rehabilitation objectives and design criteria, discussed on pages 7-9.

(III) FARMER MEETING: A simulated meeting with AB-99 farmers to consider the proposed design, at which time farmers will ask the team some number of questions, and the team will try to answer, finding out how good a job it did of acquiring information to identify various problems and of dealing with them. (Not all problems may "surface" even in this situation, it should be noted.)

(IV) RE-DESIGN: An opportunity for the team to make revisions in the proposed rehabilitation design based on feedback from the users.

(V) EVALUATION: Consideration of how many of the main problems in AB-99 the team identified and dealt with through its planning and design efforts and also of what can be learned about "rehabilitation" from such an exercise.

The teams are each interdisciplinary to the greatest extent possible, to bring different perspectives to bear on the process of identifying and solving problems in rehabilitation. There is a Gamemaster who guides the team through the phases, providing information, enforcing time constraints, setting realistic limits on the play, deciding any contested issues, etc.

When more than one team is playing the game at the same time, there may be some informal competition to see which can do a better, and possibly quicker job of identifying and dealing with problems. But there is no outright competition, as each should be trying to do the best job it collectively can in improving the productive potential of AB-99 and the farming community there -- and in the process, to learn as best it can about the tasks of irrigation rehabilitation.

REHABILITATION OBJECTIVES AND DESIGN CRITERIA

The rehabilitation of Any Branch is intended to provide more adequate and reliable water supply, with possibilities for more efficient water use through better water control, presently minimal within the system. Water is actually controlled, with measurement of flow, at very few points within the system, just at the reservoir and major bifurcations. The gates on most diversions are inoperable or missing, so water has been running freely beyond the few main control points. Farmers have improvised checks in channels, even main ones, to capture more water when available.

Because of overall scarcity of water and lack of control capacity, the system has been operated on a rotational schedule, alternating deliveries among branch canals, five days on (water flowing) and then five days off (closed). The announced schedule has for a variety of reasons not been adhered to very strictly, encouraging competitive behavior among water users. The plan is to switch to a system of continuous flow, where a reduced but steady flow of water is provided in all branch channels and distributary channels (like AB-99) to give water continuously down to the field channel turnouts.

A system of rotation among fields will be required since the flow of water reaching each field channel turnout will not have enough head to spread over the fields unless it is alternatively given to just one or two fields at a time. There is some question whether the head of water reaching some field channel turnouts will be adequate even for this system of distribution unless there is rotation among field channels but the ID has insisted that it can deliver sufficient water to all field channel turnouts on a continuous flow basis.

To have some uniformity in design, the ID wants to have all field channels designed with 1 cusec capacity, serving standard blocks of 15-20 hectares (about 40 to 50 acres) each. This may create problems because it will not always be possible given topography and hydrology, to have rotational blocks just this size. Larger blocks will have water shortage and smaller ones, water surplus, unless some adjustments are made in water deliveries. The ID says some adjustments can be made, though with continous flow, only changes in amount, not schedule, can be made. Also there may need to be some adjustments made for variation in soil types. The official ID view is that after 30 years of irrigation, enough of a sub-surface pan should have been built up that all soils are essentially the same for irrigation purposes. Farmers do not agree and complain about problems in "sandy" areas.)

To control offtakes better, no allotments will be permitted to take water directly from a branch or distributary channel, only from a field channel. This does not present a major problem for rehabilitation on AB-99 but the rule does apply.

The rule against subdivisions of holdings is in the process of being relaxed. The original allotments in AB-99 area were 1.5 hectares, and despite the prohibition against subdivision, many allotments have been informally

divided between or among heirs of original allottees, or sometimes part of a holding has been mortgaged and then effectively lost, so it is tenanted. The rule now is that holdings can be subdivided, but only into plots no smaller than 0.75 hectares. There is some confusion about this. The ID has been told to give separate pipe inlets to fields of this size if registered with the Land Commissioner's Department by eligible heirs of original allottees. Nothing smaller is to be registered by the government or to be given water.

The rule against encroachment on "reservation" land along branch, distributary and field channels, which was supposed to facilitate maintenance work, has not been enforced. So in many places, farmers have extended their fields up to the channel bund, or others (such as sons and daughters of allottees) have started cultivating micro-plots along the channels. In some cases, they have even built houses within the reserved areas, finding the locations convenient or finding no other place where they could establish themselves.

The law in such situations is difficult to enforce through the courts. If people have built a house and lived in a location (on government or even private property) for some time without being challenged, they have a presumptive right to continue living there. They can be removed only by court order and then with compensation or provision of an alternative living facility. The other place where "encroachment" presents problems is in many of the drainage areas, where fields have been extended or new ones have been created, as discussed below.

The ID's intent is to reclaim all reservation areas so as to permit more regular maintenance in the future. However recently, the Land Commissioner's Department, responding to pleas by land-hungry settlers backed by members of parliament, has agreed to register new holdings up to 0.75 hectares where the ID will waive its right to the reserved land. There is understandably much pressure on the ID to accept such claims, on humanitarian grounds.

