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AGENCY FOR INTERNATIONAL DEVELOPMENT

ECONOMIC ANALYSIS
RAJASTHAN MEDIUM IRRIGATION PROJECT

USAID / INDIA

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ECONOMIC ANALYSIS

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ECONOMIC ANALYSIS - RAJASTHAN MEDIUM IRRIGATION PROJECT[1/]

The general procedure for economic evaluation of Rajasthan Medium Irrigation Projects follows that for all capital development projects. Estimates are developed for the projected stream of net economic benefits and for the projected stream of capital outlays required to achieve the benefits. The stream of benefits is related to the stream of capital outlays. Projects for which the projected net benefits compare favorably with the projected outlays are deemed to be economically feasible; those for which the relationship is unfavorable are deemed to be infeasible. The larger the net benefits relative to the capital outlays the more beneficial the project to farm producers, to Rajasthan, to India and to the world economy.

For purposes of economic evaluation, the schedule of projected net benefits can be related to the schedule of capital outlays and expenses in one of three ways:

1. By division: dividing the benefits by the outlays and expenses to obtain the well-known Benefit/Cost Ration (B/C).

2. By subtraction: subtracting the outlays and expenses from the benefits to obtain the net value of the project, commonly called the Net Present Value (NPV).

3. By determining the rate of earnings: relating the net benefits to the outlay to measure the earning power of the total capital investment required for the project. This measure is commonly called the Internal Rate of Return (IRR).

Each of the three measures requires a procedure for relating future benefits and outlays to those in the present. Discounting formulas are used to determine equivalent current values for future benefits, and/or for determining future annualized values of "lump sum" capital expenditures. Annual compound discounting formulas normally used are of the type $(1 + i)^{-n}$ where i is the annual discount rate and n is the number of years into the future of each projected outlay and benefit.

Use of the discounting formula permits specification of minimum standards, or cut-off points, for project feasibility. For example, one may specify that the IRR be 12 percent or higher for project feasibility. This is equivalent to B/C standard of 1.0 to 1 or greater (and NPV equal to or greater than zero) when

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1/ This report was prepared, basically, by R. Phillips and R. Borsdorf of Kansas State University under Contract No. AID/TA-C-1162, and USAID/India staff.

the discount rate is 12 percent. These standards each imply that the opportunity cost of capital outlay in Rajasthan is 12 percent per annum. The Internal Rate of Return for any feasible project should be equal to or greater than the opportunity cost of capital. Properly calculated, any of the three measures of project feasibility will yield important results for decision making. Each depends on accurate projections of capital outlays and net project benefits; accuracy both in total magnitude and transition (distribution) through time. Dependable assessment of MIP feasibility requires accurate simulation of future reality for project development and the response of the benefited farm producers to this development. No two individual MIPs are identical so that each must be simulated and evaluated separately.

There are a large number of alternative candidate MIPs for implementation in Rajasthan, and limited time and resources for evaluating them Procedures and guidelines must be standardized so that the candidates can be appraised fairly within the analytical resources available. It is believed that this can be done without excessive sacrifice of quality of result. The existing procedures used by the GOR Departments of Agriculture (Water Utilization Cell) and Irrigation provide a solid foundation for doing so. Computer techniques are available for extending the existing procedures to enhance the completeness and accuracy of project evaluation of alternative MIP candidates.

Examples of three MIPs are evaluated. The three are chosen to represent varying conditions of soil, climate, water supply and farm population over the State. More relevant to the evaluation procedure, the three are selected as prototypes of the three major categories of MIPs. These are new or on-going projects and modernization projects at two levels of investment command area development type activities.

2. Current Methodology used by GOR and GOI

The methodology currently used by GOR and GOI for evaluation of Medium Irrigation Projects (and for Major and Minor Irrigation Projects as well) is documented in the recent GOR Guidelines[1/] The methodology is used widely throughout India, and fully accepted by the Government of India. Benefit cost ratios are calculated, following standardized procedures for all projects. Average annual net incomes at full project development are calculated for the target farmers to be benefited. The with

1/ Dr. U. R. Mehta. Guidelines for Evaluation of Benefit Cost Ratios of Irrigation Projects and Achievement up to December 1979. Government of Rajasthan, Department of Agriculture, Water Utilization Cell. Report No. 7. Jaipur, Rajasthan, India

project net incomes are reduced by the comparable net farm incomes under the existing agriculture in the project command area to estimate the annual net project benefits.

The total capital outlay for project development is taken from the Department of Irrigation engineer's estimates. In most cases, these estimates include an annual acceleration factor for inflation and/or interest during construction for outlays to be incurred in those years after the base year. If relevant for the project in question, they include at least rough estimates of associated capital outlays needed to achieve the targeted benefits. Common examples of these "outside Project" associated capital outlays include rural roads, on-farm development, marketing facilities, accelerated agricultural extension and agricultural credit, and improved facilities for agricultural fertilizers and pesticides. If some of these relevant associated outlays have been overlooked in the engineer's estimates, they are added by Water Utilization Cell at the time the benefit-cost analysis is made.

The adjusted total capital outlay for each project is annualized by the Water Utilization Cell for computing the benefit-cost ratio, The computation is done uniformly for all MIPs by the following steps:

1. Multiplying the adjusted total capital outlay by 10 percent (capitalizing the outlay at 10 percent simple interest).

2. Dividing the adjusted outlay by the projected useful life of the project to determine an annual straight-line depreciation charge.

3. Sum the results of steps 1 and 2.

4. Add an annual charge for administration and maintenance, calculated at a standard per hectare rate applied to the total hectarage in the project command area at full development.

The final sum as determined by these four steps is used as the denominator for the B/C calculation.

The adjustment for a calculated water charge to the benefited cultivators is subtracted from the numerator rather than added to the denominator for the B/C determination. The calculated water charge is established on a per hectare basis for each crop by the GOR, and until revised is applied uniformly for all candidate MIPs under evaluation. Currently these calculated water charges range from Rs. 30/ha for such kharif crops as maize and sorghum to Rs. 100/ha for the combined-season crop, sugar cane.

The benefits obtained for purposes of the B/C calculations are affected by a number of factors, but the most crucial include the

the projected (1) pattern of transition to full development, (2) total hectorage to be served, (3) cropping and irrigation intensities, (4) per hectare crop yields, (5) farm prices, (6) production inputs and costs and (7) cropping patterns (crop mix). With the exception of the first one, each of these is reviewed carefully by the Water Utilization Cell in the process of evaluating each candidate project, as explained below. Since only average full development benefits are used in the calculation, the transition to full development is not reflected in the present GOR analysis (except for the inflation and/or interest during construction applied to the capital cost estimates, noted above).

Total hectarage to be served by a given MIP is determined by the topography of the area and the available water for irrigation, through the interdependency with irrigation intensity, cropping intensity and cropping pattern. For most MIPs, the area of suitable soil that can be reached by gravity flow is not the limiting factor; the available water supply is limiting. Nonetheless, those areas within the calculated command of each project are reviewed as to crop production capability, existing land use, existing cropping patterns, existing yield levels, existing well irrigation, existing markets, etc. Where necessary, the proposed area to be benefited is adjusted in the benefit-cost evaluation.

Irrigation intensity, given the total hectarage to be benefited and the projected cropping pattern, is a direct function of the available water supply. The hydrological and engineering calculations of the Irrigation Department are carefully reviewed by the Water Utilization Cell. Calculated average supplies rather than normal supplies are used for this purpose (see Section III C). Water requirement tables by season and by crop are reviewed carefully by the Cell. Where necessary, adjustments are made in proposed irrigation intensities to meet the agronomic requirements of the crops included in the cropping pattern.

Cropping intensity, given the projected irrigation patterns, are a function of agroclimatic factors and established farming practices. Often fields irrigated during the rabi season are left fallow during the kharif season, and vice versa, so that cropping intensities in Rajasthan rarely reach 200 percent, even in areas where rainfed crops are regularly grown. Rainfed cropping does increase as areas are developed for irrigation, however, and this fact is reflected in the feasibility analysis. Using historical experience in adjoining project areas, the Water Utilization Cell reviews proposed cropping intensitites for each project, and makes upward or downward adjustments when they are indicated.

Crop yields projected for the project area also are reviewed for each candidate MIP by the Water Utilization Cell, and adjusted as needed. Comparisions are made with existing yields in the command area and with those neighboring areas where projects have been developed. Separate estimates of projected yields are made

for each MIP, and within each MIP by rabi or kharif season and for irrigated, unirrigated and bed cultivation. To date transitions in yields after development have not been reflected, as noted above. Likewise, separate projections have not been made for well irrigation, for level of water course lining and on-farm development, etc.

Farm prices, are projected for each crop and farm input in real terms. For the most part, standard sets of farm prices are used for all candidate MIPs in the same region of the State. Crop prices used by the Water Utilization Cell are based on actual prices received by farmers and, if anything are conservative. Farm prices in Rajasthan average about 30 percent below economic prices based on world markets, introducing additional conservatism in the B/C ratios for projects submitted for international donor support (see Table 5).

Production inputs and costs are computed directly by the Water Utilization Cell, following standard guidelines and worksheets as well as specified input levels of fertilizer, plant protection, seed and other variable inputs needed to achieve projected full development yield levels. Hired farm labor (but not family labor) is included as a production cost in determining projected net benefits.

Cropping patterns used by the Water Utilization Cell represent minimal deviations from those already existing, particularly for projects in tribal areas where customs change slowly. For example, irrigated as well as rainfed fodder is retained to insure adequate forage for the farmer's work and milk animals. Relatively low-yielding crops such as gram are retained because of their ability to produce something, even under adverse "famine" conditions. High-risk crops, especially during the hot zaid season, and crops high in water requirements (e.g., paddy and sugar cane) are discouraged. The sequencing of crops in the cropping pattern is reviewed carefully to insure that practical planting and harvest dates and growing seasons have been projected. Acceptable close-by markets are used as a prerequisite for such crops as vegetables, sugar cane and groundnuts.

3. Recommended Modifications in Methodology

The major modification[2/] in evaluation procedures recommended for

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2/ Discussions with responsible GOR officials indicate a genuine interest in modifying the methodology of project evaluation to introduce workable improvement within the constraints of recources and workload. Likewise, USAID officials have indicated interest in technical assistance and training support to help GOR achieve the desired result. Computerized evaluation techniques are to be considered to the extent feasible for India and Rajasthan, primarily

GOR involve moving toward fully discounted cash flow analysis in order to measure the IRR and net present value (NPV) as well as the B/C for candidate MIPs. Once institutionalized, the modifications will permit more complete analysis and support more effective project planning and implementation. In addition, they will meet the standards for outside donor support. They can be applied to the whole range of major, medium and minor Irrigation projects for which GOR has responsibility.

The principal requirements for implementing the recommended modification are (1) procedures for discounting outlay estimates and projected benefits, (2) transition estimates for project development and achievement of full production and (3) separate estimates by major elements such as farms with both well and flow irrigation and those with lined water courses and full on-farm development. Workable discounting procedures are needed for IRR and HPV determination. Computer programs were used for doing this in the three prototype cases, but worksheets can be developed for doing so by hand calculation and graphic determination. This has been done by GOR analysists for some MIPs, including one of the prototype cases, Gudha Command Area Development Project.

Estimates of year-by-year transition to full project development and potential agricultural production are needed as input for the cash flow analysis. Such estimates can be developed by MIP planners. Substantial progress has been made in the development of standardized guidelines for this purpose, as reported in Section 4.

Separate estimates are needed for additional dimensions of certain MIPs in order to evaluate them effectively. For those in which groundwater and surface water need to be managed as complimentary resources, farms with well plus surface irrigation need to be analyzed separately. For those in which watercourse lining is to be undertaken, the impacts on projected crop yields and cropping patterns need to be reflected. For those in which additional command area development activities are to be under-

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for sensitivity analysis and project planning. Revised guidelines and worksheets, together with in-country training for staff analysists represent a major thrust of the contemplated assistance. U.S. training in computerized techniques of feasibility analysis is proposed for two or three key GOR officials, and would be structured around actual Rajasthan medium irrigation projects.

taken, the incremental response of farmers must be anticipated. Substantial progress, has been made in the development of standardized guidelines for these purposes also, as reported in Section 7.

Discounted Cash Flow Analysis can be used to determine (1) the Internal or Direct Rate of Return, (2) the Impact or Associated Rate of Return, and (3) the Economic Rate of Return, together with the corresponding fully-discounted Benefit Cost Ratios and Net Present Values. The Kansas State University computer programs now operating in New Delhi have full capability for direct determination of all three, and for simultaneous sensitivity analysis for a series of alternatives with each of them. The differences among the three are in the requirement for data and the purpose for which the results are used.

The Internal or Direct Rate of Return requires essentially the same set of input data as that now used by the GOR for B/C analysis. It is used for the same purpose -- to measure the net benefits and appraise the project in terms of impacts upon the farmers the MIP is designed to serve. It will measure the B/C ratio at the 10 percent discount rate (or any other specified rate) simultaneously with the IRR or DRR solution.[3/] Thus, starting from the present analytical methodology used by GOR, it represents a more precise and versatile method of accomplishing the same type of analysis now used.

The Associated Rate of Return is used for an additional measure of project benefits -- that of development impacts upon the total economy of the project area. The use of this measure requires estimation of the impact benefits such as those arising from added employment during project construction, the resulting greater farm production, from the marketing and processing of the additional farm products, from the economic activity stimulated by the additional demand for farm input and from the increased capital value of land and real property resulting from the stimulated economic activity. The GOR has expressed interest in this kind of analysis, but those responsible for MIP evaluation feel that resources are not available presently for making such analysis on a routine basis. As an interim step, it may be possible to present measures of a few of the more important linkage benefits, such as that of added employment to be created by each MIP. The ARR analysis presented for the three prototype MIPs provides basis for judgment regarding the general magnitude of associated benefits that may be expected by imple-

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3/ The IRR and DRR are identical except for the output format. The DRR represents more precise terminology for public projects such as MIPs where the direct benefits do not accrue to the same entity making the capital investment.

menting MIPs characterized by these prototypes in Rajasthan.

The Economic Rate of Return is a somewhat different measure; one that normally is employed by international donor agencies which must be concerned with alternative uses of development loan funds in many countries around the world. This measure requires estimation of "economic" prices for farm products and farm and product inputs in order that MIPs in Rajasthan would be feasible if all markets were based on free and unrestricted world trade. Precisely applied, it also required pricing family labor and other "non-exchanged" inputs (and outputs) at their opportunity cost in a free world exchange. For their own internal needs the GOR and GOI have only marginal interest in the ERR. The Economic Rate of Return analysis made for the three prototype Rajasthan MIPs provide an adequate basis for determining an equivalent DRR level as a cutoff for project feasibility.

Transition Estimates: Full and accurate application of the DRR and other discounted cash flow analysis requires estimating transition through time of the capital outlays and net project benefits for each MIP. At least four transition schedules are involved:

1. Construction schedule, and year-by-year identification of capital expenditures, including associated expenditures which are "outside" the project for financial purposes.

2. Farm irrigation system and land development schedule.

3. Schedule of transition to full farm production potentials, starting from the time each irrigated farm is completed.

4. Schedule of transition in cropping patterns from those at present to those projected at full development.

The last two of these may be expected to undergo one type of transition without the project and another with the project; therefore, appropriate MIP evaluation is made by comparing "projections with Project" to "projections without project" rather than "projections with Project" to "present".

The first two types of transition usually are estimated by the GOR in the course of MIP evaluation under current procedures. It is believed that the other two will not be difficult to incorporate into the evaluation procedure on a regular basis. Preliminary guidelines are now established for doing so.

Estimates for Added Dimensions: Separate estimates (including transitions) for added dimensions of concern in varying degrees in individual MIP candidates can be incorporated into the standardized evaluation procedures of the GOR. The tentative estimates used for (1) farms with wells plus surface irrigation and (2) farms

with surface irrigation only in the Gudha and Morel prototypes have been developed jointly with GOR officials and appear to be reasonable. Certainly they provide a means of more completely and accurately reflecting the full potential direct benefits of MIPs involving complimentary use of surface and ground water resources.

The differential estimates and transitions developed with GOR officials between the modernization prototype under Command Area Development and that with less complete and coordinated development of the project command area provide an example of what can be done to reflect this dimension. Similar differential estimates and transition patterns will be helpful in adequately reflecting the full potential benefits of watercourse lining, alternative degrees of land shaping and leveling, land reclamation and other dimensions of MIPs.

It is recommended that differential estimates be developed and incorporated in the standard GOR project evaluation procedures for those dimensions which prove to have definite merit in most MIPs. Unique dimensions with special merit in only a few MIPs can be incorporated on a case-by-case basis. The present evaluation procedures of the Water Utilization Cell can accomodate the unique dimensions of individual projects, provided that those formulating such projects furnish the accompanying differential estimates and transition schedules.

4. Transition Estimates for Prototype MIPs

The three Rajasthan prototype MIPs analyzed represent three distinct classes of candidate MIPs -- modernization projects with full command area development (Gudha), modernization projects with partial development (Morel), and new projects (Gosunda). Each prototype is distinct with respect to requirements for transition estimates and kinds of sensitivity analysis of most value. It is hoped that these three will serve not only as a representative base for Rajasthan Medium Irrigation Project review, but as a set of models for other MIP candidates within each prototype[4/]

Characteristics of the Prototypes

The Gudha project is characterized by the full potential for improvement under CAD. Lack of drainage, seepage from canals and watercourses and salinity are major problems in the upper reaches and lack of dependable water supply is a major problem in lower reaches. Farmers, agricultural leaders and agribusinessmen in the command area who were interviewed are unanimous in their anxiety to see the project move forward. The water table is

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4/ Selection of the specific examples under each prototype is arbitrary and implies no preference among candidate MIPs. Each of the GOR Irrigation Department Reports supplied to USAID represent promising candidates, as do many others on the total list.

relatively shallow and irrigation wells are common. There is need for the full dimensions of project modernization.

The Morel project is characterized by less critical multi-dimensional problems, but large unexploited potential. Groundwater represents an important resource, and well irrigation to supplement surface supplies must be considered. There is a need for and potential payoff from serious attention to watercourses, on-farm development, rural roads, drainage, development of marketing and fisheries development along with expanded agricultural extension and farm credit programs. Some of the base data needed for projection of transitions are not yet available, and the preliminary estimates used are subject to revision. They provide a reasonable basis for testing the prototype, however, and indicate that the project is attractive.

The Gosunda project represents a different stage in Rajasthan irrigated agriculture -- that much earlier step of turning sparsely-cropped rainfed areas into productive farming; that of exposing many very poor farm families to the first step on the track of potential for irrigated agriculture. A dependable supply of life-giving water is the first step; perhaps a step even more spectacular than the high payoff of the modernization projects.

Transition in Agricultural Production: The standardized schedule of transition to full agricultural production potential once water and land development have reached the farm under each of the three prototypes is shown in Table 1. It is expected that the production potentials will vary from MIP to MIP within each prototype, but that the transition pattern is a function of the type of MIP. New projects represent the longest transition in this regard because of time required for both the farmer and his land to make the early transition to irrigated agriculture. The transition under full modernization is a bit slower than that under other modernization projects because of the additional modifications to the existing system that are involved.

Schedules of Land Area Development: The schedules of land area development are unique to each project but reflect the characteristics of the type into which it falls. The schedules for each of the three prototypes as used as input to the evaluation analysis are shown in the corresponding Table 2. In the cases of Gudha and Morel schedules are developed for without project as well as with project, and the areas to be added by project obtained by subtraction. In the case of the new project, Gosunda, this is not necessary because without a source of surface water supply little or no change will take place (the transition without project is zero).

