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ECONOMIC EVALUATION OF THE GOBONDERY SOIL CONSERVATION PROJECT

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Soil Conservation Service
of New South Wales

Orange

From the 1960's onwards considerable effort and expenditure has been directed towards soil conservation projects in New South Wales. These projects have traditionally involved joint co-operation and funding between a number of landholders, local authorities and government, both state and federal.

The present competition for the allocation of scarce public funds in all areas of government administration has led to the requirement that soil conservation projects be subjected to economic evaluation. Government and taxpayers in general are more than ever concerned that public money be put to the best possible use.

In this paper, the results of a study to evaluate the Gobondery Soil Conservation project near Tullamore in New South Wales are presented. The study undertaken is in the form of a cost-benefit analysis, incorporating the costs of the project, as well as on-farm and off-farm benefits.

The project area is 3300 ha with the predominant soil type being a hard-setting red brown earth. The average annual rainfall is about 480 mm. The area was subdivided into soldier settler blocks in 1918 and has had a history of grazing and intensive cropping since then. The result has been extensive sheet and gully erosion, loss of soil fertility and increased runoff leading to flooding of roads, the railway and the Gobondery grain silo.

The project includes on-farm structural works, co-ordinated drainage works and the promotion of improved, on-going farm management practices. The project commenced in 1984 and the majority of the work was completed by 1987, except for some on-farm broadacre works. The land not yet treated will continue to affect peak discharge rates through the rest of the project until such time that the works are completed.

The total cost of the project is \$1.27 million, of which the eleven landholders will have contributed \$201,000. The rest of the cost has been borne by the Federal Government (through the National Soil Conservation Program), the State Government (through the Soil Conservation Service), the Parkes Shire Council and the State Rail Authority.

BACKGROUND

Grain worth \$60,000 was destroyed when the Gobondery silo was flooded in 1982. The flood also severely damaged roads, railways and bridges, as well as washing away precious soil. The cause of the problem was recognised to be the farming practices implemented throughout the catchment.

Local landholders and soil conservationists tried to start a total catchment plan for overcoming the problem, but it was a very big task to get all the parties, including the Grain Handling Authority (GHA), State Rail Authority (SRA) and Parkes Shire Council together. The National Soil Conservation Program (NSCP) provided the means to bring all the parties together. The Gobondery project thus became a joint project funded by the landholders, SRA, Parkes Shire Council, NSCP and the Soil Conservation Service of New South Wales (SCS).

GOBONDERY PROJECT AREA

The Gobondery Project Area is located 10km south of Tullamore in the Central West of New South Wales. The predominant soil type is a hard-setting red brown earth and the average annual rainfall is 480mm, with a slight, but unreliable summer dominance. The area has been subjected to an intensive cropping and grazing regime since 1918, when it was subdivided for soldier settler blocks.

The traditional size of the soldier settler blocks was a square mile or 640 acres (259 ha). These blocks gradually became too small to be economically viable propositions, leading to either an amalgamation of holdings, a more intensive farming regime, or both. The area of cropping has doubled since 1970 with disastrous consequences for the districts' highly erodible soils. These soils are especially vulnerable during summer, when high-intensity storms are frequent. They have suffered extensive sheet and gully erosion.

There are 11 landholders in the project, which covers an area of 3300 ha. Some of the holdings lie completely in the catchment, while some are partly in the catchment. All but one of the landholders have completed their on-farm broad-acre works. The outstanding landholder has not been able to fulfil his commitment in the project due to financial constraints. If this work remains unfinished, the rest of the project could be adversely affected by peak discharge rates.

The Project was established with the following objectives:

(i) Soil problems to be treated utilising total catchment management principles. This includes controlling sheet, rill and gully erosion on rural lands and preventing the flooding, erosion and siltation of roads and railways, particularly in village access areas.

(ii) Through (i), demonstrate to landholders, local government and other public authorities the benefits of coordinated soil conservation programs.

FUNDING OF THE PROJECT

Project Areas may be declared under the Soil Conservation Act, 1938, for the purpose of soil conservation or erosion mitigation. The sources of funds for the Gobondery Project are outlined in Table 1, and include NSCP, SCS, landholders, SRA and the Shire Council.