Decisions are further complicated by land tenure issues in some of the drainage areas, where entrepreneurial persons (e.g. merchants, government employees, etc.) have seen water "going waste" in the drains at certain times of the year because of lack of control upstream. They have found ways to divert it (with anicuts) so as to cultivate new areas that are not registered or authorized, but which are justified as using water that would otherwise run into the sea. These persons are also often well-connected politically, so their operation of holdings (usually through tenants or hired labor) above the government's 1.5 hectare ceiling has not been challenged. The ID has been told not to serve any holdings above the 1.5 hectare ceiling, but to refer any such cases to the Land Commissioner's Department for reallocation in 0.75 hectare holdings to eligible claimants (children of original allottees).

All settlers were provided originally with a household plot which was classified as "upland" because it was not served by irrigation water. A house was build by the settlement authorities for each family, which could establish a garden on the available upland area. In some instances, the household plot was low-lying enough that irrigation water could be brought to it, by short or even long unauthorized channels, or by siphons. (The latter are not much a problem because their capacity is usually less than a channel.)

The ID wants to restrict all such unauthorized use because one of the objectives of the rehabilitation effort is to increase the amount of water

that can be sent to tail-end users who now get little or no irrigation water. This is a difficult task because sometimes the upstream encroachers are long-established and it would be hard to evict them. Also, the ID knows that such persons may probably re-establish themselves after rehabilitation even if evicted. So the policy is to accomodate existing users where possible and within government guidelines.

The Irrigation Department has a number of "design criteria" that are based on its "engineering" objectives and calculations:

(1) Control structures and channels to be re-designed as necessary to permit operation under "continuous flow" regime.

(2) Field channel command areas to be, as uniformly as possible, 15-20 hectares with standard 1 cusec field channel capacities.

(3) No fields to be served directly from distributary channels.

(4) Each allotment (1.5 hectares) to be served by only one pipe inlet unless subdivision (no smaller than 0.75 hectares) has been authorized.

(5) Reservation areas (rights-of-way) to be reclaimed where encroached upon, to permit maintenance of channels and drains as necessary. (Some local politicians have challenged the extent of ROW claimed, as being excessive and thereby depriving poor farmers of opportunities for livelihood, but the courts have been reluctant to rule on this. It may become an issue in parliament.)

This latter "criterion," like the fourth one, gets into land tenure issues which the ID is not in a good position to deal with.

The plan to switch to continuous flow makes the eroded condition of structures and channels more of a liability than with the present rotational issue, as more control must be maintained over volumes and levels of flow to all parts of the system. Channel bunds will need to be reshaped and restored or numerous cross-regulators will need to be build to head up the water in given channel stretches.

Considerable work will need to be done on channel reconstruction, usually requiring use of heavy machinery on the D-channels and a good deal of hand labor on field channels. Given problems of compacting soil, it would be desirable to have machines for work often even on field channels, but there is no budget provision for this.

To save costs, no allocation was made for payment for work at field channel (tertiary) levels. It was considered that free labor at this level would be farmers' contribution to the project, a form of "participation." It should be noted that farmers were never consulted about this previously. The rehabilitation project design team simply assumed that farmers would (agree to) do this work. The fact that they may refuse, or do a poor job, has put some pressure on the Irrigation Department to be solicitous toward farmers, since if tertiary rehabilitation is not done effectively, much of the benefit of its investment for rehabilitating primary and secondary levels will be forgone.

THE GAME: PHASES AND PROCEDURES

Before the game begins, players will have background information on the game, its procedures, and on AB-99 (including a maintenance diagram, the simple map which the Irrigation Department has showing the numbers and configuration of channels -- see page 5). Any information which the ID would have on hand and which it could make available to the team will be given.

1: PRE-DESIGN (up to 60 minutes)

Each team after choosing a team leader will identify as specifically as possible what information it will want to gather as a basis for designing the rehabilitation plan for AB-99, and how it expects to get this information.

There are three alternative sources for information, apart from what the ID has on hand and will have given the team:

(a) survey which will yield reasonably precise and reliable data, but at considerable cost, since this would be done by professional staff to rigorous technical specifications;

(b) reconnaissance, which involves "quick and dirty" observation of the field situation, and thus costs less but gives less exact and less abundant data; and

(c) farmer consultation, such as "walking the channel" with farmers, to get their information on the operation and problems of the area; this is quicker and cheaper but often not quantifiable and may not be reliable.

Some kinds of information can only be gotten by one or two means, not all three. Participants must bear in mind hat there is some "cost" of getting that information from that source (represented by a composite sum which combines estimates of time and money in to some number of points). Each team faces a budget constraint of 100 points for information gathering. Teams should be somewhat cost-conscious in deciding on information and methods of obtaining it, though teams should concentrate initially on what they want to know and why, not at first trying to "economize."