For each project the projected land use pattern for the rabi and kharif seasons at full development is summarized in the lower section of Table 2. Gudha is projected to reach irrigation intensity of 90.2% in rabi and 29.4% in kharif, with total cropping intensity

of 158.2% Gosunda will achieve irrigation intensity of 73.9% in rabi and 22.9% in kharif, with total cropping intensity of 124%. The corresponding projections for Morel are 61.5% in rabi and 23.3% in kharif, with total cropping intensity of 158.5%.

It will be noted that rainfed hectarages for Gudha show a declining pattern as more complete irrigation is developed -- a shift which is not offset by the additional 3,475 hectares brought under irrigation by raising the dam.

The year-by-year development areas shown in the upper section of Table 2 for Gosunda and in Section C of Table 2 for the other two projects represent those needed for the estimation of net project benefits. The figures upon which they are based are taken from the GOR project reports.

Estimates of Farm Production Expense: Following the existing procedures and reference tables of the GOR Department of Agriculture Water Utilization Cell, the basic data for computing farm production expenses both with and without project are shown in Tables 3A and 3B. These figures are not unique by project type, but rather apply uniformly to all MIPs. They include all projected production expenses except farm labor, which is computed separately.

The variable expenses shown in Table 3A represent a constant percentage of the gross revenue for each crop at varying yield levels. An example of the corresponding Rs. value is given for wheat at the yield level of 25 quintals per hectare and farm price of Rs. 124 per quintal. The percentage figures shown are based directly upon the GOR tables with the exception of chemical fertilizers. These include upward adjustments based on World Bank projections.[5/]

The fixed production expense estimates shown in Table 3B are taken as constant for each season-crop-type of cultivation combination, regardless of yield level. They include expenses for seed plus land charges.[6/] In the case of well irrigation they include operating and maintenance expenses for supplemental irrigation based on crop water requirements and well costs. They represent the anticipated pumping required in an average year; actual costs in a given year will vary from the average, depending upon the supply of surface water available.

Crop Yield Estimates: Crop yield estimates for each of the three prototype MIPs are shown in the corresponding Table 4. The projections

5/ World Bank Report 2529a-IN, Vol. 1, Table 7021, Sept. 13, 1979
6/ Land charges to the GOR Revenue Dept. might be excluded as a transfer payment, but because GOR holds title to the land they are treated herein as in the nature of land rent rather than tax, per se.

with project and without project represent full development. They are applied to the percentages in Table 1 to obtain the yield estimates for transition years. Note that in general, the projections are highest for Gudha and lowest for Gosunda, reflecting the type of MIP represented by each prototype. The relative yields by crop vary somewhat from one prototype to another, reflecting differences in soil and climate suitability.

The difference between projected yield levels with project and without project is a key determinate affecting the magnitude of net benefits for any MIP. Note that on this score Gosunda ranks very well, reflecting the relatively high incremental production when dry or partially well-irrigated lands are originally brought under surface irrigation.

The bed cultivation category shown for Gosunda represents a new type of cultivation brought in with development of the dam -- rabi cultivation of wheat and barley around the perimeter of the reservoir as water is drawn out for irrigation.[7]

Projected Farm Prices: The projected farm prices used in the evaluation of the three prototype MIPs are shown in units of Rs. per quintal in Table 5. The prices represent projected 1990 levels, indexed to current (1980) purchasing power. The figures in column (1) simulate actual prices received by farmers in Rajasthan. Those for groups of pulses, vegetables and oilseed crops are weighted averages for the prevailing kinds of these crops grown in the State. They are based on the list of prices currently used by the Water Utilization Cell for evaluating MIPs. Note that prices are not included for straw and other crop by products which are used dominantly for cattle feed on the farm where used. Such intermediate products are reflected in the factor for net bullock expense included in Table 3A.

The column (1) prices are used in determining the projected added net farm incomes attributed to each prototype project for the DRR analysis and for the farm budgets.

In contrast, the economic prices in column (2) are World Bank

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7/ Following usual procedure in India and elsewhere, the costs of compensation and resettlement within the lake bed are included in the capital cost estimate rather than as a negative benefit from lost revenue.

estimates of simulated free world market prices, "backed" to the farm gate. They were developed in the recent World Bank report on Maharashtra II Irrigation Project of September 1979 so that they may be considered applicable for Rajasthan. The only adjustment made was to convert them from U.S. dollar values to rupee values at Rs. 8.00 = $1.00. Note that the resulting economic prices are higher than the corresponding actual prices for all of the crops (column 3). This reflects the impact of Indian food and agricultural policies designed to maintain low cost food in the country. The relationship insures that all MIPs meeting feasibility tests by Direct Rate of Return analysis will show enhanced feasibility by the Economic Rate of Return analysis. The magnitude of the positive differential will vary somewhat from one MIP to another depending upon the relative weights of the individual crops and the increased yields achieved.

Corresponding prices for fertilizers and hired farm labor are shown in the lower section of Table 5. In the case of chemical fertilizers the relationship between actual farm prices and economic prices is reversed. In this case the -5 percent differential represents deduction of the State tax (a transfer payment) reflected in the actual farm price of fertilizer materials.

Projected Farm Labor Requirements: The projected farm labor requirements for each of the three prototype MIPs are shown in units of man day per hectare in the corresponding Table 6. The format of these tables follows that of the crop yields (Table 4). The labor requirements listed represent projections at full development; the requirements for each transition year are obtained by applying the transition patterns from Table 1 to those shown in Table 6. As in the case of yields the relevant labor requirements for project evaluation are those with project minus those without project. Those shown under the "existing" column are included for reference only.

From the limited socio-economic data available by project area in Rajasthan, about 10 percent of the total labor requirements is supplied by hired labor. The other 90 percent is supplied by the cultivator and his family. Thus, only 10 percent of the crop labor requirement represents a cash production expense to the cultivator. The economic cost of unpaid family labor depends upon the opportunity cost of such labor. Compared to the prevailing rate of Rs. 5.00 per day for hired labor, the opportunity cost of family labor in Rajasthan lies somewhere between Rs. 0.00 and Rs. 5.00. Maintaining the labor requirement in man days facilitates sensitivity analysis to determine the impact of alternative labor rates.

The labor requirements illustrated in Table 6 may be expected to vary from one MIP to another. The figures shown for the three prototypes reflect differences by class of projects, however. The requirements for the most part are highest for Gudha (full modern-

ization) next highest for Morel (partial modernization) and lowest for Gosunda (new project).

Transition in Cropping Pattern: The existing and projected with and without cropping patterns for each project by type of cultivation and cropping season are shown in units of hectares per 1000 hectares cropped in Table 7 for each prototype MIP. The figures are based directly upon the GOR project reports for the three prototypes.

The projected shifts in cropping pattern are relatively minor for all three projects. For the most part they reflect GOR and GOI efforts to encourage certain crops and discourage others. The projections indicate relative decreases in rice for all three crops and decreases in sugar cane in Morel and Gosunda. They indicate small relative increases in garden vegetables in Morel and Gudha, and in pulses and irrigated fodder in all three. All of these reflect policies to decrease water requirements per unit of irrigated area, to improve the nutrition intake of rural families, to reduce the risk of crop loss in drought years and to take care of the cattle. None of them reflect attempts to maximize cultivators' net incomes and cash flows. Based on the projected yields, prices and production costs used in the analysis herein, several of the projected shifts in cropping pattern decrease rather than increase the projected incomes of cultivators. At least the reviewer may be confident that the feasibility of the three prototypes is not overstated because of unrealistic balances of high earning crops.

The information presented in Tables 1-7 represents the full set of input data needed to complete economic evaluation of Rajasthan Medium Irrigation projects. The analytical methodology outlined in Sections 2 and 3 is applied to these input numbers to obtain the results summarized in the following section.

5. Feasibility Findings for the Three Prototypes

Each of the three prototype MIPs was subjected to the same analysis. Kansas State University computer programs were installed in New Delhi to make the analysis. The primary evaluations made include (1) DRR and B/C ratios (based on the farm prices from column (1) of Table 5, (2) analysis of sensitivity of the resulting DRR and B/C ratio to alternatives[6/], (3) ERR (based on the economic prices from column (2) of Table 5), and (4) ARR analysis of economic impact to the command area and the market area of the MIP.

Direct Rate of Return: The results of the DRR and B/C ratio analysis are shown by the accompanying reproductions of computer printouts for the three MIPs evaluated. Two pages of printout are included for each prototype. The first page of the computer printouts for each prototype labeled "Investment Feasibility Analysis" shows the results obtained. The projected total capital outlay is summarized in the columns to the left, the projected operating benefits and expenses in the center section, and the present values in the columns to the right. The "bottom line", the Direct Rate of Return on Total Capital investment, is shown at the top of this printout page. The fully discounted Benefit-Cost Ratios at six alternative discount rates are shown in the lower left sections of the printout table. The present values of the schedules of benefits, capital outlays and balances (NPV) at the corresponding discount rates are shown in the lower right section. The second, labeled "A Listing of the Data" summarizes the supporting schedules of capital outlay for (1) major irrigation and drainage works, (2) on-farm development and (3) associated outlays, the schedule of net benefits to producers; the schedule of farm labor costs; and the schedule of operation and maintenance costs projected for each project. All figures are in units of Rs. 1000.

Economic Rate of Return: The economic rate of return together with corresponding B/C ratios and net present values for the three prototype MIPs are shown by the accompanying reproductions of computer printout. The tables follow the same format as those for the direct rate of return, but the results are based on the economic prices shown in column (2) of Table 5 and average opportunity costs for unpaid family farm labor of Rs. 3.00 per man day. Adjustment has not been made for the 5 percent reduction in economic prices for fertilizers (see Table 5), so that ERRs for all three proto-

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6/ This step is done simultaneously with the original DRR solution by the computer program, but if conducted by hand requires completely new solution for each alternative considered. For this reason it is the first step to be considered for computerization by the Water Utilization Cell.

types are slightly understated.[7/] The results shown by the DRR and ERR analysis are summarized in Table A and discussed below for each prototype.

Table A Economic Feasibility Indicators

	Gudha	Morel	Gosunda
1. DRR			
A. Base case	9.761	7.869	5.059
B. Full modernization	10.822	8.260	8.481
C. Advanced construction		9.903	6.193
D. Adjusted DRR (B and C)	10.822	10.294	9.700
2. ERR			
A. Base case	14.055	10.630	7.668
B. Adjusted ERR	15.116	12.886	12.918
3. ARR			
A. Base case	5.498	3.116	2.616
4. SRR (Social Rate of Return)			
A. Adjusted DRR + ARR	16.320	13.241	12.231

Investment Alternatives: A number of investment alternatives were analyzed for each project. The more interesting ones are discussed below. The DRR for the base case and each of the alternatives analyzed are presented in Tables A, B, and C, Annex. The economic feasibility analysis required minor adjustments in the investment costs prepared by the GOR/ID, primarily to provide consistency between the three sub-projects. These adjustments are in Tables D, E, and F, Annex A.

7/ The magnitude of the ERR statement is less and 0.5 percent, however.

Gudha

The Gudha project is fully modernized except for watercourse lining and the GOR/ID proposed project yields a DRR of 9.761 which is a fully justified project. Lining one-third of the watercourses, which would increase yields by five percent and add 600 to 1,200 ha of rabi and kharif irrigated area, would increase the DRR by .52 to 1.1 percentage points over the base case.

Medium irrigation projects are sensitive to both yields and farm labor costs assumptions. In the case of Gudha, reducing farm labor costs by one rupee (20%) increases the DRR about one percentage point. For Gosunda, a similar reduction in farm labor costs increased the DRR about one half percentage point. Since full development farm income and farm labor costs are comparable for the two projects, the difference results from the delayed occurrence (9 years vs 1 year) of costs and benefits for Gosunda due to the long construction period.

A similar relationship exists in the case of crop yields with a 20 percent yield increase adding two points to the DRR for Gudha and only one for Gosunda.

The base case ERR of 14.055 increases to 15.116 with full modernization of watercourses.

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

GUDHA COMMAND AREA DEVELOPMENT PROJECT

DIRECT RETURN ON TOTAL CAPITAL 9.761 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1930	18600.	0.	18600.	0.	0.	0.	1.0000	18600.	0.
2	1931	26340.	0.	26340.	558.	873.	-315.	0.9111	23958.	-287.
3	1932	22550.	0.	22550.	3112.	1143.	1969.	0.8300	18726.	1634.
4	1933	0.	0.	0.	5441.	1186.	4255.	0.7562	0.	3218.
5	1934	0.	0.	0.	8012.	2424.	5588.	0.6890	0.	3850.
6	1935	0.	0.	0.	10637.	3517.	7120.	0.6277	0.	4469.
7	1936	0.	0.	0.	11121.	3914.	7207.	0.5719	0.	4122.
8	1937	0.	0.	0.	11550.	4003.	7547.	0.5210	0.	3932.
9	1938	0.	0.	0.	12174.	4140.	8034.	0.4747	0.	3814.
10	1939	0.	0.	0.	13549.	4227.	9322.	0.4325	0.	4029.
11	1940	0.	0.	0.	12826.	4300.	8526.	0.3940	0.	3359.
12	1941	0.	0.	0.	13906.	4336.	9572.	0.3590	0.	3077.
13	1942	0.	0.	0.	13981.	4369.	9612.	0.3270	0.	2816.
14	1943	0.	0.	0.	13058.	4402.	8656.	0.2980	0.	2579.
15	1944	0.	0.	0.	13134.	4436.	8698.	0.2715	0.	2361.
16	1945	0.	0.	0.	13212.	4470.	8742.	0.2473	0.	2162.
17	1946	0.	0.	0.	13286.	4503.	8783.	0.2253	0.	1979.
18	1947	0.	0.	0.	13361.	4536.	8825.	0.2053	0.	1812.
19	1948	0.	0.	0.	13437.	4569.	8868.	0.1870	0.	1659.
20	1949	0.	0.	0.	13511.	4604.	8907.	0.1704	0.	1518.
21	1950	0.	0.	0.	13585.	4635.	8950.	0.1552	0.	1389.
22	1951	0.	0.	0.	13658.	4668.	8990.	0.1414	0.	1272.
23	2000	0.	0.	0.	13731.	4700.	9031.	0.1289	0.	1164.
24	2003	0.	0.	0.	13807.	4732.	9075.	0.1174	0.	1065.
25	2004	0.	0.	0.	13879.	4764.	9114.	0.1070	0.	975.
26	2005	-33550.	0.	-33550.	0.	0.	0.	0.0974	-3266.	0.
TOTAL		93550.	0.	93550.	275925.	93849.	182076.		57538.	57538.

INTEREST % PER ANN.	BENEFIT/COST RATIO
8.000	1.215
9.000	0.968
12.000	0.807
14.000	0.692
15.000	0.605
16.000	0.539

PRESENT VALUE IN RS. 1000

BENEFIT	OUTLAY	BALANCE
68704.	56658.	12046.
56222.	57604.	-1382.
46012.	57817.	-11:35.
39275.	57596.	-18322.
33439.	57162.	-23683.
28777.	56504.	-27728.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVES
BASE CASE: ALL FACTORS TAKEN AS PRESENTED IN APPENDIX B-1 AND B-2, VOLUME I

A LISTING OF THE DATA

6 0 1 2 2 3 0 1 0.000000

SUDMA COMMAND AREA DEVELOPMENT PROJECT

PERIOD NO.	YEAR	[illegible]	[illegible]	[illegible]	ROAD WORKS	OTHER WORK	CONT PRICE	% INC	FARM INCOM	FARM LABOR	O & M COST
11989	[illegible]	[illegible]	4400.	[illegible]	1000.	3300.	4400.		0.	0.	0.
21992	[illegible]	[illegible]	[illegible]	[illegible]	1400.	2600.	8400.		[illegible]	[illegible]	11.
31995	[illegible]	[illegible]	[illegible]	[illegible]	0.	3100.	[illegible]		[illegible]	[illegible]	33.
41998	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	66.
51994	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	88.
61995	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
71996	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
81997	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
91998	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
101999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
111999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
121999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
131999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
141999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
151999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
161999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
171999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
181999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
191999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
201999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
211999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
221999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
231999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
241999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
251999	0.	0.	0.	0.	0.	0.	0.		[illegible]	[illegible]	110.
261999	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		0.	0.	0.

INVESTMENT FEASIBILITY ANALYSIS

GUDHA COMMAND AREA DEVELOPMENT PROJECT

DIRECT RETURN ON TOTAL CAPITAL 10.822 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1930	20638.	0.	20638.	0.	0.	0.	1.0000	20638.	0.
2	1931	26920.	0.	26920.	931.	1580.	-349.	0.9023	26728.	-315.
3	1932	25393.	0.	25393.	3797.	1345.	2452.	0.8142	20676.	1996.
4	1933	0.	0.	0.	7126.	1863.	5263.	0.7347	0.	3867.
5	1934	0.	0.	0.	8775.	2342.	6425.	0.6630	0.	4591.
6	1935	0.	0.	0.	12977.	2537.	4840.	0.5982	0.	5284.
7	1936	0.	0.	0.	13568.	4606.	5961.	0.5398	0.	4837.
8	1937	0.	0.	0.	14084.	4712.	9372.	0.4871	0.	4569.
9	1938	0.	0.	0.	14852.	4873.	9979.	0.4395	0.	4386.
10	1939	0.	0.	0.	15310.	4976.	10333.	0.3966	0.	4098.
11	1940	0.	0.	0.	15648.	5063.	10585.	0.3579	0.	3788.
12	1941	0.	0.	0.	15745.	5103.	10643.	0.3229	0.	3437.
13	1942	0.	0.	0.	15337.	5144.	10193.	0.2914	0.	3116.
14	1943	0.	0.	0.	15834.	5183.	10748.	0.2629	0.	2826.
15	1944	0.	0.	0.	16023.	5223.	10800.	0.2373	0.	2562.
16	1945	0.	0.	0.	16118.	5264.	10855.	0.2141	0.	2324.
17	1946	0.	0.	0.	16209.	5303.	10906.	0.1932	0.	2107.
18	1947	0.	0.	0.	16300.	5342.	10958.	0.1743	0.	1910.
19	1948	0.	0.	0.	16393.	5341.	11013.	0.1573	0.	1732.
20	1949	0.	0.	0.	16483.	5422.	11062.	0.1419	0.	1570.
21	2000	0.	0.	0.	16574.	5459.	11115.	0.1281	0.	1424.
22	2001	0.	0.	0.	16663.	5498.	11165.	0.1156	0.	1290.
23	2002	0.	0.	0.	16752.	5535.	11216.	0.1043	0.	1170.
24	2003	0.	0.	0.	16843.	5573.	11271.	0.0941	0.	1061.
25	2004	0.	0.	0.	16933.	5611.	11320.	0.0849	0.	961.
26	2005	1-44953.	0.	-44953.	0.	0.	0.	0.0766	-3445.	0.
TOTAL		30699.	0.	30699.	336629.	110493.	226135.		64596.	54596.

INTEREST PER CENT	BENEFIT/COST RATIO
8.000	1.349
10.000	1.085
12.000	0.897
14.000	0.757
16.000	0.650
18.000	0.565

PRESENT VALUE IN RS. 1000 BENEFIT	OUTLAY	BALANCE
85344.	63269.	22075.
69844.	64401.	5442.
57996.	64682.	-6687.
48798.	64460.	-15662.
41551.	63943.	-22393.
35761.	63259.	-27498.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
LINE ONE THIRD WATER COURSES. YIELD INCREASE 5 PERCENT. CROPPED AREA INCREASE 1200 HA.

A LISTING OF THE DATA

[illegible]

ADOMA COMMAND AREA DEVELOPMENT PROJECT

PERIOD NO.	YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	COST PRICE INC	FARM INCOM	FARM LABOR	O & M COST
SCALE OF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0000	[illegible]	[illegible]	1.0000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.	0.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
102[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
11[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
12[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
13[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
14[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
15[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
16[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
17[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
18[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
19[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
20[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
21[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
22[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
23[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
24[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
25[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
26[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	110.
262003	[illegible]	[illegible]	-4400.	-3200.	-5500.	-4200.	[illegible]	0.	0.	0.