Teams can approach the Gamemaster several times requesting information, but they will not be able to get draw on more than one-third of their budget at a time. After about half an hour, the team is advised to review and organize its information requests, becoming by this time more aware of its budget constraints.

If a team makes requests that exceed its "cost" allocation," it will have to discuss dropping certain information requests or changing the mode of information acquisition to a cheaper one, in order to come within the limit. If it is unable to agree on a list which comes within the limit, it may decide to seek a larger budget for information in this Pre-Design phase.

There is a "price" for exceeding the original budget. In actual practice it would take time for a design team to get more resources in this first phase, to get higher authorities to agree to increase its budget. So in our game, if a team chooses to try to get more time-money for information acquisition, it must give up some of the time allocated to it for the Design phase which follows.

It should not be assumed that a request for more budget will be approved. The team must argue persuasively in justification of its request, e.g. that if it has more information, its work in the Design phase will be easier or less error-prone. If the team is able to persuade the Gamemaster to increase its Pre-Design budget, he will decide how much of its time in the Design phase the team has to give up for this Pre-Design information.

As requests have been accepted and charged against the team's "budget" by the Gamemaster, he will give them the information that has been "paid" for. Where possible the information will be given in map form, though some must be provided descriptively on cards.

II: DESIGN (up to 60 minutes; longer if team has "saved" time during Phase I, or shorter if it has given up time to get more information)

With information in hand from the various sources (existing data, surveys, field reconnaissance and farmer consultation), the team proceeds to discuss how it would design a rehabilitated system for AB-99. Rehabilitation objectives and design criteria (pages 7-9) should be consulted and discussed. Where the team wishes to deviate from these, it may propose this and give justification, recognizing that final approval for its plan will have to come from higher authorities.

After there has been discussion of the problems and proposed solutions, the Gamemaster will review a set of design questions with the team to focus its decisions on specific issues and options, such as whether to change the designed discharge capacity of AB-99's D-channel gate? Would any changes be made in the configuration of field channels? What if anything should be done with the drainage channels?

Answers to these questions will constitute the proposed design for AB-99. The team leader or someone designated by him should sketch these onto a map which can be taken to the farmer meeting in the next stage. Rationale for any decisions should be agreed on in case the design decisions have to be justified at the farmer meeting or to superiors in the Irrigation Department.

III: FARMER MEETING (about 30 minutes)

The team should make a brief presentation, about 10 minutes, conveying its proposed design and its rationale to an imagined assembly of AB-99 farmers. (Where there is no time constraint on playing the game, the team could be asked to make a more detailed presentation, up to 30 minutes.) In a more abbreviated presentation, it is assumed that the ideas discussed and agreed on during the Design phase have been communicated to farmers as part of a more elaborate presentation.

At this point in the game, the Gamemaster will by throwing dice or other random means, determine how many questions will come from the farmers to the team (some number between 7 and 12.) In response to each question, read by the Gamemaster, the team should be able to say:

(a) it knew about this problem from its pre-design efforts and it has taken the problem into account in thus and so way (if this is not judged an adequate response by the Gamemaster, he may pursue the matter on behalf of the farmers), or

(b) it did not know about this problem but will try to take care of it in a revision of the design.

As a matter of scoring, the team will get 5 "bonus" points for each question it can satisfactorily answer at this stage of the process. The Gamemaster can award fewer points for a partially satisfactory answer. (Such decisions will not be discussed and any appeals will lead to disallowance of any points.)

At the end of this phase, the Gamemaster will give a "vote of thanks" on behalf of the farmers, in which he may voice appreciation, disappointment, any other problems he thinks should be called to the team's attention, etc., in the South Asian tradition of such closing remarks at meetings with officials.

IV: RE-DESIGN (up to 15 minutes)

After the meeting, the team may reconsider its initial proposal and make any changes it considers appropriate in light of the discussions with farmers.

V: EVALUATION (up to 60 minutes)

At the start of this phase, the Gamemaster will go over the final proposed design. (Remember that this design has not been approved by higher authorities, who may or may not accept any deviations from design criteria that might have been made; if they disapprove any part of the design, there may be disappointment and even difficulties from the farmers' side.)

The Gamemaster has a set of criteria for judging the design which has been previously drawn up according to what are known "on the ground" to be some of the major problems affecting irrigation performance in AB-99. He will award points for each problem where the team requested and got the information on which some solution could be based, and points for each "solution" to a problem. The highest score would go to a team which had (a) identified all of the major problems through its Pre-design inquiries, and (b) taken care of all of them, within reasonable resource constraints, in its Design work. Any bonus points from the Farmer Meeting will be added to this score.

The purpose of such scoring is to give the team some objectified "feedback" on how thorough and imaginative was its approach to rehabilitation on AB-99. The remainder of the time should be spent in a broad-ranging discussion of what participants think they learned from the game. If the team has gone overtime in preceding phases, there will unfortunately be less time for evaluation at the end.