SCALE FACTORS APPLIED TO DATA BEGINNING IN PERIOD [illegible]

INVESTMENT FEASIBILITY ANALYSIS

GUDHA COMMAND AREA DEVELOPMENT PROJECT

ECONOMIC RETURN ON TOTAL CAPITAL 14.055 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1930	18600.	0.	18600.	0.	0.	0.	1.0000	18600.	0.
2	1931	26340.	0.	26340.	657.	528.	129.	0.8768	23094.	113.
3	1932	22500.	0.	22500.	3993.	899.	2964.	0.7687	17343.	2278.
4	1933	0.	0.	0.	6875.	978.	5897.	0.6740	0.	3974.
5	1934	0.	0.	0.	8430.	1490.	6941.	0.5909	0.	4098.
6	1935	0.	0.	0.	12520.	2154.	10366.	0.5181	0.	5371.
7	1936	0.	0.	0.	13089.	2392.	10697.	0.4543	0.	4859.
8	1937	0.	0.	0.	13594.	2445.	11149.	0.3983	0.	4440.
9	1938	0.	0.	0.	14329.	2528.	11801.	0.3492	0.	4121.
10	1939	0.	0.	0.	14770.	2580.	12190.	0.3062	0.	3733.
11	1940	0.	0.	0.	15096.	2624.	12472.	0.2684	0.	3348.
12	1941	0.	0.	0.	15244.	2544.	12540.	0.2354	0.	2953.
13	1942	0.	0.	0.	15278.	2665.	12613.	0.2064	0.	2603.
14	1943	0.	0.	0.	15368.	2685.	12684.	0.1809	0.	2295.
15	1944	0.	0.	0.	15429.	2676.	12753.	0.1586	0.	2023.
16	1945	0.	0.	0.	15551.	2726.	12825.	0.1391	0.	1784.
17	1946	0.	0.	0.	15638.	2746.	12892.	0.1219	0.	1572.
18	1947	0.	0.	0.	15726.	2766.	12960.	0.1069	0.	1386.
19	1948	0.	0.	0.	15815.	2785.	13030.	0.0937	0.	1222.
20	1949	0.	0.	0.	15902.	2806.	13096.	0.0822	0.	1076.
21	2000	0.	0.	0.	15990.	2825.	13165.	0.0721	0.	949.
22	2001	0.	0.	0.	16075.	2845.	13231.	0.0632	0.	836.
23	2002	0.	0.	0.	16161.	2864.	13297.	0.0554	0.	737.
24	2003	0.	0.	0.	16251.	2883.	13368.	0.0486	0.	649.
25	2004	0.	0.	0.	16334.	2902.	13432.	0.0426	0.	572.
26	2005	-38850.	0.	-38850.	0.	0.	0.	0.0373	-1451.	0.
TOTAL		28650.	0.	28650.	324764.	57269.	267495.		57566.	57566.

INTEREST PER CENT	BENEFIT/COST RATIO
8.000	1.783
10.000	1.436
12.000	1.188
14.000	1.004
16.000	0.853
18.000	0.751

PRESENT VALUE IN RS. 1000 BENEFIT	OUTLAY	BALANCE
101022.	56658.	44364.
82707.	57604.	25103.
68712.	57617.	10994.
57848.	57596.	252.
49291.	57122.	-7831.
42455.	56504.	-14049.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVES
ASSUME FARM INCOME INCREASE 17 PERCENT, LABOR VALUED AT RS THREE.

A LISTING OF THE DATA

S 0 1 2 [illegible] 1 0.000000

LOWER COMMAND AREA DEVELOPMENT PROJECT

PERIOD NO.	YEAR	[illegible] WORKS	[illegible] WORKS	O.F.D. WORKS	[illegible] WORKS	OTHER ACT.	CONT $ PRICE INC	FARM INCOME	FARM LABOR	O & M COST
SCALE FACTORS:		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.1770	0.6000	1.0000
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.	0.	0.
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	657.	517.	11.
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	666.	33.
4	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	66.
5	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	1402.	88.
6	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2044.	110.
7	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2282.	110.
8	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2336.	110.
9	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2418.	110.
10	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2470.	110.
11	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2514.	110.
12	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2534.	110.
13	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2555.	110.
14	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2575.	110.
15	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2596.	110.
16	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2616.	110.
17	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2636.	110.
18	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	110.
19	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	110.
20	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	110.
21	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2715.	110.
22	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2735.	110.
23	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2754.	110.
24	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2773.	110.
25	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	2792.	110.
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.	0.	0.

SCALE FACTORS [illegible] TO [illegible] [illegible] IN [illegible]

Morel

The Morel project is partly modernized. As prepared by the GOR/ID, the DRR is 7.869. By adding lining to 1/3 of the watercourses, yields on rabi and kharif surface irrigation would increase five percent, resulting in an DRR of 8.260.

The GOR/ID report lags investment in roads - two years, market development - 5 years, on-farm works - three years, and fisheries - 3 years from project initiation. Assuming that these investments were advanced two years and the net revenue stream advanced accordingly, the resulting adjusted DRR would be 9.903 a fully justified project.
A number of other sensitivity tests were made, including various yield assumptions and alternative investment packages. Generally, yield increase increments of 5 percent raise the DRR about 0.3, i.e. 20 percent higher yields would increase the DRR by 1.2 percentage points. Various alternatives that reduced on-farm investments resulted in lower DRR's than the base case.

The base case ERR of 10.630 increases to 12.886 with full modernization and a shortened construction period.

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

MODEL MODERNIZATION PROJECT
AS TENTATIVELY PLANNED

DIRECT RETURN ON TOTAL CAPITAL 7.869 PERCENT

PERIOD		INVESTMENT (RS. 1000)			OPERATING (RS. 1000)			PRESENT	PRESENT VALUES	
			WORKING		DIRECT	OPERATING	NET	VALUE	TOTAL	NET
NO.	IDENT.	FACILITIES	CAPITAL	TOTAL	BENEFIT	EXPENSES **	BENEFIT	FACTOR	INVESTMENT	BENEFIT
1	1982	16310.	0.	16310.	0.	0.	0.	1.0000	16310.	0.
2	1983	32620.	0.	32620.	0.	0.	0.	0.9270	30240.	0.
3	1984	25630.	0.	25630.	0.	0.	0.	0.8594	24605.	0.
4	1985	22330.	0.	22330.	0.	24.	-24.	0.7967	17831.	-19.
5	1986	12350.	0.	12350.	1261.	314.	947.	0.7386	9122.	699.
6	1987	15750.	0.	15750.	3854.	926.	2928.	0.6847	10791.	2005.
7	1988	13430.	0.	13430.	8269.	2004.	6265.	0.6348	8557.	3977.
8	1989	2060.	0.	2060.	11838.	3242.	8596.	0.5885	1212.	5058.
9	1990	0.	0.	0.	17391.	4592.	12799.	0.5455	0.	6982.
10	1991	0.	0.	0.	21157.	5767.	15390.	0.5057	0.	7783.
11	1992	0.	0.	0.	23796.	6588.	17208.	0.4688	0.	8058.
12	1993	0.	0.	0.	24927.	6940.	17987.	0.4346	0.	7818.
13	1994	0.	0.	0.	25346.	7070.	18276.	0.4029	0.	7364.
14	1995	0.	0.	0.	25346.	7070.	18276.	0.3735	0.	6827.
15	1996	0.	0.	0.	25346.	7070.	18276.	0.3463	0.	6329.
16	1997	0.	0.	0.	25346.	7070.	18276.	0.3210	0.	5867.
17	1998	0.	0.	0.	25346.	7070.	18276.	0.2976	0.	5439.
18	1999	0.	0.	0.	25346.	7070.	18276.	0.2759	0.	5042.
19	2000	0.	0.	0.	25346.	7070.	18276.	0.2558	0.	4674.
20	2001	0.	0.	0.	25346.	7070.	18276.	0.2371	0.	4333.
21	2002	0.	0.	0.	25346.	7070.	18276.	0.2198	0.	4017.
22	2003	0.	0.	0.	25346.	7070.	18276.	0.2038	0.	3724.
23	2004	0.	0.	0.	25346.	7070.	18276.	0.1889	0.	3453.
24	2005	0.	0.	0.	25346.	7070.	18276.	0.1751	0.	3201.
25	2006	0.	0.	0.	25346.	7070.	18276.	0.1624	0.	2967.
26	2007	-86756.	0.	-86756.	0.	0.	0.	0.1505	-13059.	0.
TOTAL		56824.	0.	56824.	441991.	122307.	319684.		105609.	105609.

INTEREST PERCENT	BENEFIT/COST RATIO	PRESENT VALUE IN RS. 1000 BENEFIT	OUTLAY	BALANCE
7.000	0.983	103884.	105656.	-1772.
10.000	0.772	81332.	105319.	-23987.
12.000	0.622	64488.	103637.	-39149.
14.000	0.511	51737.	101243.	-49506.
16.000	0.426	41961.	98509.	-56548.
18.000	0.359	34376.	95651.	-61275.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
COST ESTIMATES AND DEVELOPMENT SCHEDULE AS DERIVED BY ENGINEERING DEPARTMENT, GOR.
TOTAL FARM LABOR CHARGED AT RS 5.00 PER MAN DAY

A LISTING OF THE DATA

5 0 2 2 214 0 1 0.000000

ADRIL MODERNIZATION PROJECT
AS TENTATIVELY PLANNED

PERIOD NO.	YEAR	MAJOR WORKS	ROADS ETC.	MARKETING DEVELOP.	ON FARM WORKS	FISH DEVELOP.	FARM INCOME	FISH INCOME	FARM LABOR	O&M COST
1	1992	16310.	0.	0.	0.	0.	0.	0.	0.	0.
2	1993	32620.	0.	0.	0.	0.	0.	0.	0.	0.
3	1994	16310.	12320.	0.	0.	0.	0.	0.	0.	0.
4	1995	0.	12320.	0.	9140.	920.	0.	0.	0.	24.
5	1996	0.	0.	0.	11430.	920.	1201.	60.	222.	92.
6	1997	0.	0.	2050.	13710.	0.	3704.	150.	750.	176.
7	1998	0.	0.	2050.	11430.	0.	7969.	300.	1727.	277.
8	1999	0.	0.	2050.	0.	0.	11385.	450.	2660.	362.
9	1990	0.	0.	0.	0.	0.	16721.	600.	4230.	362.
10	1991	0.	0.	0.	0.	0.	20557.	600.	5405.	362.
11	1992	0.	0.	0.	0.	0.	27191.	600.	6226.	362.
12	1993	0.	0.	0.	0.	0.	24327.	600.	5578.	362.
13	1994	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
14	1995	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
15	1996	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
16	1997	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
17	1998	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
18	1999	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
19	2000	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
20	2001	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
21	2002	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
22	2003	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
23	2004	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
24	2005	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
25	2006	0.	0.	0.	0.	0.	24746.	600.	6708.	362.
26	2007	-48930.	-12320.	-2050.	-22350.	-6[illegible]6.	0.	0.	0.	0.

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

(OPEN MODERNIZATION PROJECT)
AS TENTATIVELY PLANNED

DIRECT RETURN ON TOTAL CAPITAL 3.250 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1932	15310.	0.	15310.	0.	0.	-0.	1.0000	15310.	-0.
2	1933	32630.	0.	32630.	0.	0.	-0.	0.9237	30131.	-0.
3	1934	25930.	0.	25930.	0.	0.	-0.	0.8532	24429.	-0.
4	1935	25707.	0.	25707.	0.	24.	-24.	0.7881	22260.	-19.
5	1936	15511.	0.	15511.	1481.	371.	1110.	0.7280	12020.	809.
6	1937	20750.	0.	20750.	4532.	1117.	3415.	0.6725	13954.	2296.
7	1938	17541.	0.	17541.	9727.	2444.	7283.	0.6212	10957.	4524.
8	1939	2060.	0.	2060.	13322.	3375.	9946.	0.5738	1182.	5708.
9	1940	0.	0.	0.	20464.	5671.	14793.	0.5300	0.	7840.
10	1941	0.	0.	0.	24919.	7145.	17774.	0.4895	0.	8701.
11	1942	0.	0.	0.	28041.	8176.	19865.	0.4522	0.	8983.
12	1943	0.	0.	0.	29379.	8617.	20761.	0.4177	0.	8672.
13	1944	0.	0.	0.	29375.	8781.	21094.	0.3858	0.	8138.
14	1945	0.	0.	0.	29375.	8781.	21094.	0.3564	0.	7514.
15	1946	0.	0.	0.	29375.	8781.	21094.	0.3292	0.	6944.
16	1947	0.	0.	0.	29375.	8781.	21094.	0.3041	0.	6416.
17	1948	0.	0.	0.	29375.	8781.	21094.	0.2809	0.	5925.
18	1949	0.	0.	0.	29375.	8781.	21094.	0.2595	0.	5473.
19	2000	0.	0.	0.	29375.	8781.	21094.	0.2397	0.	5055.
20	2001	0.	0.	0.	29375.	8781.	21094.	0.2214	0.	4670.
21	2002	0.	0.	0.	29375.	8781.	21094.	0.2045	0.	4313.
22	2003	0.	0.	0.	29375.	8781.	21094.	0.1889	0.	3984.
23	2004	0.	0.	0.	29375.	8781.	21094.	0.1745	0.	3680.
24	2005	0.	0.	0.	29375.	8781.	21094.	0.1612	0.	3400.
25	2006	0.	0.	0.	29375.	8781.	21094.	0.1489	0.	3140.
26	2007	-95033.	0.	-95033.	0.	0.	-0.	0.1375	-13075.	-0.
TOTAL		65145.	0.	65145.	520873.	151689.	369144.		116168.	116153.

INTEREST PER CENT	BENEFIT/COST RATIO
8.000	1.033
10.000	0.815
12.000	0.659
14.000	0.543
16.000	0.454
18.000	0.384

PRESENT VALUE IN RS. 1000

BENEFIT	OUTLAY	BALANCE
120807.	116159.	3448.
93957.	115340.	-21373.
74516.	113099.	-33584.
59790.	110125.	-50335.
48500.	106818.	-58318.
39739.	103412.	-63673.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVES:
ONE THIRD W.C. LINED, YIELD INCREASE 5 PERCENT R AND K SURFACE IRR., ADDL AREA OF 2100 MA

A LISTING OF THE DATA

5 0 2 2 214 1 .

PERIOD NO.	YEAR	MAJOR WORKS	ROADS ETC.	MARKETING DEVELOP.	ON FARM AREAS	FISH DEVELOP.	FARM INCOME	FISH INCOME	FARM LABOR	O&M COST
							TOTAL MOTIVIZATION PROJECT AS TENTATIVELY PLANNED			
SCALERS:		1.0000	1.0000	1.0000	[illegible]	1.0000	[illegible]	1.0000	1.2550	1.0000
1	1982	16310.	0.	0.	0.	0.	0.	0.	0.	0.
2	1983	32620.	0.	0.	0.	0.	0.	0.	0.	0.
3	1984	16310.	[illegible]	0.	0.	0.	0.	0.	0.	0.
4	1985	0.	[illegible]	0.	[illegible]	[illegible]	0.	0.	0.	24.
5	1986	0.	0.	0.	[illegible]	0.	[illegible]	0.	[illegible]	[illegible]
6	1987	0.	0.	[illegible]	[illegible]	0.	[illegible]	[illegible]	[illegible]	175.
7	1988	0.	0.	[illegible]	[illegible]	0.	[illegible]	350.	[illegible]	277.
8	1989	0.	0.	0 0.	0.	0.	[illegible]	450.	[illegible]	352.
9	1990	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
10	1991	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
11	1992	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
12	1993	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
13	1994	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
14	1995	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
15	1996	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
16	1997	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
17	1998	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
18	1999	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
19	2000	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
20	2001	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
21	2002	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
22	2003	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
23	2004	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
24	2005	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
25	2006	0.	0.	0.	0.	0.	[illegible]	500.	[illegible]	352.
26	2007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.	0.	0.	0.

SCALE FACTORS APPLIED TO DATA [illegible]

INVESTMENT FEASIBILITY ANALYSIS

MODEL MODERNIZATION PROJECT
AS TENTATIVELY PLANNED

DIRECT RETURN ON TOTAL CAPITAL 9.905 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1932	38480.	0.	38480.	0.	26.	-26.	1.0000	38480.	-26.
2	1933	57290.	0.	57290.	1261.	315.	947.	0.9009	52128.	852.
3	1934	30020.	0.	30020.	3854.	929.	2925.	0.8277	24834.	2424.
4	1935	13480.	0.	13480.	8269.	2004.	6265.	0.7533	10155.	4719.
5	1936	2050.	0.	2050.	11838.	3242.	8596.	0.6854	1405.	5892.
6	1937	2060.	0.	2060.	21157.	4592.	16565.	0.6237	1285.	10331.
7	1938	0.	0.	0.	23796.	5767.	18029.	0.5675	0.	10231.
8	1939	0.	0.	0.	24822.	6484.	18339.	0.5163	0.	9469.
9	1940	0.	0.	0.	25346.	5940.	18455.	0.4698	0.	8669.
10	1941	0.	0.	0.	25346.	7070.	18276.	0.4275	0.	7813.
11	1942	0.	0.	0.	25346.	7073.	18276.	0.3890	0.	7109.
12	1943	0.	0.	0.	25346.	7073.	18276.	0.3539	0.	6468.
13	1944	0.	0.	0.	25346.	7070.	18276.	0.3220	0.	5885.
14	1945	0.	0.	0.	25346.	7073.	18276.	0.2930	0.	5355.
15	1946	0.	0.	0.	25346.	7070.	18276.	0.2666	0.	4873.
16	1947	0.	0.	0.	25346.	7073.	18276.	0.2426	0.	4434.
17	1948	0.	0.	0.	25346.	7073.	18276.	0.2207	0.	4036.
18	1949	0.	0.	0.	25346.	7070.	18276.	0.2008	0.	3671.
19	2021	0.	0.	0.	25346.	7073.	18276.	0.1827	0.	3340.
20	2022	0.	0.	0.	25346.	7073.	18276.	0.1663	0.	3039.
21	2023	0.	0.	0.	25346.	7070.	18276.	0.1513	0.	2765.
22	2033	0.	0.	0.	25346.	7073.	18276.	0.1377	0.	2516.
23	2034	0.	0.	0.	25346.	7073.	18276.	0.1253	0.	2289.
24	2035	0.	0.	0.	25346.	7073.	18276.	0.1140	0.	2083.
25	2036	0.	0.	0.	25346.	7073.	18276.	0.1037	0.	1895.
26	2037	-35765.	0.	-35765.	0.	0.	0.	0.0944	-3376.	0.
TOTAL		56634.	0.	56634.	525994.	143527.	382467.		123121.	120721.

INTEREST PER CENT	BENEFIT/COST RATIO
5.000	1.229
10.000	0.990
12.000	0.820
14.000	0.693
16.000	0.595
18.000	0.518

PRESENT VALUE IN RS. 1000

BENEFIT	OUTLAY	BALANCE
145333.	118207.	27126.
118996.	120172.	-1176.
98813.	120527.	-21709.
83115.	119939.	-36822.
73719.	119884.	-46165.
60501.	117369.	-56868.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVES:
ALL INVESTMENT (EXCEPT MAJOR WORKS) ADVANCED TWO YEARS, NET INCOME STREAM ADVANCED TWO YEARS

A LISTING OF THE DATA

5 0 2 2 2 2 1

[illegible] MODERNIZATION PROJECT
[illegible] UNIVERSITY [illegible]
FARM FISH FARM

PERIOD	MAJOR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11[illegible]	[illegible]	0.	0.	[illegible]0.	0.	0.	0.	0.	74.
21[illegible]	32[illegible]0.	[illegible]0.	0.	[illegible]	[illegible]	[illegible]	[illegible]	222.	92.
31[illegible]	16[illegible]0.	0.	0.	[illegible]1[illegible]	[illegible]	[illegible]	150.	755.	175.
41[illegible]	0.	0.	[illegible]	[illegible]0.	0.	7969.	700.	1727.	277.
51[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	450.	2880.	362.
61[illegible]	0.	0.	[illegible]	[illegible]	[illegible]	[illegible]	600.	4230.	362.
71[illegible]	0.	0.	0.	0.	0.	[illegible]	600.	5405.	352.
81[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600.	6226.	362.
91[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600.	6578.	362.
[illegible]	0.	0.	0.	[illegible]	0.	[illegible]	[illegible]	5703.	352.
[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600.	6703.	362.
[illegible]	0.	0.	[illegible]	[illegible]	[illegible]	[illegible]	600.	5703.	362.
[illegible]	0.	0.	0.	0.	0.	[illegible]	500.	5703.	352.
[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500.	5704.	352.
[illegible]	0.	0.	0.	[illegible]	[illegible]	[illegible]	600.	5703.	362.
[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500.	5703.	352.
[illegible]	0.	0.	[illegible]	[illegible]	[illegible]	[illegible]	600.	5704.	362.
19[illegible]00.	0.	0.	[illegible]	[illegible]	[illegible]	[illegible]	500.	6703.	362.
[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500.	5703.	352.
[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600.	5704.	362.
[illegible]00.	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	600.	6707.	362.
[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500.	5703.	352.
[illegible]	0.	0.	[illegible]	0.	[illegible]	[illegible]	500.	5704.	352.
[illegible]	0.	[illegible]	[illegible]	[illegible]	0.	[illegible]	600.	5703.	362.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	500.	5703.	362.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.	[illegible]	0.

-30-

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

MOATEL MODERNIZATION PROJECT
AS TENTATIVELY PLANNED

ECONOMIC RETURN ON TOTAL CAPITAL 10.630 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1932	16310.	0.	16310.	0.	0.	0.	1.0000	16310.	0.
2	1933	32620.	0.	32620.	0.	0.	0.	0.9039	29486.	0.
3	1934	28630.	0.	28630.	0.	0.	0.	0.8171	23392.	0.
4	1935	22380.	0.	22380.	0.	24.	-24.	0.7385	16529.	-18.
5	1936	12350.	0.	12350.	1458.	225.	1233.	0.6676	8245.	823.
6	1937	15760.	0.	15760.	4508.	626.	3882.	0.6034	9510.	2343.
7	1938	13480.	0.	13480.	9706.	1313.	8393.	0.5454	7353.	4578.
8	1939	2060.	0.	2060.	14831.	2090.	12741.	0.4930	1016.	6282.
9	1940	0.	0.	0.	20466.	2900.	17566.	0.4457	0.	7828.
10	1941	0.	0.	0.	24936.	3605.	21331.	0.4028	0.	8591.
11	1942	0.	0.	0.	27996.	4098.	23898.	0.3641	0.	8702.
12	1943	0.	0.	0.	29319.	4309.	25010.	0.3291	0.	8232.
13	1944	0.	0.	0.	29810.	4387.	25423.	0.2975	0.	7564.
14	1945	0.	0.	0.	29810.	4387.	25423.	0.2689	0.	6837.
15	1946	0.	0.	0.	29810.	4387.	25423.	0.2431	0.	6180.
16	1947	0.	0.	0.	29810.	4387.	25423.	0.2197	0.	5586.
17	1948	0.	0.	0.	29810.	4387.	25423.	0.1985	0.	5049.
18	1949	0.	0.	0.	29810.	4387.	25423.	0.1795	0.	4564.
19	2000	0.	0.	0.	29810.	4387.	25423.	0.1623	0.	4126.
20	2001	0.	0.	0.	29810.	4387.	25423.	0.1467	0.	3729.
21	2002	0.	0.	0.	29810.	4387.	25423.	0.1326	0.	3371.
22	2003	0.	0.	0.	29810.	4387.	25423.	0.1198	0.	3047.
23	2004	0.	0.	0.	29810.	4387.	25423.	0.1083	0.	2754.
24	2005	0.	0.	0.	29810.	4387.	25423.	0.0979	0.	2490.
25	2006	0.	0.	0.	29810.	4387.	25423.	0.0885	0.	2250.
	2007	-86756.	0.	-86756.	0.	0.	0.	0.0800	-6942.	0.
	TOTAL	56824.	0.	56824.	520720.	76221.	444499.		104897.	104897.

INTEREST PER CENT	BENEFIT/COST RATIO
8.000	1.356
10.000	1.073
12.000	0.864
14.000	0.710
16.000	0.592
18.000	0.499

PRESENT VALUE IN RS. 1000 BENEFIT	OUTLAY	BALANCE
144373.	105656.	38717.
113013.	105319.	7694.
89592.	103637.	-14045.
71863.	101243.	-29380.
58272.	95509.	-40237.
47725.	95651.	-47923.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
ECONOMIC PRICES TABLE 5 WITH OPPORTUNITY COST OF LABOR AT RS 3.00

A LISTING OF THE DATA

5 0 2 2 7 0 0 1 0.000000

PERIOD NO.	YEAR	MAJOR WORKS	MINOR WORKS ETC.	MAINTENANCE DEVELOP.	[illegible] WORKS	[illegible] DEVELOP.	[illegible] INCOME	[illegible] INCOME	[illegible] LABOR	[illegible] COST
1	1982	16310.	0.	0.	0.	0.	0.	0.	0.	0.
2	1983	32620.	0.	0.	0.	0.	0.	0.	0.	0.
3	1984	[illegible]	[illegible]	0.	0.	0.	0.	0.	0.	0.
4	1985	0.	[illegible]	0.	[illegible]	920.	0.	0.	0.	[illegible]
5	1986	0.	0.	0.	[illegible]	920.	[illegible]	60.	[illegible]	[illegible]
6	1987	0.	0.	0.	0.	0.	[illegible]58.	150.	450.	176.
7	1988	0.	0.	[illegible]	[illegible]	0.	[illegible]	300.	1036.	277.
8	1989	0.	0.	[illegible]	0.	0.	[illegible]	450.	1728.	352.
9	1990	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
10	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
11	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
12	[illegible]	0.	0.	0.	0.	0.	2871.	[illegible]	[illegible]	352.
13	[illegible]	0.	0.	0.	0.	0.	29210.	[illegible]	[illegible]	352.
14	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
15	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
16	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
17	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
18	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
19	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
20	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
21	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
22	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
23	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
24	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
25	[illegible]	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	352.
26	[illegible]	-48930.	-12320.	-2050.	-22850.	-616.	0.	0.	0.	0.

Gosunda

Gosunda is a new project. As proposed in the GOR/ID report it is not an economically viable project. The DRR is 5.059. However, when modernized according to the criteria agreed upon between GOR and USAID, the Gosunda project is economically feasible at the lower standard accepted for projects in tribal and backward areas with a DRR of 8.481.

Only main and branch canals are lined in the base case. Modernization of the Gosunda project involves lining of minors and distributaries, and construction of modernized watercourses. This would more than double the investment in land development. The resulting more assured water supply is expected to increase yields by 20 percent and water savings from lining permits the expansion of 1,590 ha of irrigated area in rabi and kharif. This increased the DRR by 1.817. In addition, with modernization, rainfed kharif is expected to increase from 2,365 ha to 4,730 ha, an adjustment similar to that expected on the Morel project. This increased the DRR by 1.605.

A major problem in the economic feasibility of the Cosunda project is the long construction period. With a construction period of eight years and land development, yield, and cropping pattern transitions assumed for the analysis, the full benefit stream is not achieved until the 19th year after starting construction. By reducing the number of new starts and concentrating available resources and staff on fewer projects, the GOR/ID could accelerate the construction program for all projects undertaken, albeit a small number. For purposes of illustration it was assumed that the construction period for Gosunda could be reduced from eight to five years, bringing the benefit stream forward three years. This results in an increase of 1.134 in the base case DRR. Combining all three adjustments - modernization, increased rainfed kharif, and rescheduling construction - results in a DRR of 9.700, a fully justified project. The combined ERR is 12.918. Whether the adjustments in construction schedules and the implied shifts in resource allocation are feasible is a matter for the GOR to investigate.

Typically, MIP's are designed for extensive use of available water - canal systems are longer and serve a larger area. Higher rates of return can be achieved by reducing the distribution system and the area served but increasing available water per ha, cropping intensity, and yields. The Gosunda sub-project was experimentally redesigned in this fashion. (See Annex A, Table C for details). The resulting DRR is 17.279, more than three times the base case DRR. The ERR is 22.615. However, teh number of beneficiaries was reduced by about 30 percent.

DJCC

INVESTMENT FEASIBILITY ANALYSIS

GOJUKA IRR. MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

DIRECT RETURN ON TOTAL CAPITAL 5.059 PERCENT

PERIOD NO.	PERIOD CENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1980	3026.	0.	3026.	0.	0.	0.	1.0000	3026.	0.
2	1981	5176.	0.	5176.	0.	0.	0.	0.9518	4926.	0.
3	1982	10027.	0.	10027.	0.	0.	0.	0.9060	9085.	0.
4	1983	13142.	0.	13142.	0.	0.	0.	0.8624	11333.	0.
5	1984	13142.	0.	13142.	0.	0.	0.	0.8209	10788.	0.
6	1985	13162.	0.	13162.	0.	0.	0.	0.7815	10284.	0.
7	1986	7283.	0.	7283.	0.	0.	0.	0.7437	5416.	0.
8	1987	4233.	0.	4233.	0.	95.	-95.	0.7079	2993.	-64.
9	1988	1937.	0.	1937.	185.	210.	-25.	0.6738	1305.	-17.
10	1989	1937.	0.	1937.	609.	429.	180.	0.6413	1242.	115.
11	1990	2421.	0.	2421.	1719.	836.	883.	0.6105	1478.	539.
12	1991	1453.	0.	1453.	2306.	1484.	1322.	0.5811	844.	768.
13	1992	0.	0.	0.	5317.	2158.	3159.	0.5531	0.	1747.
14	1993	0.	0.	0.	8155.	2958.	5197.	0.5265	0.	2736.
15	1994	0.	0.	0.	10792.	3937.	6855.	0.5011	0.	3435.
16	1995	0.	0.	0.	13367.	4567.	8800.	0.4770	0.	4197.
17	1996	0.	0.	0.	14778.	5137.	9641.	0.4540	0.	4377.
18	1997	0.	0.	0.	15569.	5502.	10067.	0.4321	0.	4351.
19	1998	0.	0.	0.	16197.	5667.	10530.	0.4113	0.	4332.
20	1999	0.	0.	0.	16608.	5702.	10906.	0.3915	0.	4270.
21	2000	0.	0.	0.	16608.	5702.	10906.	0.3727	0.	4064.
22	2001	0.	0.	0.	16608.	5702.	10906.	0.3547	0.	3868.
23	2002	0.	0.	0.	16608.	5702.	10906.	0.3376	0.	3682.
24	2003	0.	0.	0.	16608.	5702.	10906.	0.3214	0.	3506.
25	2004	0.	0.	0.	16608.	5702.	10906.	0.3059	0.	3336.
26	2005	-59203.	0.	-59203.	0.	0.	0.	0.2912	-16246.	0.
TOTAL		22734.	0.	22734.	139459.	67047.	122412.		49582.	45[illegible].

INTEREST PER CENT	BENEFIT/COST RATIO
8.000	0.389
10.000	0.633
12.000	0.327
14.000	0.252
16.000	0.199
18.000	0.155

PRESENT VALUE (RS. 1000) BENEFIT	OUTLAY	BALANCE
30326.	51487.	-21159.
21969.	50725.	-28756.
16118.	49246.	-33128.
11924.	47358.	-35434.
8903.	45337.	-36433.
6706.	43236.	-36530.

** EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVES:
COST ESTIMATES AND DEVELOPMENT SCHEDULE AS DERIVED BY ENGINEERING DEPARTMENT, GOK
TOTAL AREA LARGE VALUED AT RS 5 PER MAN DAY

LISTING OF THE DATA

[illegible]

PERIOD NO.	YEAR	MAJOR WORKS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		[illegible]	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
[illegible]		-0.	[illegible]	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	[illegible]	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	[illegible]	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	[illegible]	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.
[illegible]		-0.	-0.	[illegible]	[illegible]	[illegible]	-0.	-0.	-0.	-0.

D.U.C.C

INVESTMENT FEASIBILITY ANALYSIS

GOJANDA DIS MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

DIRECT RETURN ON TOTAL CAPITAL 6.876 PERCENT

YEAR		INVESTMENT (RS. 1000)			OPERATING (RS. 1000)			PRESENT VALUE	PRESENT VALUES	
			WORKING		DIRECT	OPERATING	NET		TOTAL	NET
NO.	CONST.	FACILITIES	CAPITAL	TOTAL	BENEFIT	EXPENSES **	BENEFIT	FACTOR	INVESTMENT	BENEFIT
1	1980	3026.	0.	3026.	0.	0.	0.	1.000	3026.	0.
2	1981	5179.	0.	5179.	0.	0.	0.	0.9357	4848.	0.
3	1982	10327.	0.	10327.	0.	0.	0.	0.8755	9038.	0.
4	1983	13142.	0.	13142.	0.	0.	0.	0.8192	10765.	0.
5	1984	13142.	0.	13142.	0.	0.	0.	0.7665	10073.	0.
6	1985	13163.	0.	13163.	0.	0.	0.	0.7171	9439.	0.
7	1986	7283.	0.	7283.	0.	0.	0.	0.6710	4887.	0.
8	1987	6813.	0.	6813.	0.	50.	-50.	0.6278	4278.	-31.
9	1988	4161.	0.	4161.	201.	220.	49.	0.5873	2444.	29.
10	1989	4161.	0.	4161.	677.	470.	207.	0.5497	2287.	114.
11	1990	5200.	0.	5200.	2494.	934.	1560.	0.5143	2675.	777.
12	1991	3131.	0.	3131.	4706.	1725.	2981.	0.4812	1506.	1434.
13	1992	0.	0.	0.	7354.	3549.	3805.	0.4503	0.	1713.
14	1993	0.	0.	0.	11613.	5526.	6087.	0.4213	0.	2564.
15	1994	0.	0.	0.	13964.	4563.	10401.	0.3942	0.	4100.
16	1995	0.	0.	0.	18407.	5492.	13115.	0.3688	0.	4837.
17	1996	0.	0.	0.	21044.	6196.	14848.	0.3451	0.	5124.
18	1997	0.	0.	0.	23307.	6735.	16571.	0.3229	0.	5349.
19	1998	0.	0.	0.	23307.	6836.	16513.	0.3021	0.	4988.
20	1999	0.	0.	0.	23307.	6879.	16428.	0.2827	0.	4643.
21	2000	0.	0.	0.	23307.	6879.	16428.	0.2645	0.	4345.
22	2001	0.	0.	0.	23307.	6879.	16428.	0.2475	0.	4065.
23	2002	0.	0.	0.	23307.	6879.	16428.	0.2316	0.	3805.
24	2003	0.	0.	0.	23307.	6879.	16428.	0.2167	0.	3560.
25	2004	0.	0.	0.	23307.	6879.	16428.	0.2027	0.	3331.
26	2005	-63943.	0.	-63943.	0.	0.	0.	0.1897	-12129.	0.
	TOTAL	28474.	0.	28474.	269791.	93501.	195289.		94111.	94111.

INTEREST RATE (PERCENT)	BENEFIT/COST RATIO	PRESENT VALUE IN RS. 1000 BENEFIT	COSTS	BALANCE
10.000	3.333	47370.	56474.	-9104.
11.000	3.117	74191.	95197.	-21006.
12.000	2.927	95776.	121750.	-25974.
13.000	2.756	115577.	150982.	-35405.
14.000	2.601	133391.	169820.	-36429.
15.000	2.461	149803.	185214.	-35411.

** ALL OTHER DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
ALL CANALS LINED, 1/3 OF WATERWAYS LINED, ALL W.C. MODERNIZED, YIELD INCREASE FROM 25 PERCENT--ADDITIONAL AREA OF 1990 HA

[illegible]

[illegible]

[illegible] IRRIGATION PROJECT
[illegible] ADJUSTMENT IN CROPPING PATTERN

PERIOD NO. YEAR	MAJOR WORKS	LAND DEVELOP.	FARM INCOME	[illegible]	[illegible]					
SCALE [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

D.U.C.C

INVESTMENT FEASIBILITY ANALYSIS

CESUNDA (E) MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

DIRECT RETURN ON TOTAL CAPITAL 6.624 PERCENT

PERIOD		INVESTMENT (RS. 1000)			OPERATING (RS. 1000)			PRESENT	PRESENT VALUES	
			WORKING		DIRECT	OPERATING	NET	VALUE	TOTAL	NET
NO.	IDENT.	FACILITIES	CAPITAL	TOTAL	BENEFIT	EXPENSES **	BENEFIT	FACTOR	INVESTMENT	BENEFIT
1	1980	3026.	0.	3026.	0.	0.	0.	1.0000	3026.	0.
2	1981	9176.	0.	9176.	0.	0.	0.	0.9375	8603.	0.
3	1982	10027.	0.	10027.	0.	0.	0.	0.8784	8813.	0.
4	1983	13142.	0.	13142.	0.	0.	0.	0.8240	10829.	0.
5	1984	13142.	0.	13142.	0.	0.	0.	0.7726	10153.	0.
6	1985	13162.	0.	13162.	0.	0.	0.	0.7243	9533.	0.
7	1986	7281.	0.	7281.	0.	0.	0.	0.6791	4945.	0.
8	1987	4229.	0.	4229.	0.	-90.	-90.	0.6364	2692.	-57.
9	1988	1937.	0.	1937.	234.	215.	19.	0.5968	1156.	11.
10	1989	1937.	0.	1937.	772.	452.	320.	0.5595	1084.	179.
11	1990	7421.	0.	7421.	2174.	896.	1283.	0.5244	1273.	674.
12	1991	1453.	0.	1453.	4188.	1618.	2570.	0.4918	715.	1264.
13	1992	0.	0.	0.	9492.	3376.	6116.	0.4611	0.	2127.
14	1993	0.	0.	0.	13775.	3775.	7087.	0.4323	0.	3061.
15	1994	0.	0.	0.	13772.	4325.	9448.	0.4053	0.	3327.
16	1995	0.	0.	0.	16757.	5284.	11472.	0.3800	0.	4355.
17	1996	0.	0.	0.	13724.	5724.	12000.	0.3562	0.	4631.
18	1997	0.	0.	0.	20131.	6135.	13997.	0.3338	0.	4674.
19	1998	0.	0.	0.	23775.	6326.	14455.	0.3131	0.	4526.
20	1999	0.	0.	0.	33414.	6359.	14556.	0.2935	0.	4272.
21	2000	0.	0.	0.	26414.	6359.	14556.	0.2752	0.	4006.
22	2001	0.	0.	0.	23414.	6359.	14556.	0.2580	0.	3756.
23	2002	0.	0.	0.	23414.	6359.	14556.	0.2419	0.	3521.
24	2003	0.	0.	0.	23414.	6359.	14556.	0.2268	0.	3301.
25	2004	0.	0.	0.	23414.	6359.	14556.	0.2128	0.	3096.
26	2005	-5820.	0.	-5820.	0.	0.	0.	0.1993	-1160.	0.
	TOTAL	22734.	0.	22734.	260745.	74562.	186183.		51215.	51215.

INTEREST PER CENT	BENEFIT/COST RATIO	PRESENT VALUE IN RS. 1000 BENEFIT	COSTS	BALANCE
8.000	3.753	41110.	51487.	-10377.
10.000	3.638	25944.	52754.	-26810.
12.000	3.443	21087.	49244.	-27157.
14.000	3.342	16209.	47356.	-31145.
16.000	3.267	12116.	45327.	-33212.
18.000	3.211	9126.	43290.	-34164.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
RAISED KHARIF INCREASED FROM 2WS TO 4TOG(BASE YEAR TO YEAR 13)

A LISTING OF THE DATA

D.U.G.G. PROGRAM

GUADALUPE RIVER IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

PERIOD NO.	YEAR	MAJOR WORKS	LAND DEVELOP.	CROP INCOME	FARM INCOME	C.A.A. COST				
SCAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-0.0	-0.0	-0.0	-0.0
1	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
2	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
3	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
4	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
5	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
6	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
7	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
8	[illegible]	[illegible]	.	.	.	0.	-0.	-0.	-0.	-0.
9	[illegible]	.	[illegible]	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
10	[illegible]	.	[illegible]	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
11	[illegible]	.	[illegible]	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
12	[illegible]	.	[illegible]	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
13	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
14	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
15	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
16	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
17	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
18	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
19	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
20	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
21	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
22	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
23	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
24	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
25	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
26	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
27	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
28	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
29	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.
30	[illegible]	.	.	[illegible]	[illegible]	[illegible]	.	-0.	-0.	-0.

[illegible]

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

GOSUNDA NEW MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

DIRECT RETURN ON TOTAL CAPITAL 6.193 PERCENT

PERIOD		INVESTMENT (RS. 1000)			OPERATING (RS. 1000)			PRESENT	PRESENT VALUES	
			WORKING		DIRECT	OPERATING	NET	VALUE	TOTAL	NET
NO.	IDENT.	FACILITIES	CAPITAL	TOTAL	BENEFIT	EXPENSES **	BENEFIT	FACTOR	INVESTMENT	BENEFIT
1	1980	7130.	0.	7130.	0.	0.	0.	1.0000	7130.	0.
2	1981	17617.	0.	17617.	0.	0.	0.	0.9417	16590.	0.
3	1982	21500.	0.	21500.	0.	0.	0.	0.8868	19065.	0.
4	1985	17617.	0.	17617.	0.	0.	0.	0.8350	14711.	0.
5	1986	9352.	0.	9352.	0.	90.	-90.	0.7863	7354.	-71.
6	1987	1937.	0.	1937.	185.	210.	-25.	0.7405	1434.	-19.
7	1988	1937.	0.	1937.	609.	429.	180.	0.6973	1351.	126.
8	1989	2421.	0.	2421.	1716.	826.	890.	0.6566	1590.	584.
9	1990	1453.	0.	1453.	3306.	1484.	1822.	0.6183	898.	1127.
10	1991	0.	0.	0.	5517.	2158.	3359.	0.5823	0.	1956.
11	1992	0.	0.	0.	8155.	2958.	5197.	0.5483	0.	2850.
12	1993	0.	0.	0.	13792.	3807.	6985.	0.5163	0.	3607.
13	1994	0.	0.	0.	15267.	6567.	8500.	0.4862	0.	4133.
14	1995	0.	0.	0.	14778.	5137.	9641.	0.4579	0.	4414.
15	1996	0.	0.	0.	15889.	5502.	10387.	0.4312	0.	4479.
16	1997	0.	0.	0.	16397.	5667.	10730.	0.4060	0.	4357.
17	1998	0.	0.	0.	16508.	5702.	10806.	0.3823	0.	4132.
18	1999	0.	0.	0.	16508.	5702.	10806.	0.3601	0.	3891.
19	2000	0.	0.	0.	16508.	5702.	10806.	0.3391	0.	3664.
20	2001	0.	0.	0.	16508.	5702.	10806.	0.3193	0.	3450.
21	2002	0.	0.	0.	16508.	5702.	10806.	0.3007	0.	3249.
22	2003	0.	0.	0.	16508.	5702.	10806.	0.2831	0.	3059.
23	2004	0.	0.	0.	16508.	5702.	10806.	0.2666	0.	2881.
24	2005	0.	0.	0.	16508.	5702.	10806.	0.2511	0.	2713.
25	2006	0.	0.	0.	16508.	5702.	10806.	0.2364	0.	2555.
26	2007	-58200.	0.	-58200.	0.	0.	0.	0.2226	-12957.	0.
	TOTAL	22734.	0.	22734.	238983.	84153.	154830.		57136.	57136.

INTEREST PER CENT	BENEFIT/COST RATIO
8.000	0.742
10.000	0.554
12.000	0.426
14.000	0.334
15.000	0.266
18.000	0.214

PRESENT VALUE IN RS. 1000		
BENEFIT	OUTLAY	BALANCE
43737.	58942.	-15205.
32910.	59352.	-26442.
25047.	58791.	-33744.
19268.	57691.	-38424.
14972.	56310.	-41338.
11745.	54799.	-43053.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
RESCHEDULE OF CONSTRUCTION OF MAJOR WORKS FROM 8 YEARS TO 5 YEARS

A LISTING OF .E DATA

2 0 1 2 7 1 0 1 0.000000

GOSUNDA NEW MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

PERIOD NO.	YEAR	MAJOR WORKS	LAND DEVELOP.	FARM INCOME	FARM LABOR	O & M COST				
1	1980	7100.	0.	0.	0.	0.	0.	0.	0.	0.
2	1981	17617.	0.	0.	0.	0.	0.	0.	0.	0.
3	1982	21500.	0.	0.	0.	0.	0.	0.	0.	0.
4	1985	17617.	0.	0.	0.	0.	0.	0.	0.	0.
5	1986	7100.	2252.	0.	0.	90.	0.	0.	0.	0.
6	1987	0.	1937.	185.	43.	167.	0.	0.	0.	0.
7	1988	0.	1937.	609.	185.	244.	0.	0.	0.	0.
8	1989	0.	2421.	1716.	485.	341.	0.	0.	0.	0.
9	1990	0.	1453.	3306.	1084.	400.	0.	0.	0.	0.
10	1991	0.	0.	5517.	1758.	400.	0.	0.	0.	0.
11	1992	0.	0.	8155.	2558.	400.	0.	0.	0.	0.
12	1993	0.	0.	10792.	3407.	400.	0.	0.	0.	0.
13	1994	0.	0.	13067.	4167.	400.	0.	0.	0.	0.
14	1985	0.	0.	14778.	4737.	400.	0.	0.	0.	0.
15	1986	0.	0.	15889.	5112.	400.	0.	0.	0.	0.
16	1997	0.	0.	16397.	5267.	400.	0.	0.	0.	0.
17	1998	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
18	1999	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
19	2000	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
20	2001	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
21	2002	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
22	2003	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
23	2004	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
24	2005	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
25	2006	0.	0.	16508.	5302.	400.	0.	0.	0.	0.
20	2007	-53200.	-5000.	0.	0.	0.	0.	0.	0.	0.

I N V E S T M E N T F E A S I B I L I T Y A N A L Y S I S

GODUNDA NEW MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

DIRECT RETURN ON TOTAL CAPITAL 9.700 PERCENT

PERIOD NO.	PERIOD CONT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1930	7100.	0.	7100.	0.	0.	0.	1.0000	7100.	0.
2	1931	17517.	0.	17517.	0.	0.	0.	0.9116	16059.	0.
3	1932	21500.	0.	21500.	0.	0.	0.	0.8310	17866.	0.
4	1933	17517.	0.	17517.	0.	0.	0.	0.7575	13345.	0.
5	1934	11937.	0.	11937.	0.	90.	-90.	0.6905	8243.	-62.
6	1935	4251.	0.	4251.	313.	225.	88.	0.6295	2639.	55.
7	1936	4251.	0.	4251.	1535.	1592.	537.	0.5738	2387.	308.
8	1937	5780.	0.	5780.	2787.	992.	1909.	0.5231	2720.	998.
9	1938	3121.	0.	3121.	5539.	1456.	3735.	0.4765	1488.	1781.
10	1939	0.	0.	0.	5328.	2761.	5623.	0.4345	0.	2355.
11	1940	0.	0.	0.	11790.	4435.	7355.	0.3962	0.	3144.
12	1941	0.	0.	0.	14549.	4972.	9577.	0.3612	0.	4294.
13	1942	0.	0.	0.	22556.	5895.	16661.	0.3293	0.	5301.
14	1943	0.	0.	0.	16990.	6762.	13228.	0.3000	0.	5471.
15	1944	0.	0.	0.	25863.	7252.	19616.	0.2736	0.	5357.
16	1945	0.	0.	0.	27737.	7474.	20264.	0.2494	0.	5151.
17	1946	0.	0.	0.	27315.	7521.	20394.	0.2273	0.	4637.
18	1947	0.	0.	0.	27915.	7521.	20394.	0.2072	0.	4227.
19	2000	0.	0.	0.	27915.	7521.	20394.	0.1889	0.	3851.
20	2001	0.	0.	0.	27915.	7521.	20394.	0.1722	0.	3512.
21	2002	0.	0.	0.	27915.	7521.	20394.	0.1570	0.	3202.
22	2003	0.	0.	0.	27915.	7521.	20394.	0.1431	0.	2919.
23	2004	0.	0.	0.	27915.	7521.	20394.	0.1305	0.	2660.
24	2005	0.	0.	0.	27915.	7521.	20394.	0.1190	0.	2425.
25	2006	0.	0.	0.	27915.	7521.	20394.	0.1084	0.	2211.
26	2007	-6394.	0.	-6394.	0.	0.	0.	0.0988	-6319.	0.
TOTAL		26474.	0.	26474.	400270.	110796.	289474.		65509.	65509.

INTER-EST RATE %	BENEFIT/COST RATIO
8.000	0.[illegible]
10.000	0.[illegible]
12.000	0.744
14.000	0.[illegible]
16.000	0.[illegible]
18.000	0.392

PRESENT VALUE IN RS. 1000 BENEFIT	OUTLAY	BALANCE
63375.	65448.	17924.
62835.	65429.	-2593.
47904.	64415.	-16512.
36919.	62868.	-25949.
25746.	61061.	-32315.
22569.	58122.	-35553.

**EXCLUDING DEPRECIATION, INTEREST AND INCOME TAX

ALTERNATIVE:
ALL NA AND NS APPLIED TO LOCAL PURCHASE OF CONSTRUCTION

A LISTING OF THE [illegible]

[illegible] 0.00000

PERIOD NO.	YEAR	MAJOR CROPS	LAND [illegible]	[illegible]	[illegible]	FARM LAND	[illegible] COST	[illegible]	[illegible]	[illegible]	[illegible]
SCALERS:		1.0000	[illegible]	[illegible]	[illegible]	[illegible]	1.0000	0.0000	0.0000	0.0000	0.0000
11980		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21981		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31982		2[illegible]00.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41983		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
51986		[illegible]	48[illegible]7.	[illegible]	[illegible]	[illegible]	0.	0.	0.	[illegible]	0.
61987		[illegible]	4[illegible]	[illegible]	[illegible]	58.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
71988		[illegible]	41[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
81989		[illegible]	5[illegible]	2902.	651.	[illegible]	[illegible]	0.	0.	0.	0.
91990		[illegible]	[illegible]	5590.	1456.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
101991		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
111992		0.	0.	13790.	3435.	[illegible]00.	[illegible]	0.	0.	0.	0.
121993		[illegible]	[illegible]	18249.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
131994		[illegible]	[illegible]	[illegible]	96.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
141995		0.	0.	0.	6362.	[illegible]00.	[illegible]	0.	0.	0.	[illegible]
151996		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
161997		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
171998		0.	0.	27915.	7121.	[illegible]00.	[illegible]	0.	0.	[illegible]	[illegible]
181999		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
192000		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
202001		0.	0	[illegible]	[illegible]	[illegible]00.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
212002		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
222003		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
232004		0.	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
242005		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
252006		[illegible]	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.	[illegible]
262007		[illegible]00.	[illegible]0	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SCALE FACTO[illegible]

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J.I.C.C

INVESTMENT FEASIBILITY ANALYSIS

SOURCE OF REGION IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

ECONOMIC RETURN ON TOTAL CAPITAL 7.660 PERCENT

PERIOD		INVESTMENT (RS. 1000)			OPERATING (RS. 1000)			PRESENT VALUE FACTOR	PRESENT VALUES	
NO.	DESCR.	FACILITIES	WORKING CAPITAL	TOTAL	GROSS BENEFIT	OPERATING EXPENSES **	NET BENEFIT		TOTAL INVESTMENT	NET BENEFIT
1	1980	3026.	0.	3026.	0.	0.	0.	1.0000	3026.	0.
2	1981	9175.	0.	9175.	0.	0.	0.	0.9288	8522.	0.
3	1982	10027.	0.	10027.	0.	0.	0.	0.8626	8650.	0.
4	1983	13142.	0.	13142.	0.	0.	0.	0.8012	10529.	0.
5	1984	13142.	0.	13142.	0.	0.	0.	0.7441	9779.	0.
6	1985	13163.	0.	13163.	0.	0.	0.	0.6911	9097.	0.
7	1986	7283.	0.	7283.	0.	0.	0.	0.6419	4675.	0.
8	1987	4224.	0.	4224.	0.	0.	0.	0.5962	2521.	0.
9	1988	1977.	0.	1977.	232.	132.	99.	0.5537	1173.	54.
10	1989	1977.	0.	1977.	465.	368.	97.	0.5143	1016.	50.
11	1990	2421.	0.	2421.	2161.	633.	1527.	0.4777	1156.	729.
12	1991	1451.	0.	1451.	4170.	1750.	2420.	0.4437	645.	1154.
13	1992	0.	0.	0.	6665.	1455.	5210.	0.4121	0.	2277.
14	1993	0.	0.	0.	10161.	1934.	8227.	0.3827	0.	3264.
15	1994	0.	0.	0.	13721.	2444.	11277.	0.3555	0.	3771.
16	1995	0.	0.	0.	15494.	2500.	12993.	0.3301	0.	4481.
17	1996	0.	0.	0.	19640.	3242.	16397.	0.3066	0.	4721.
18	1997	0.	0.	0.	20221.	3461.	16760.	0.2848	0.	4717.
19	1998	0.	0.	0.	20851.	3560.	17291.	0.2645	0.	4321.
20	1999	0.	0.	0.	20765.	3561.	17204.	0.2457	0.	4227.
21	2000	0.	0.	0.	20765.	3561.	17204.	0.2282	0.	3925.
22	2001	0.	0.	0.	20765.	3561.	17204.	0.2119	0.	3646.
23	2002	0.	0.	0.	20765.	3561.	17204.	0.1968	0.	3385.
24	2003	0.	0.	0.	20765.	3561.	17204.	0.1828	0.	3145.
25	2004	0.	0.	0.	20765.	3561.	17204.	0.1698	0.	2921.
26	2005	-5220.	0.	-5220.	0.	0.	0.	0.1577	-5178.	0.
	TOTAL	22344.	0.	22344.	218148.	32903.	185245.		51451.	51451.

INTEREST RATE	BENEFIT/COST RATIO
8.000	0.937
10.000	0.868
12.000	0.771
14.000	0.697
16.000	0.311
18.000	0.251

PRESENT VALUE IN RS. 1000		
BENEFIT	COSTS	BALANCE
28576.	51483.	-22907.
38439.	53763.	-15324.
35658.	59234.	-23576.
35264.	62320.	-27056.
34308.	67227.	-32919.
30772.	63370.	-32598.

** EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

SITE INFORMATION:
SOIL WITH LABOR AT COMPETITIVE COST OF RS 2.00

DUCC

[illegible]	[illegible] YEARS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

GOSUNDA NEW MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

ECONOMIC RETURN ON TOTAL CAPITAL 12.918 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (RS. 1000) DIRECT BENEFIT	OPERATING EXPENSES **	NET BENEFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	NET BENEFIT
1	1980	7100.	0.	7100.	0.	0.	0.	1.0000	7100.	0.
2	1981	17617.	0.	17617.	0.	0.	0.	0.8556	15062.	0.
3	1982	21538.	0.	21538.	0.	0.	0.	0.7843	16882.	0.
4	1985	17617.	0.	17617.	0.	0.	0.	0.6946	12236.	0.
5	1986	11937.	0.	11937.	0.	90.	-90.	0.6151	7343.	-55.
6	1987	4161.	0.	4161.	394.	202.	193.	0.5447	2266.	105.
7	1988	4161.	0.	4161.	1298.	393.	905.	0.4824	2007.	436.
8	1989	5200.	0.	5200.	3657.	732.	2925.	0.4272	2222.	1249.
9	1990	3121.	0.	3121.	7045.	1274.	5771.	0.3783	1181.	2184.
10	1991	0.	0.	0.	11757.	1817.	9940.	0.3351	0.	3331.
11	1992	0.	0.	0.	17378.	2462.	14917.	0.2967	0.	4426.
12	1993	0.	0.	0.	22998.	3145.	19852.	0.2628	0.	5217.
13	1994	0.	0.	0.	27846.	3759.	24087.	0.2327	0.	5605.
14	1995	0.	0.	0.	31492.	4218.	27274.	0.2061	0.	5621.
15	1996	0.	0.	0.	33859.	4512.	29347.	0.1825	0.	5356.
16	1997	0.	0.	0.	34942.	4645.	30297.	0.1616	0.	4777.
17	1998	0.	0.	0.	35179.	4673.	30505.	0.1431	0.	4367.
18	1999	0.	0.	0.	35179.	4673.	30505.	0.1268	0.	3867.
19	2000	0.	0.	0.	35179.	4673.	30505.	0.1123	0.	3426.
20	2001	0.	0.	0.	35179.	4673.	30505.	0.0994	0.	3033.
21	2002	0.	0.	0.	35179.	4673.	30505.	0.0880	0.	2686.
22	2003	0.	0.	0.	35179.	4673.	30505.	0.0779	0.	2378.
23	2004	0.	0.	0.	35179.	4673.	30505.	0.0691	0.	2106.
24	2005	0.	0.	0.	35179.	4673.	30505.	0.0612	0.	1865.
25	2006	0.	0.	0.	35179.	4673.	30505.	0.0542	0.	1652.
26	2007	-63940.	0.	-63940.	0.	0.	0.	0.0480	-3067.	0.
	TOTAL	28474.	0.	28474.	509273.	69310.	439963.		63752.	53752.

INTEREST PER CENT	BENEFIT/COST RATIO
3.000	1.911
10.000	1.441
12.000	1.117
14.000	0.992
16.000	0.708
18.000	0.575

PRESENT VALUE IN RS. 1000

BENEFIT	OUTLAY	BALANCE
125065.	65542.	59523.
94299.	65429.	28870.
71927.	64415.	7511.
55464.	62868.	-7404.
43212.	61061.	-17849.
33994.	59152.	-25159.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
ALT \1 AND \3 APPLIED TO GOSUNDA RESCHEDLE OF CONSTRUCTION

A LISTING OF THE DATA

2 0 1 2 7 1 0 1 0.000000

GOSUNDA NEW MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

PERIOD NO.	YEAR	MAJOR WORKS	LAND DEVELOP.	FARM INCOME	FARM LABOR	O & M COST				
SCALERS:		1.0000	2.1430	2.1310	0.8060	1.0000	0.0000	0.0000	0.0000	0.0000
11	980	7100.	0.	0.	0.	0.	0.	0.	0.	0.
21	981	17617.	0.	0.	0.	0.	0.	0.	0.	0.
31	982	21500.	0.	0.	0.	0.	0.	0.	0.	0.
41	985	17617.	0.	0.	0.	0.	0.	0.	0.	0.
51	986	7100.	4837.	0.	0.	90.	0.	0.	0.	0.
51	987	0.	4161.	394.	35.	167.	0.	0.	0.	0.
71	988	0.	4161.	1298.	149.	244.	0.	0.	0.	0.
81	989	0.	5200.	3657.	391.	341.	0.	0.	0.	0.
91	990	0.	3121.	7045.	874.	400.	0.	0.	0.	0.
101	991	0.	0.	11757.	1417.	400.	0.	0.	0.	0.
111	992	0.	0.	17378.	2062.	400.	0.	0.	0.	0.
121	993	0.	0.	22998.	2746.	400.	0.	0.	0.	0.
131	994	0.	0.	27846.	3359.	400.	0.	0.	0.	0.
141	985	0.	0.	31492.	3818.	400.	0.	0.	0.	0.
151	986	0.	0.	33859.	4112.	400.	0.	0.	0.	0.
161	997	0.	0.	34942.	4245.	400.	0.	0.	0.	0.
171	998	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
181	999	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
192	000	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
202	001	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
212	002	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
222	003	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
232	004	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
242	005	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
252	006	0.	0.	35179.	4273.	400.	0.	0.	0.	0.
202	007	-53200.	-10740.	0.	0.	0.	0.	0.	0.	0.

SCALE FACTORS APPLIED TO DATA BEGINNING IN PERIOD 1

Financial Benefits to Targeted Farm Families: The budgeted financial benefits to targeted farm families in the command area of each prototype Medium Irrigation Project can be derived from (1) the schedule of projected added net farm income for the command area as shown in the DRR computer output "Investment Feasibility Analysis", (2) Section C of the schedule of land area to be developed (Table 2) and (3) the distribution of farm size of the targeted farm families in the command area of the prototype.

The schedule of added net farm income for the prototype as a whole is shown in the center section of the DRR computer output labeled "Investment Feasibility Analysis". No adjustments need be made in this schedule as shown for the base case of each prototype. The unpaid family labor component of the labor cost (about 90 percent of total farm labor in Rajasthan MIP command areas) is not added back. Instead it is assumed that this non cash component offsets the added farm household expenditures stimulated by the project. For more precision one would add back the annual operation and maintenance expense for the project (an expenditure not incurred directly by the benefited farmers) and subtract the annual water charge for surface irrigation actually made to farmers in command area of the prototype (not included in the budgeted expense of the farm). Since the two are roughly offsetting, both adjustments can be omitted.

When the schedule of added net farm income for the prototype is divided by the schedule of total hectares added by the project with totals from Section C of Table 2), the result is the schedule of additional net farm income per hectare resulting from the project. The resulting per hectare figures are properly weighted by the cropping pattern, transitions in added yields, farm prices and mix of types of cultivation for the total impacted area. This schedule of per hectare benefits is multiplied by the number of hectares, e.g. 0.5, for each farm size group of interest to estimate the added farm income to farmers of that size group as direct result of the project. The incremental net income is then added to the existing average net income for farmers of that size group to obtain before and after comparisons for the MIP.

NOTE: Insufficient time prevented the consultants from completing this part of the analysis. See Part III of the Project Paper for farm size discussion.

Economic Feasibility Criteria: The increase in relative feasibility as measured by the ERR analysis compared to that measured by the DRR analysis is significant for all three of the prototype medium irrigation projects. There is every reason to believe that the differentials obtained between ERR results and the DRR results for the three prototypes are representative of Rajasthan candidate MIPs in general. Because of the additional analysis required, and in the absence of internal need for it by GOR and GOI, it is recommended that the ERR analysis not be a general requirement. Rather it is recommended that a DRR of 9 percent qualify sub-projects for implementation. Following current practice of the GOI/GOR of accepting lower levels of feasibility for projects in disadvantaged areas, a lower DRR of 7.5 percent should be acceptable in tribal and backward areas.

Associated Rate of Return: The associated rate of return on total capital investment for each of the three prototype MIPs is shown by the accompanying computer printouts. They follow the same general format as that of the Direct Rate of Return output, but represent an independent measure of additional benefits through direct linkages to the total economy of command area served by each prototype. The schedule of net associated benefits is related to the same schedule of project capital outlays as used in the DRR analysis, so that solution ARR may be added to the solution DRR for the project. The sum so obtained provides for total development rate of return on the capital investment in the project. This rate of return for total economic development of the area is sometimes called the Social Rate of Return (SRR)8/.

The estimated schedules of associated benefits by source are shown by the "Listing of the Data" printouts. The estimates for employment during construction are based on the project labor costs equal to 70 percent of earth work outlays, 15 percent of concrete work outlays and 20 percent of other outlays. The estimates for employment in farming are taken at the added total farm labor requirement due to the project. Both types of labor benefit are valued at an incremental rate of Rs. 2.00 per man day (to approximate the existing underemployment and employment in the lower paying jobs in Rajasthan.)

The estimates of associated benefits in the marketing sector for farm products are based on the total added farm revenue for the prototype, multiplied by a factor of 0.16. The factor is obtained

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8/ It will be noted that the SRR is not the same measure as the ERR; the two provide different indicators. Furthermore, the ARR can not be added to the ERR because of the element of duplication involved.

by an estimate applying a fraction of added net income over fixed costs of 0.4 to value added through marketing and processing of 40 percent of the farm-gate value. Actually, both components of the factor vary by crop (being relatively high for sugar cane and relatively low for pulses, for example), but it is believed that the factor used is a realistic weighted average.

The estimates of associated benefits in the farm supply and service sector shown in the computer printouts for the three prototypes are derived in similar fashion. The value of purchased farm inputs and services represent roughly 20 percent of the gross farm revenue added by the project (see Table 3) assuming rates for value added and income over fixed costs comparable to those in the product marketing sector, the pricing factor for this source is 0.032 of the projected total revenue added by the project (.20 x .4 x .40).

Other associated benefits include those from such sources as increased capital value of business and residential properties, and net income opportunities for service industries stimulated by the project. The combined value of such additional associated benefits are taken at one percent of the annual gross farm revenue added by the project.

No associated benefit is taken for the added tax base and additional revenues to the State of Rajasthan and Government of India through sales, excise, license, income and other taxes. These represent transfer payments, and as such duplicate associated benefits reflected in the other measures.

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

GODHA COMMAND AREA DEVELOPMENT PROJECT

ASSOCIATED RETURN ON TOTAL CAPITAL 5.498 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	ASSOCIATED EFFECTS (RS. 1000) ASSOCIATED BENEFITS	ASSOCIATED COST	ASSOCIATED NET BENEFITS	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	ASSOCIATED NET BENEFITS
1	1930	18600.	0.	18600.	812.	0.	812.	1.0000	18600.	812.
2	1931	26340.	0.	26340.	1646.	0.	1646.	0.9479	24967.	1560.
3	1932	22560.	0.	22560.	2516.	0.	2516.	0.8985	20270.	2261.
4	1933	0.	0.	0.	1950.	0.	1950.	0.8517	0.	1661.
5	1934	0.	0.	0.	2768.	0.	2768.	0.8073	0.	2235.
6	1935	0.	0.	0.	3765.	0.	3765.	0.7652	0.	2881.
7	1936	0.	0.	0.	4090.	0.	4090.	0.7253	0.	2967.
8	1937	0.	0.	0.	4272.	0.	4272.	0.6875	0.	2937.
9	1938	0.	0.	0.	4495.	0.	4495.	0.6517	0.	2929.
10	1939	0.	0.	0.	4633.	0.	4633.	0.6177	0.	2862.
11	1940	0.	0.	0.	4737.	0.	4737.	0.5856	0.	2762.
12	1941	0.	0.	0.	4766.	0.	4766.	0.5550	0.	2645.
13	1942	0.	0.	0.	4799.	0.	4799.	0.5261	0.	2525.
14	1943	0.	0.	0.	4831.	0.	4831.	0.4987	0.	2409.
15	1944	0.	0.	0.	4863.	0.	4863.	0.4727	0.	2299.
16	1945	0.	0.	0.	4896.	0.	4896.	0.4481	0.	2194.
17	1946	0.	0.	0.	4927.	0.	4927.	0.4247	0.	2093.
18	1947	0.	0.	0.	4958.	0.	4958.	0.4026	0.	1996.
19	1948	0.	0.	0.	4990.	0.	4990.	0.3816	0.	1904.
20	1949	0.	0.	0.	5023.	0.	5023.	0.3617	0.	1817.
21	2000	0.	0.	0.	5053.	0.	5053.	0.3429	0.	1733.
22	2001	0.	0.	0.	5085.	0.	5085.	0.3250	0.	1653.
23	2002	0.	0.	0.	5115.	0.	5115.	0.3081	0.	1576.
24	2003	0.	0.	0.	5146.	0.	5146.	0.2920	0.	1503.
25	2004	0.	0.	0.	5175.	0.	5175.	0.2768	0.	1432.
26	2005	-33350.	0.	-33350.	0.	0.	0.	0.2624	-10193.	0.
TOTAL		24650.	0.	24650.	105291.	0.	105291.		53644.	53644.

INTEREST PER CENT	ASSOCIATED BENEFIT RATIO	PRESENT VALUE IN RS. 1000 ASSOC. BENEFITS	OUTLAY	BALANCE
4.000	0.732	41483.	56658.	-15175.
10.000	0.598	34453.	57604.	-23152.
12.000	0.503	29075.	57817.	-28743.
14.000	0.432	24894.	57596.	-32702.
15.000	0.378	21596.	57122.	-35526.
18.000	0.335	18956.	56504.	-37549.

ALTERNATIVES

LISTING OF THE DATA

GODHA COMMAND AREA DEVELOPMENT PROJECT

PERIOD NO.	YEAR	IRRIG. WORKS	DRAINAGE WORKS	O.F.D. WORKS	ROAD WORKS	OTHER AGR.	CONT & PRICE INC	FARM LABOR	CONST. LABOR	MARKET MARGIN	FARM INPUTS	OTHER BENEFITS
1	1931	4100.	1600.	4100.	1000.	7500.	4400.	0.	812.	0.	0.	0.
2	1932	8500.	2300.	[illegible]	2000.	[illegible]	5400.	154.	1140.	279.	56.	17.
3	1933	5700.	2000.	[illegible]	0.	[illegible]	5800.	522.	1289.	558.	112.	35.
4	1934	0.	0.	0.	0.	0.	0.	534.	0.	1002.	201.	63.
5	1935	0.	0.	0.	0.	0.	0.	1036.	0.	1372.	274.	86.
6	1936	0.	0.	0.	0.	0.	0.	1481.	0.	1809.	362.	113.
7	1937	0.	0.	0.	0.	0.	0.	1654.	0.	1929.	386.	121.
8	1938	0.	0.	0.	0.	0.	0.	1702.	0.	2036.	407.	127.
9	1939	0.	0.	0.	0.	0.	0.	1762.	0.	2165.	433.	135.
10	1940	0.	0.	0.	0.	0.	0.	1303.	0.	2242.	448.	140.
11	1941	0.	0.	0.	0.	0.	0.	1820.	0.	2295.	459.	143.
12	1942	0.	0.	0.	0.	0.	0.	1851.	0.	2309.	462.	144.
13	1943	0.	0.	0.	0.	0.	0.	1866.	0.	2323.	465.	145.
14	1944	0.	0.	0.	0.	0.	0.	1882.	0.	2336.	467.	145.
15	1945	0.	0.	0.	0.	0.	0.	1896.	0.	2350.	470.	147.
16	1946	0.	0.	0.	0.	0.	0.	1912.	0.	2363.	473.	148.
17	1947	0.	0.	0.	0.	0.	0.	1926.	0.	2377.	475.	149.
18	1948	0.	0.	0.	0.	0.	0.	1941.	0.	2390.	478.	149.
19	1949	0.	0.	0.	0.	0.	0.	1956.	0.	2403.	481.	150.
20	1950	0.	0.	0.	0.	0.	0.	1972.	0.	2417.	483.	151.
21	2000	0.	0.	0.	0.	0.	0.	1985.	0.	2430.	486.	152.
22	2001	0.	0.	0.	0.	0.	0.	2000.	0.	2443.	489.	153.
23	2002	0.	0.	0.	0.	0.	0.	2014.	0.	2456.	491.	154.
24	2003	0.	0.	0.	0.	0.	0.	2028.	0.	2470.	494.	154.
25	2004	0.	0.	0.	0.	0.	0.	2042.	0.	2482.	496.	155.
26	2005	-1300.	-2500.	-330.	-200.	-5500.	-5200.	0.	0.	0.	0.	0.

I N V E S T M E N T F E A S I B I L I T Y A N A Y I S

MODEL MODERNIZATION PROJECT
AS TENTATIVELY PLANNED

ASSOCIATED RETURN ON TOTAL CAPITAL 3.116 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	ASSOCIATED EFFECTS (RS. 1000) ASSOCIATED BENEFITS	ASSOCIATED COST	ASSOCIATED NET BENEFITS	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	ASSOCIATED NET BENEFITS
1	1932	16310.	0.	16310.	692.	0.	692.	1.0000	16310.	692.
2	1933	32620.	0.	32620.	1384.	0.	1384.	0.9698	31634.	1342.
3	1934	28630.	0.	28630.	2249.	0.	2249.	0.9405	25926.	2115.
4	1935	22310.	0.	22310.	2356.	0.	2356.	0.9121	20412.	2149.
5	1936	12350.	0.	12350.	1338.	0.	1338.	0.8845	10924.	1183.
6	1937	15750.	0.	15750.	2274.	0.	2274.	0.8578	13519.	1951.
7	1938	13400.	0.	13400.	3327.	0.	3327.	0.8319	11214.	2768.
8	1939	2050.	0.	2050.	3488.	0.	3488.	0.8067	1662.	2814.
9	1940	0.	0.	0.	5284.	0.	5284.	0.7824	0.	3778.
10	1941	0.	0.	0.	5315.	0.	5315.	0.7587	0.	4031.
11	1942	0.	0.	0.	7175.	0.	7175.	0.7358	0.	5279.
12	1943	0.	0.	0.	7544.	0.	7544.	0.7136	0.	5383.
13	1944	0.	0.	0.	7681.	0.	7681.	0.6920	0.	5315.
14	1945	0.	0.	0.	7681.	0.	7681.	0.6711	0.	5155.
15	1946	0.	0.	0.	7681.	0.	7681.	0.6508	0.	4999.
16	1947	0.	0.	0.	7681.	0.	7681.	0.6312	0.	4848.
17	1948	0.	0.	0.	7681.	0.	7681.	0.6121	0.	4701.
18	1949	0.	0.	0.	7681.	0.	7681.	0.5936	0.	4559.
19	2000	0.	0.	0.	7681.	0.	7681.	0.5757	0.	4422.
20	2001	0.	0.	0.	7681.	0.	7681.	0.5583	0.	4289.
21	2002	0.	0.	0.	7681.	0.	7681.	0.5414	0.	4159.
22	2003	0.	0.	0.	7681.	0.	7681.	0.5250	0.	4033.
23	2004	0.	0.	0.	7681.	0.	7681.	0.5092	0.	3911.
24	2005	0.	0.	0.	7681.	0.	7681.	0.4938	0.	3793.
25	2006	0.	0.	0.	7681.	0.	7681.	0.4789	0.	3678.
26	2007	-35765.	0.	-35765.	0.	0.	0.	0.4644	-41295.	0.
TOTAL		56824.	0.	56824.	143070.	0.	143070.		92305.	92305.

INTEREST PER CENT	ASSOCIATED BENEFIT RATIO	PRESENT VALUE IN RS. 1000 ASSOC. BENEFITS	OUTLAY	BALANCE
5.000	0.482	50937.	105656.	-54720.
10.000	0.399	41156.	105319.	-64163.
12.000	0.326	33795.	103637.	-69842.
14.000	0.278	28173.	101243.	-73070.
16.000	0.242	23313.	98504.	-74591.
18.000	0.[illegible]	20400.	95651.	-75251.

ALTERNATIVE:
ADDITIONAL LABOR COMPOSED OF CONSTRUCTION LABOR AND ADDITIONAL FARM LABOR REQUIRED DUE TO PROJECT

A LISTING OF THE DATA

5 0 4 0 3 3 0 . 0.000000

PERIOD NO.	YEAR	MAJOR WORKS	[illegible]	[illegible] DEVELOP.	ON FARM WORKS	FISH DEVELOP.	ADDIT. LABOR	FARM INPUTS	MARK. MARGIN	OTHER BENEFIT
11982		16310.	0.	0.	0.	0.	692.	0.	0.	0.
21983		32520.	0.	0.	0.	0.	1384.	0.	0.	0.
31984		16310.	[illegible]	0.	0.	0.	[illegible]	0.	0.	0.
41985		0.	[illegible]	0.	9140.	920.	[illegible]	0.	0.	0.
51986		0.	0.	0.	11430.	920.	[illegible]	[illegible]	192.	12.
61987		0.	0.	[illegible]	13710.	0.	[illegible]	[illegible]	593.	37.
71988		0.	0.	[illegible]	11430.	0.	[illegible]	[illegible]	1275.	80.
81989		0.	0.	2060.	0.	0.	[illegible]	[illegible]	[illegible]	114.
91990		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	168.
101991		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	205.
111992		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	232.
121993		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	243.
131994		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
141995		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
151996		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
161997		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
171998		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
181999		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
19[illegible]		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
202001		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
212002		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
22[illegible]		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
23[illegible]		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
24[illegible]		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
25[illegible]		0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]	247.
262007		[illegible]	[illegible]	[illegible]	-2285.	616.	[illegible]	0.	[illegible]	0.

DHEC

INVESTMENT FEASIBILITY ANALYSIS

GLSONDA NEW MEDIUM IRRIGATION PROJECT
WITHOUT ADJUSTMENT IN CROPPING PATTERN

ASSOCIATED RETURN ON TOTAL CAPITAL 2.016 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (RS. 1000) FACILITIES	WORKING CAPITAL	TOTAL	ASSOCIATED BENEFITS (RS. 1000) ASSOCIATED BENEFITS	ASSOCIATED COST	ASSOCIATED NET BENEFITS	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL INVESTMENT	ASSOCIATED NET BENEFITS
1	1980	3026.	0.	3026.	131.	0.	131.	1.0000	3026.	131.
2	1981	5176.	0.	5176.	397.	0.	397.	0.9745	5041.	387.
3	1982	10027.	0.	10027.	434.	0.	434.	0.9497	9521.	412.
4	1983	13142.	0.	13142.	569.	0.	569.	0.9255	12162.	527.
5	1984	13142.	0.	13142.	569.	0.	569.	0.9019	11852.	513.
6	1985	13169.	0.	13169.	570.	0.	570.	0.8789	11568.	501.
7	1986	7293.	0.	7293.	315.	0.	315.	0.8565	6248.	270.
8	1987	4228.	0.	4228.	273.	0.	273.	0.8347	3529.	228.
9	1988	1937.	0.	1937.	218.	0.	218.	0.8136	1576.	177.
10	1989	1937.	0.	1937.	359.	0.	359.	0.7927	1535.	285.
11	1990	2421.	0.	2421.	745.	0.	745.	0.7724	1870.	575.
12	1991	1453.	0.	1453.	1224.	0.	1224.	0.7528	1094.	921.
13	1992	0.	0.	0.	1818.	0.	1818.	0.7336	0.	1334.
14	1993	0.	0.	0.	2671.	0.	2671.	0.7149	0.	1909.
15	1994	0.	0.	0.	3343.	0.	3343.	0.6967	0.	2328.
16	1995	0.	0.	0.	4307.	0.	4307.	0.6789	0.	2924.
17	1996	0.	0.	0.	4879.	0.	4879.	0.6616	0.	3228.
18	1997	0.	0.	0.	5250.	0.	5250.	0.6447	0.	3385.
19	1998	0.	0.	0.	5430.	0.	5430.	0.6283	0.	3412.
20	1999	0.	0.	0.	5453.	0.	5453.	0.6123	0.	3340.
21	2000	0.	0.	0.	5455.	0.	5455.	0.5967	0.	3255.
22	2001	0.	0.	0.	5455.	0.	5455.	0.5815	0.	3172.
23	2002	0.	0.	0.	5455.	0.	5455.	0.5666	0.	3091.
24	2003	0.	0.	0.	5455.	0.	5455.	0.5521	0.	3012.
25	2004	0.	0.	0.	5455.	0.	5455.	0.5381	0.	2935.
26	2005	-58200.	0.	-58200.	0.	0.	0.	0.5244	-30521.	0.
	TOTAL	32734.	0.	32734.	66434.	0.	66434.		42354.	42354.

INTEREST PER CENT	ASSOCIATED BENEFIT RATIO	PRESENT VALUE IN RS. 1000 ASSOC. BENEFITS	COTLAY	BALANCE
8.000	0.358	18436.	51487.	-33052.
10.000	0.275	13977.	50754.	-36777.
12.000	0.219	10788.	49244.	-39455.
14.000	0.179	8479.	47356.	-38876.
16.000	0.150	6784.	45327.	-38542.
18.000	0.128	5526.	43290.	-37765.

ALTERNATIVE:

PERIOD NO.	RATE OF WD	LAST MONTH								
[illegible]	[illegible]	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	[illegible]	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	[illegible]	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	[illegible]	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	[illegible]	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	[illegible]	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	[illegible]	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	7283.	- .	[illegible]	[illegible]	- .	- .	- .	- .	- .	-0.
[illegible]	1976.	2252.	- .	2	- .	- .	- .	- .	- .	-0.
[illegible]	- .	1937.	17.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	1937.	74.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	2421.	194.	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	1453.	434.	- .	0	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	703.	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	1023.	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	1363.	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	1667.	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	1894.	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	2041.	- .	5	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	2107.	- .	5	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	2121.	- .	[illegible]	[illegible]	2641.	165.	- .	-0.
[illegible]	- .	- .	[illegible]	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	[illegible]	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	[illegible]	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	[illegible]	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	[illegible]	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	- .	- .	[illegible]	- .	[illegible]	[illegible]	[illegible]	[illegible]	- .	-0.
[illegible]	-53200.	-5000.	-0.	- .	- .	- .	- .	- .	- .	-0.

6. Subordinate Indicators of Economic Benefit

A number of subordinate indicators of economic benefit are derived in the process of evaluation of economic feasibility of the prototype MIPs. Using computerized techniques, a complete set of such subordinate indicators were derived for Gudha. The computer output presenting these indicators is on file at USAID, New Delhi. It is far too voluminous to be reproduced here. Copies will be provided to the COR for their use.

Added Food Production: The annual volume of added food production is shown in computer output. The added volumes of food production by crop are useful for a number of purposes. They can be related to projected consumption requirements of the area to estimate the net surpluses or deficits. They can be reduced to projected flow patterns for optimizing the timing, sizing and location of godowns, processing facilities, and transport facilities in the future. The projected volumes for specific commodities (Sugar cane, for example) provide the basis for more accurate planning of industry development (of the sugar industry, for example)

Added Gross Farm Revenue: The schedule of added gross farm revenue is shown in the computer output. These schedules provide the basis for developing the estimates of associated project benefits arising from linkages to the product marketing and farm supply sectors (see Section 5). They also provide the basis for other uses, such as impact on the gross economic product of the command area and the state, and the corresponding impact on average per capita incomes.

Added Demand for Fertilizer and Other Inputs: The added demand for fertilizers, plant protection materials, high-yielding seed and other technical farm inputs created by the prototype can be derived from supporting tables developed when making the project evaluation. Aggregate estimates can be made from the projections of gross revenue and unit farm input requirements, as indicated in Section 6. Specific estimates by crop and season can be derived from the projections of physical volume of production or from the added cropping intensities and corresponding cropping patterns. These kinds of estimates often are needed to support planning for production and distribution of specific technical farm inputs.

Added Employment: As discussed in Section 6, added employment created by the project can be estimated for both the construction phase and the agricultural production phase of each MIP. Such estimates provide the basis for estimating a major source of associated benefits to the MIP.

If needed, more specific estimates can be developed for classes of laborers of interest, such as hired farm laborers, skilled and unskilled construction workers and women laborers. Such estimates are made by applying appropriate factors to the projected total labor requirements in agriculture, in earth moving, in masonry work, etc.

7. Suggested Approach to Standardizing Procedures for MIP Evaluation by GOR

The desire of the Department of Irrigation and Department of Agriculture to standardize MIP evaluation procedures is well founded, and deserves attention and support. Standardization can enhance comparability of analysis and findings from one MIP to another. It can provide more orderly and timely procession of each MIP candidate through the planning and analytical steps. It can help identify the more important factors and relationships affecting the technical and economic soundness of each project. It can help minimize gaps and interruptions in the total MIP planning, approval and implementation process. It can add to the effectiveness and efficiency of the Water Utilization Cell and others with responsibility for economic evaluation of candidate MIPs.

Starting with the foundation of present procedures, one of the first steps is to standardize the needed input data and the formats in which they are presented (see Section 2). The organization of tabular input material shown by Tables 1 through 7 represent a solid step in this direction (See Section 4). Similar standard input data formatting is needed for technical and engineering information regarding each MIP candidate.

Another early step that deserves attention and standardization is the sequential phasing of the needed steps in MIP planning and evaluation. For example, more effective planning (and more productive MIPs) can be achieved if some of the sensitivity analysis can be done early in the total process. Attention needs to be given to specific points in the process for most effective interaction between those of the different disciplines and responsibilities involved. The more nearly the whole process can be reduced to formal critical path planning, the more rewarding the end result will be.

Perhaps the next step will be to develop a manual of procedures, complete with easy to follow worksheets and specific guidelines for each procedural step. Such a manual can be the vehicle for finalizing and documenting previous steps, for structuring sequential flows through the process of project planning and evaluation and for design and conduct of training workshops on the procedures.

It will be helpful to focus on the content and details of the final analysis and reports for MIPs, and then determine the most efficient way to get there. Computerized techniques should be considered to the extent that they will facilitate the process, but not beyond. As with the entire process, further thought should be given to what should be computerized first, and how it should be done. It seems probable that final sensitivity analysis at the stage of DRR evaluation is the most logical starting point. If so the logical next step may be to use comparable computerized procedures as a planning tool at a fairly early stage of project planning and design. If the intermediate steps prior to DRR sensitivity analysis are standardized effectively and reduced to worksheet form, there may be little advantage in using computer analysis at these steps for the for foreseeable future.

TABLE 1 PERCENTAGE OF PROJECTED TOTAL INCREASE IN AGRICULTURAL PRODUCTIVITY

Year following water to farm gate	New Projects *	Full Modernization	Partial Modernization
0	0	0	0
1	8	10	15
2	20	30	40
3	40	60	75
4	60	80	90
5	80	100	100
6	95	100	100
7	100	100	100
8	100	100	100
9	100	100	100
10	100	100	100

* Applies to each portion of the area ready for irrigation as per schedule of construction (see CHAPPI Report, Chap. 6)

Procedure for use of Table : First determine the incremental change in present per hectare productivity level to projected level. If present = A and projected = C, then the incremental will be c - a = B.
Transition to apply only to B (which then can be added to A for projection by year for the project benefits).
The transition in B values are standardized for the three types of projects.

TABLE 2

SCHEDULE OF LAND AREA TO BE DEVELOPED ANNUALLY FOR EACH USE
GUDHA PROJECT
(Hectares)

A. With Project Transition Yr	Surface and Wells	Surface Only	Rain-fed	Surface and Wells	Surface Only	Rain-fed
Base (year 0)	510	7,296	1,227	1,663	0	6,125
First (year 1)	35	250	-156	22	360	-353
Second (year 2)	35	250	-156	22	360	-380
Third (year 3)	35	250	-156	22	360	-379
Fourth (year 4)	40	260	-165	27	368	-381
Fifth (year 5)	35	236	-156	24	360	-351
Totals	690	8,542	438	1,780	1,808	4,281

a/ Excluding 965 ha and 806 ha, respectively, of sugarcane included in kharif data (which also is irrigated in Rabi)

Projected Land Use at Full Development (Hectares)

Land Use		Rabi b/		Kharif
Irrigated		11,003		3,588
Surface & Wells	1,655		1,780	
Surface only	9,348		1,808	
Rainfed		421		4,281
Fallow		---		4,328
Total		12,197 c/		12,197
Irrigation Intensity		90.2		29.4
Total Cropping Intensity			158.2	

b/ Includes sugarcane as a rabi as well as a kharif crop
c/ Includes 10,860 ha CCA under flow irrigation.

SCHEDULE OF LAND AREA TO BE
DEVELOPED ANNUALLY FOR EACH USE
GUDHA PROJECT
(Hectares)

B. Without Project[a/] Transition Yr	Surface and Wells	Surface Only	Rain-fed	Surface and Wells	Surface Only	Rain-fed
Base (year 0)	486	6,922	1,152	1,581	0	6,100
First (year 1)	-17	-74	-74	-7	170	-373
Second (year 2)	-17	-74	-74	-6	170	-401
Third (year 3)	-17	-74	-74	-6	170	-401
Fourth (year 4)	-18	-75	-75	-7	171	-403
Fifth (year 5)	-17	-75	-75	-6	170	-374
Totals	400	6,550	1,549	1,549	851	4,150
C. Added by Project[b/]						
Base (year 0)	24	374	75	82	0	25
First (year 1)	52	324	-230	29	190	20
Second (year 2)	52	324	-230	28	190	21
Third (year 3)	52	324	-230	28	190	22
Fourth (year 4)	58	335	-240	34	197	22
Fifth (year 5)	52	311	-231	30	190	21
Totals	290	1,992	-342	231	957	131

a/ Reflects 667 ha of waterlogged area to be reclaimed, with corresponding savings over transition period.

b/ Section a minus section b.

TABLE 2 SCHEDULE OF LAND AREA TO BE DEVELOPED ANNUALLY FOR EACH USE - MOREL PROJECT
(Hectares)

	RABI			KHARIF		
	Irrigated			Irrigated		
	Surface & Wells a/	Surface Only a/	Dryland	Surface & Wells	Surface Only	Rainfed
A. With Project						
Transition Year:						
Base (year 4)	1,112	7,322	4,287	2,053	803	5,812
First (year 5)	38	931	591	69	368	572
Second (year 6)	47	1,164	738	87	459	715
Third (year 7)	56	1,397	886	104	552	859
Fourth (year 8)	47	1,165	739	87	460	716
Totals	1,300	11,979	7,241	2,400	2,642	8,674

a/ Including respectively 25 Ha and 53 Ha of sugar cane included in kharif data (which also is irrigated in Rabi)

Projected Land Use at Full Development (Hectares):

Land Use		Rabi		Kharif
Irrigated b/		13,279		5,042
Surface & Wells c/	1,300		2,400	
Surface only	11,979		2,642	
Rainfed		7,241		8,674
Fallow		1,080		7,884
Total		21,600		21,600

Irrigation Intensity	61.5%	b/	23.3%
Total Cropping Intenstiy		158.5%	

b/ Including sugar cane
c/ Estimated from preliminary partial survey information; complete well and ground water assessment not yet made.

TABLE 2 SCHEDULE OF LAND AREA TO BE DEVELOPED ANNUALLY FOR EACH USE - MOREL PROJECT
(Hectares)

	RABI			KHARIF		
	Irrigated			Irrigated		
	Surface & wells	Surface only	Dryland	Surface & wells	Surface only	Rainfed
B. Without Project[a/]						
Transition Year:						
Base (year 4)	1,065	7,009	4,104	1,965	769	5,564
First (year 5)	- 2	40	20	- 3	20	100
Second (year 6)	- 2	50	25	- 3	25	125
Third (year 7)	- 2	60	30	- 3	30	150
Fourth (year 8)	- 2	50	25	- 3	25	125
Totals	1,057	7,209	4,204	1,953	869	6,064
C. Added By Project[b/]						
Base (year 4)	47	313	183	88	34	248
First (year 5)	40	891	571	72	348	472
Second (year 6)	49	1,114	713	90	434	590
Third (year 7)	58	1,337	856	107	522	709
Fourth (year 8)	49	1,115	714	90	435	591
Totals	243	4,770	3,037	447	1,773	2,610

a/ Reflects waterlogged area of 800 Ha to be reclaimed by project, and comparable continued loss of productive land without project

b/ Figures with project minus those without project.

TABLE 2 SCHEDULE OF LAND AREA TO BE DEVELOPED ANNUALLY FOR EACH USE - GOSUNDA PROJECT

(hectares)

	Rabi		Kharif	
Without Project	Irrigated	Rainfed	Irrigated	Rainfed
Base (Year 0)	1699	361	430	2163
First (Year 1)	--	--	--	--
All succeeding years	--	--	--	--
	1699	361	430	2163
With Project				
(Year 0)	1699	361	430	2163
First (Year 1) to	--	--	--	--
Seven (Year 7)	--	--	--	--
Base (year 8)	-196	-39	-62	-236
Ninth (year 9)	1178	3	384	88
Tenth (year 10)	1178	3	384	88
Eleventh (year 11)	1178	3	384	88
Twelth) (year 12)	1473	3	479	109
Thirteenth (Year 13)	884 a/	2	287	65
	7394	338	2286	2365

a/ Excluding 352 hectares of sugar cane included in kharif which is also irrigated in rabi

PROJECTED LAND USE AT FULL DEVELOPMENT (Hectares)

Land Use		Rabi		Kharif
Irrigated		7394		2286
Surface and Wells	1564		483	
Surface only	5828		1803	
Rainfed		338		2365
Fallow		2268		5349
Total excluding bed		10000		10000
Bed cultivation		315		--
Irrigation Intensity (excluding bed)		73.9%		22.9%
Total cropping intensity			124%	

TABLE 3A

ESTIMATED VARIABLE FARM PRODUCTION EXPENSE
(Excluding Farm Labor)

Input	% of Gross Crop Revenue	Example for Irrigated Wheat (Rs. /Hecatre) c/
1. Organic fertilizer	6.5	201.5
2. Chemical fertilizer	8.9 a/	275.9
3. Bullock expense	7.0 b/	217.0
4. Implement expense	2.7	83.7
5. Farm maintenance and improvement	3.0	93.0
6. Plant protection measures	1.0	31.0
Total	29.1	902.1

a/ Reflects anticipated increases in real 1990 chemical fertilizer prices over those currently used by the Department of Agriculture, GOR as follows:

Nitrogen	41 percent (Rs. 3540/MT to Rs. 4990/MT)
P_2O_5	24 percent (Rs. 3680/MT to Rs. 4580/MT)
K_2O	31 percent (Rs. 1410/MT to Rs. 1850/MT)

b/ Net of manure credit of 3 percent of gross revenue, which is included in item 1.

c/ Based on an average projected yield of 25 quintals per hectare and projected real price of Rs. 124 per quintal.

TABLE 3B

ESTIMATED FIXED FARM PRODUCTION EXPENSE BY CROP

(Rs. per Hectare)

CROP	Type of Cultivation: Dryland a/	Flow Irrigation b/	Flow plus well irrigation c/
RABI:			
Wheat	132	253	793
Barley	106	169	N.A.
Pulses	115	145	657
Vegetables	N.A.	150	757
Oilseeds	140	240	570
Fodder	N.A.	350	630
Condiments	98	126	633
KHARIF:			
Maize	40	80	427
Sorghum	35	92	300
Pulses	115	145	390
Vegetables	N.A.	150	557
Oilseeds	140	240	388
Paddy	N.A.	80	680
Sugar cane	N.A.	670	1955
Fodder	10	N.A.	N.A.
Cotton	N.A.	270	710

a/ Includes average land charge of Rs. 10 plus seed and related expense for the crop (based on GOR, Dept of Agr. data)

b/ Includes average land charge of Rs. 20 plus seed and related expense for the crop

c/ Same as b, plus well and pump operating and maintenace expense for supplemental irrigation

TABLE 4

CROP YIELDS
GUDHA PROJECT
(QQ/HA)

Season Category & Crop	Existing	PROJECTED Without Project	PROJECTED With Project
1. RABI			
A. Irrigated, Surface & Wells			
1. Wheat	15.0	20.0	30.0
2. Barley	Not applicable		
3. Oilseeds	8.0	9.0	18.0
4. Pulses	8.0	9.0	14.0
5. Vegetables	85.0	125.0	145.0
6. Fodder	150.0	170.0	210.0
7. Condiments	8.0	8.5	12.0
B. Irrigated, Surface only			
1. Wheat	12.0	15.0	18.0
2. Barley	12.0	15.0	17.0
3. Oilseeds	6.0	8.0	9.0
4. Pulses	7.0	8.0	9.0
5. Vegetables	65.0	75.0	100.0
6. Fodder	120.0	150.0	190.0
7. Condiments	7.0	7.5	8.0
C. Dryland			
1. Wheat	8.0	9.0	10.0
2. Barley	10.0	12.0	14.0
3. Oilseeds	5.0	7.0	8.0
4. Pulses	6.0	7.0	8.0
5. Condiments	4.0	5.0	6.0

TABLE 4

CROP YIELDS
GUDHA PROJECT
(QQ/HA)

Season Catergory & Crop	Existing	PROJECTED Without Project	PROJECTED With Project
2. KHARIF			
A. Irrigated, Surface & Wells			
1. Maize	12.0	19.0	25.0
2. Sorghum	13.0	17.0	20.0
3. Oilseeds	6.0	9.0	10.0
4. Pulses	7.0	8.0	9.0
5. Vegetables	80.0	110.0	130.0
6. Paddy	27.0	37.0	40.0
7. Sugarcane	300.0	500.0	700.0
B. Irrigated, Surface only			
1. Maize	12.0	15.0	19.0
2. Sorghum	12.0	14.0	18.0
3. Oilseeds	5.0	7.0	9.0
4. Pulses	6.0	7.0	8.0
5. Vegetables	60.0	80.0	100.0
6. Paddy	21.0	27.0	32.0
7. Sugar Cane	200.0	250.0	400.0
C. Rainfed			
1. Maize	8.0	10.0	12.0
2. Sorghum	8.0	10.0	12.0
3. Oilseeds	4.0	5.0	6.0
4. Pulses	4.0	6.0	8.0
5. Fodder	100.0	110.0	120.0

TABLE 4 CROP YIELDS, MOREL PROJECT (QQ/HA)

Season, Category & Crop	Existing 1/	PROJECTED Without Project	PROJECTED With Project
1. Rabi			
A. Irrigated, Surface & Wells			
1. Wheat	15	20	30
2. Barley	13	N.A.	N.A.
3. Pulses	8	10	13
4. Vegetables	85	125	140
5. Oilseeds	8	10	12
6. Fodder	150	170	200
7. Condiments	8	9	11
B. Irrigated, Surface only			
1. Wheat	13	15	18
2. Barley	12	14	16
3. Pulses	7	8	10
4. Vegatables	65	75	90
5. Oilseeds	7	8	10
6. Fodder	120	150	180
7. Condiments	7	8	9
C. Dryland			
1. Wheat	9	10	11
2. Barley	9	9	10
3. Pulses	6	7	8
4. Oilseeds	6	8	9
5. Condiments	4	5	6

1/ Estimates, only, overall 1971-75 averages reported.

TABLE 4 CROP YIELDS, MOREL PROJECT (QQ/HA)

Season, Category & Crop	Existing[1]	PROJECTED Without Project	PROJECTED With Project
2. Kharif			
A. Irrigated, Surface & Wells			
1. Maize	12	18	23
2. Sorghum	11	15	18
3. Pulses	8	9	10
4. Vegetables	80	100	120
5. Oilseeds	9	11	13
6. Paddy	25	30	35
7. Sugar Cane	200	300	500
8. Cotton	12	15	20
B. Irrigated, Surface only			
1. Maize	10	13	17
2. Sorghum	10	12	15
3. Pulses	7	8	9
4. Vegetables	60	80	100
5. Oilseeds	8	10	13
6. Paddy	18	22	26
7. Sugar Cane	200	250	350
8. Cotton	10	12	17
C. Rainfed			
1. Maize	6	8	11
2. Sorghum	6	8	10
3. Pulses	5	6	7
4. Oilseeds	6	8	10
5. Paddy	10	11	12
6. Cotton	5	6	7
7. Fodder	100	100	110

1. Estimates: only overall 1971-1975 average reported.

TABLE 4 CROP YIELDS, GOSUNDA PROJECT (QQ/HA)

Season, Category & Crop	Existing	PROJECTED Without Project	PROJECTED With Project
1. Rabi			
A. Irrigated			
1. Wheat	11.25	12	20
2. Barley	12	13	18
3. Pulses	7	8	10
4. Oilseeds	8	9	12
5. Condiments	8	8	10
6. Fodder	150	160	200
B. Dryland			
1. Wheat	7	8	10
2. Pulses	5.5	6	8
3. Oilseeds	6.5	7	9
4. Condiments	3.0	4	6
C. Bed Cultivation			
1. Wheat	N.A.	N.A.	10
2. Barley	N.A.	N.A.	10

TABLE 4 CROP YIELDS, GOSUNDA PROJECT (QQ/HA)

Season, Category & Crop	Existing	PROJECTED Without Project	PROJECTED With Project
Kharif			
A. Irrigated			
1. Maize	7	9	18
2. Sorghum	6	8	16
3. Pulses	6	7	9
4. Oilseeds	7	8	10
5. Condiments	4	4	5
6. Sugar Cane	205	250	600
7. Cotton	5	7	15
B. Rainfed			
1. Maize	5.5	6	10
2. Sorghum	4.5	5	9
3. Pulses	4	4	6
4. Oilseeds	5	5	6
5. Condiments	1.5	2	3
6. Cotton	3	3	3
7. Fodder	100	100	110

TABLE 5 PROJECTED 1990 FARM PRICES FOR RAJASTHAN
Rupees per Quintal in Real Terms (1980-1.00)

Commodity	For DRR	For ERR	(2)/(1)
RABI CROPS:			
Wheat	124	164	1.323
Barley	97	128	1.320
Pulses	180	194	1.078
Vegetables	50	65	1.300
Oilseeds	280	287	1.025
Fodder (irrigated)	10	13	1.300
Condiments	416	473	1.137
KHARIF CROPS:			
Maize	117	152	1.299
Sorghum	130	166	1.277
Pulses	180	194	1.077
Vegetables	50	65	1.300
Oilseeds	280	287	1.025
Paddy	160	173	1.081
Sugar Cane	13	17	1.308
Fodder (rainfed)	10	11	1.100
Cotton	400	470	1.175
FARM INPUTS:			
N	499	474	0.95
P_2O_5	458	435	0.95
K_2O	185	175	0.95
Organic Fertilizer	3.23	2.58	0.95
Farm Labor (hired) Rs/day	5	6.5	1.30

Column (1) prices Water Utilization Cell, Dept. of Agriculture, GOR
Column (2) World Bank Report 2529a-IN, Vol. 1, Table T-20, Sept. 13, 1979, adjusted to Rs 8.00 - $1.00

TABLE 6

LABOR REQUIREMENTS
GUDHA PROJECT
(Man Days/Hectare)

Season, Category & Crop	Existing	PROJECTED Without Project	PROJECTED With Project
RABI			
A. Irrigated, Surface & Wells			
1. Wheat	125	135	150
2. Barley	70	80	90
3. Oilseeds	65	75	85
4. Pulses	65	70	75
5. Vegetables	50	70	80
6. Fodder	120	130	140
7. Condiments	55	60	65
B. Irrigated, Surface Only			
1. Wheat	110	120	145
2. Barley	65	70	80
3. Oilseeds	55	60	70
4. Pulses	60	65	70
5. Vegetables	40	50	60
6. Fodder	100	110	130
7. Condiments	45	50	60
C. Irrigated, Surface Only			
1. Wheat	80	90	105
2. Barley	65	70	90
3. Oilseeds	30	35	40
4. Pulses	45	50	60
5. Condiments	30	40	50

TABLE 6 LABOR REQUIREMENTS, GUDHA PROJECT
(Man Days/Hectare)

Season, Category & Crop	Existing	Projected Without Project	Projected With Project
2. Kharif			
A. Irrigated, Surface & Wells			
1. Maize	70	75	90
2. Sorghum	70	75	85
3. Oilseeds	55	60	70
4. Pulses	70	75	80
5. Vegetables	50	60	70
6. Paddy	145	165	180
7. Sugar Cane	285	360	425
B. Irrigated, Surface Only			
1. Maize	60	65	70
2. Sorghum	60	65	80
3. Oilseeds	50	55	65
4. Pulses	60	65	70
5. Vegetables	40	50	60
6. Paddy	125	145	160
7. Sugar Cane	240	265	310
C. Rainfed			
1. Maize	50	55	65
2. Sorghum	50	55	65
3. Oilseeds	45	50	60
4. Pulses	45	50	60
5. Fodder	40	45	50

TABLE 6

LABOR REQUIREMENTS, MOREL PROJECT
(Man Days/Hectare)

Season, Category & Crop	Existing	Projected Without Project	Projected With Project
1. Rabi			
A. Irrigated, Surface & Wells			
1. Wheat	125	140	150
2. Barley	80	N.A.	N.A.
3. Pulses	65	77	82
4. Vegetables	50	70	73
5. Oilseeds	65	77	82
6. Fodder	120	130	136
7. Condiments	55	62	64
B. Irrigated, Surface only			
1. Wheat	115	125	145
2. Barley	65	68	78
3. Pulses	60	65	68
4. Vegetables	40	50	56
5. Oilseeds	58	70	76
6. Fodder	100	110	125
7. Condiments	45	60	65
C. Dryland			
1. Wheat	90	105	115
2. Barley	60	65	68
3. Pulses	45	50	58
4. Oilseeds	50	55	63
5. Condiments	30	40	46

TABLE 6 LABOR REQUIREMENTS, MOREL PROJECT
(Man Days/Hectare)

Season, Category & Crop	Existing	Projected Without Project	Projected With Project
2. Kharif			
A. Irrigated, Surface & Wells			
1. Maize	60	64	80
2. Sorghum	55	70	80
3. Pulses	75	80	85
4. Vegetables	50	58	68
5. Oilseeds	65	75	80
6. Paddy	140	150	160
7. Sugar Cane	240	285	360
8. Cotton	125	140	180
B. Irrigated, Surface only			
1. Maize	55	62	67
2. Sorghum	50	60	65
3. Pulses	65	70	75
4. Vegetables	40	50	60
5. Oilseeds	60	70	75
6. Paddy	115	128	135
7. Sugar Cane	240	265	300
8. Cotton	105	125	150
C. Rainfed			
1. Maize	45	53	58
2. Sorghum	42	50	55
3. Pulses	48	50	55
4. Oilseeds	60	65	70
5. Paddy	70	80	90
6. Cotton	90	100	110
7. Fodder	40	40	45

TABLE 6 LABOR REQUIREMENTS, GOSUNDA PROJECT
(Man Days/Hectare)

Season, Category & Crop	Existing	Projected Without Project	Projected With Project
1. Rabi			
A. Irrigated			
1. Wheat	100	110	135
2. Barley	65	75	90
3. Pulses	50	60	80
4. Oilseeds	60	70	90
5. Condiments	60	60	65
6. Fodder	110	125	135
B. Dryland			
1. Wheat	70	80	105
2. Pulses	40	45	55
3. Oilseeds	50	55	70
4. Condiments	30	40	50
C. Bed Cultivation			
1. Wheat	N.A.	N.A.	105
2. Barley	N.A.	N.A.	65

TABLE 6

LABOR REQUIREMENTS, GOSUNDA PROJECT
(Man Days/Hectare)

Season, Category & Crop	Existing	Projected	
		Without Project	With Project
2. Kharif			
A. Irrigated			
1. Maize	45	48	68
2. Sorghum	42	50	70
3. Pulses	60	65	80
4. Oilseeds	55	62	70
5. Condiments	30	30	40
6. Sugar Cane	230	265	395
7. Cotton	80	90	140
B. Rainfed			
1. Maize	35	40	55
2. Sorghum	30	33	53
3. Pulses	45	45	60
4. Oilseeds	50	50	60
5. Condiments	20	25	30
6. Cotton	60	60	80
7. Fodder	40	40	45

TABLE 7 EXISTING AND PROJECTED CROPPING PATTERN
GUDHA PROJECT
(Hectares/1000 Hectare cropped)

Season, Category & Crop	Existing	Projected Without Project	Projected With Project
1. Rabi			
A. Irrigated, Surface & Wells			
1. Wheat	780	655	385
2. Barley			
3. Pulses	10	10	
4. Vegetables	15	50	100
5. Oilseeds	65	135	265
6. Fodder	100	100	150
7. Condiments	30	50	100
B. Irrigated, Wells only			
1. Wheat	780	667	535
2. Barley	52	42	
3. Pulses	115	128	158
4. Vegetables	8	14	30
5. Oilseeds	7	64	134
6. Fodder	35	57	76
7. Condiments	3	28	67
C. Dryland Cultivation			
1. Wheat	96	256	285
2. Barley	20	26	
3. Pulses	716	641	428
4. Oilseeds	39		
5. Condiments	129	77	287

Transition from Existing to projected:	Year 1	Year 2	Year 3
	0	60%	100%

TABLE 7

EXISTING AND PROJECTED CROPPING PATTERNS
GUDHA PROJECT
(Hectares/1000 Hectares cropped)

Season, Category & Crop	Existing	Projected: Without Project	Projected: With Project
2. Kharif			
A. Irrigated, Surface & Wells			
1. Maize	120	140	180
2. Sorghum	96	76	50
3. Pulses	100	60	28
4. Vegetables	50	75	100
5. Oilseeds	15	70	100
6. Paddy	77	37	
7. Sugar Cane	542	542	542
B. Irrigated, Surface only			
1. Maize	90	146	171
2. Sorghum	71	103	103
3. Pulses	180	167	151
4. Vegetables	33	42	69
5. Oilseeds	7	42	60
6. Paddy	77		
7. Sugar Cane	542	500	446
C. Rainfed Cultivation			
1. Maize	431	413	345
2. Sorghum	35	45	57
3. Pulses	12	69	217
4. Oilseeds	123	92	237
5. Fodder	399	381	144

Transition from existing to projected:	Year 1	Year 2	Year 3
	0	60%	100%

TABLE 7 EXISTING AND PROJECTED CROPPING PATTERN
MOREL PROJECT
(Hectares/1000 Hectares Cropped)

Season, Category & Crop	Existing	Projected Without Project	Projected With Project
1. Rabi			
A. Irrigated, Surface & Wells			
1. Wheat	712	712	605
2. Barley	57	57	0
3. Pulses	144	144	201
4. Vegetables	12	12	32
5. Oilseeds	60	60	107
6. Fodder	10	10	20
7. Condiments	5	5	35
B. Irrigated, Surface only			
1. Wheat	712	712	497
2. Barley	57	57	134
3. Pulses	150	150	201
4. Vegetables	6	6	13
5. Oilseeds	60	60	107
6. Fodder	10	10	13
7. Condiments	5	5	35
C. Dryland Cultivation			
1. Wheat	118	118	118
2. Barley	206	206	206
3. Pulses	483	483	483
4. Oilseeds	150	150	150
5. Condiments	43	43	43

Transition from existing to projected;	Year 1	Year 2	Year 3
	0	60%	100%

TABLE 7

EXISTING AND PROJECTED CROPPING PATTERN
MOREL PROJECT
(Hectares/1000 Hectares cropped)

Season, Category & Crop	Existing	Without Project	With Project
2. Kharif			
A. Irrigated, Surface & Wells			
1. Maize	17	17	117
2. Sorghum	174	174	174
3. Pulses	116	116	116
4. Vegetables	5	5	75
5. Oilseeds	155	155	113
6. Paddy	228	228	100
7. Sugar Cane	235	235	235
8. Cotton	70	70	70
B. Irrigated, Surface only			
1. Maize	17	17	0
2. Sorghum	174	174	316
3. Pulses	116	116	175
4. Vegetables	5	5	35
5. Oilseeds	155	155	421
6. Paddy	228	228	35
7. Sugar Cane	235	235	18
8. Cotton	70	70	0
C. Rainfed Cultivation			
1. Maize	4	4	4
2. Sorghum	246	246	246
3. Pulses	108	108	108
4. Oilseeds	624	624	572
5. Paddy	2	2	0
6. Cotton	16	16	0
7. Fodder	0	0	70

Transition from existing to projected:	Year 1	Year 2	Year 3
	0	60%	100%

TABLE 7

EXISTING AND PROJECTED CROPPING PATTERN
GOSUNDA PROJECT
(Hectares/1000 Hectares cropped)

Season, Category & Crop	Existing	Projected Without Project	Projected With Project
1. Rabi			
A. Irrigated			
1. Wheat	536	536	536
2. Barley	122	122	122
3. Pulses	122	122	122
4. Vegetables			
5. Oilseeds	122	122	122
6. Fodder	49	49	49
7. Condiments	49	49	49
B. Dryland Cultivation			
1. Wheat			
2. Barley			
3. Pulses	800	800	800
4. Oilseeds	33	33	33
5. Condiments	167	167	167
C. Bed Cultivation			
1. Wheat	750	750	750
2. Barley	250	250	250

TABLE 7

EXISTING AND PROJECTED CROPPING PATTERN
GOSUNDA PROJECT
(Hectares/1000 Hectares Cropped)

Season, Category & Crop	Existing	Projected	
		Without Project	With Project
2. Kharif			
A. Irrigated			
1. Maize	571	571	571
2. Sorghum			
3. Pulses			
4. Vegetables			
5. Oilseeds			
6. Paddy			
7. Sugar Cane	143	143	143
8. Cotton	215	215	215
9. Condiments	71	71	71
B. Rainfed Cultivation			
1. Maize	450	450	450
2. Sorghum	220	220	220
3. Pulses	50	50	50
4. Oilseeds	200	200	200
5. Paddy			
6. Cotton	20	20	20
7. Fodder	50	50	50
8. Condiments	10	10	10

ANNEX A — INVESTMENT ALTERNATIVES

TABLE A — GUDHA - ALTERNATIVES FOR ECONOMIC ANALYSIS

	DRR
1. Base Case	9.761
2. Add lining to one-third of watercourses and assume yield increases by 5% for surface irrigation for rabi and kharif.	
Add'l cost $\frac{2250}{3}$ (10,860) = 8,145,000 Rs.	
a. Add'l area = (3.77)(.64)(10.860)(75)(.31)/1000 (CFS/MSF) = 600 ha	10.278
b. Add'l area - 1,200 ha (seepage and leakage loss)	10.822

ANNEX A

INVESTMENT ALTERNATIVES

TABLE B

MOREL - ALTERNATIVES FOR ECONOMIC ANALYSIS

		DRR
1.	Base Case	7.868
2.	Add lining to one-third of watercourses and assume yield increases by 5% for surface only irrigation for rabi and kharif. Add'l cost $\frac{2312}{3}$ (21,600) = 16,646,000 Rs. Add'l irrigated area = 2,100 Ha (10 CFS/MSF seepage)	8.260
3.	Increase "with Project" yield in flow irrigated area to that for flow and well irrigated.	9.008
4.	Assume "without Project" yields are the same as at present.	9.596
5.	Eliminate investments in roads, markets and warehouses and reduce add'l area by 50%. Cost reduction = 30,800,000 Rs.	6.222
6.	Eliminate watercourse moderaization. Reduce additional area by 20%. Assume yield at "without Project" level. Cost reduction = 7,093,000	5.711
7.	Eliminate drainage, field roads and land development. Reduce total "with Project" area by 10% for irrigated rabi and 20% for all other cases. Assume yield remains at "without Project" levels. Cost reduction = 38,491,000 Rs.	6.872
8.	Advance the OFD investment and net income streams by two years.	9.903

ANNEX A

INVESTMENT ALTERNATIVES

TABLE C

GOSUNDA - ALTERNATIVES FOR ECONOMIC ANALYSIS

		DRR
1.	Base Case	5.059
2.	Only main and branch canals are to be lined. Assume that distributaries and minors and 1/3 of w.c.s. are also lined and that all watercourses are modernized.	6.876
	a. Add'l cost Rs. 21,480,000 Rs. w.o. escalation	
	b. Add'l irrigated area = 1590 Ha ave. (cropping pattern and transitions remain the same)	
	c. Yield differential (with minus without) is increased by 75%.	
3.	Assume rainfed kharif increases from 2,365 to 4,730 between base year and year 13. This is reasonable, for example, on Morel rainfed kharif increased from 25.4% to 50% intensity under irrigation).	6.664
4.	Assume construction schedule is reduced to five years from eight years.	6.193
5.	Alternatives 2, 3, and 4 combined	9.700
6.	Ideal Case	17.279

Command area is consolidated to 7,000 hectares. One-third watercourses are lined and drainage and full on-farm development provides 100% percent rabi and 75 percent kharif irrigation intensity and 200 percent cropping intensity. Yields are increased comparable to 35 QQs/Ha for wheat and 706 QQs/Ha for sugarcane. Cropping pattern increases areas in high value commodities. Construction is completed in four years and full agricultural transition completed in four additional years.

Investment:

Irrigation works, including watercourses	Rs. 80,000,000
Land development, drainage, farm roads, increased extension	11,500,000
Markets, warehouses, off-farm roads	7,000,000

ANNEX A

TABLE D

GUDHA INVESTMENT COST USED IN ECONOMIC EVALUATION

	1979 Project Report		Used in Evaluation	
	Item	Rs (000)	Item	Rs(000)
1.	Improvement of irrigation system	16,410	same	16,400
2.	Improvement of drainage system	5,698	same	5,700
3.	Farm Development and gully control 1/	16,550		
4.	Credit Facility	16,200	OFD works	17,600
5.	Farm Market Roads	2,400	same	2,400
6.	Bldgs/ & equip. for Ag. Extension and Research	1,297	same	1,300
7.	CAD Project Admin	6,870	same	6,900
8.	Maintenance during const.	825	same	800
9.	Contingencies @15%	9,938		7,600
10.	Price increases @15%	11,428		8,800
11.	Interest during construction 2/ at 12%	10,513		---
		98,129		67,500

1/ Includes 1,000,000 Rs. for storage facilities. Remainder is operating credit to farmers and is not an investment cost.

2/ Interest during construction is not an investment expense in IRR analysis.

ANNEX A

MOREL INVESTMENT COST USED IN ECONOMIC EVALUATION

TABLE E

	1979 Project Report		Used in Evaluation	
	Item	Rs (000)	Item	Rs (000) 1/
1.	Modernization of irrigation system	58,250	same	65,240
2.	Farm-Market Roads	22,000	same	24,640
3.	Fisheries Development	1,650	same	1,840
4.	Warehouse (Godown)	2,500	Marketing	
5.	Marketing Facilities	3,000	Development	6,150
6.	OFP Works	40,000	same	45,700
	a. Land Development	(17,600)		
	b. Watercourses	(5,700)		
	c. Drainage system	(11,000)		
	d. Field roads	(6,500)		
7.	Price Escalation @ 25%	32,000		
		160,000		143,600

1/ Includes 12% escalation for consistency with other projects.

TABLE F

GOSUNDA INVESTMENT COST USED IN ECONOMIC EVALUATION

	1979 Project Report		Used in Evaluation	
	Item	Rs (000)	Item	Rs (000)
1.	Irrigation Works	70,900 a/	same	70,900
2.	On-Farm Development	1,000		1,000

a/ Includes 10% allowance for expected increase in labor costs.