The landholders financed all structural and land management works directly associated with erosion control and prevention on their properties. Being in a Project Area, the landholders were waived of the normal criteria which apply for eligibility for SCS Advances. At the time of the commencement of the Project, SCS Advances were available at 4.5% over 15 years, presently the interest rate is 8%. Table 1 shows the total landholder commitment to be \$201,000.

The Federal Government, through the NSCP, funded up to 100% of the works that were of a benefit to the community as a whole, rather than to the individual landholder. On individual properties, the landholder contributed the cost of banking work, while the NSCP covered the cost of waterways, as it is in the community's interest to co-ordinate the drainage from the properties. The NSCP commitment to the project was \$327,939.

The SCS component of \$218,600 covered the costs of planning, design and co-ordination of project works and supervision of their construction.

The SRA contributed \$35,000. This was used to install new pipe outlets under the rail line in places where previous flooding had caused siltation, gullyng and losses in ballast. The Parkes Shire Council spent \$435,000 upgrading the road between Tullamore and Trundle.

TABLE 1: DIRECT PROJECT COSTS

Source of Funds	Nominal	Present Value*	%
Landholders (works)	201000	141896	15
Parkes Shire	435000	319398	35
State Rail	35000	23191	3
NSCP	327969	259228	28
SCS	218600	180080	19
TOTAL	1217569	923793	100

* 1983-84 Dollars

LAND MANAGEMENT IN GOBONDERY

Table 2 shows the extent of the erosion problem existing in the Project Area at the time of commencement of the project. The present land use is as follows: 25% of catchment under timber, 10% under native pasture and remaining

65% under regular cultivation. The project contains Class II to Class VII inclusive, as per the SCS land classification system.

TABLE 2: EXTENT OF EROSION IN GOBONDERY

Severe and extensive gully erosion	200 ha	(6%)
Moderate gully erosion	325 ha	(10%)
Sheet and rill erosion	1815 ha	(55%)
Moderate wind erosion	155 ha	(5%)
No appreciable erosion	805 ha	(24%)

The erosion problem evident from Table 2 can be directly attributed to the intensive cropping patterns adopted in the catchment. Multiple tillage and long-fallow practices have left the highly erodible soils exposed to frequent summer storms, and contributed to the rapid structural breakdown of the soil. The structural breakdown has in turn led to a reduction in infiltration rates, causing high levels of flooding during storms, as was experienced in 1982.

The project was thus designed to address the total problem, starting from the grass-roots. Contour banks were installed to stop overland flows and to direct the water into controlled flows down waterways. Concrete flumes and drop structures were erected in the flowlines to safely handle the large volumes of water that could be expected to occur during a storm. Gullies have also been filled, halting their progress across paddocks, and facilitating easier farming operations.

The drainage from the waterways has been coordinated in order for the water to be removed from the properties and safely directed past public installations. Another aspect of the project is the ongoing promotion of more conservative farming practices, such as reduced-till, the incorporation of grain legumes into the rotation in order to build up soil structure, and a larger reliance on pastures in the rotation. The incorporation of the above practices should help to reduce soil loss and productivity loss significantly.

METHODOLOGY

The approach used to evaluate the Gobondery project takes the form of a benefit-cost analysis.

Parameters and Assumptions

The implementation of the major project works commenced in 1983/84 and was substantially completed by 1988-89 (at which date the evaluation is conducted). All dollar amounts are quoted in real 1983/84 values (ie. in constant or real terms reflecting the purchasing power of a dollar in 1983/84), unless stated to be in nominal values of another year.

Two evaluation periods are used in the analysis. A fifteen year evaluation period is used as a short to medium term horizon, while a twenty five year analysis represents the medium to long term situation. A real discount rate of 5 percent equivalent to a nominal discount rate of 13 percent

Identification

Costs: The costs attributable to the project are the direct costs of expenditure incurred by the participants in the initial stages and the maintenance costs likely to be incurred during the life of the project.

Benefits: The benefits from the project are derived from several different areas. The on-farm benefits include the productivity increases resulting from the treatment of the area as well as the resulting increase in land values. Benefits also derive from less damage being incurred to roads, railways, silos and other public utilities as well as from a reduced level of damage and fewer delays incurred by road users. Benefits are also derived from the demonstration value of the project.

Measurement

(a) Project Costs

As well as the initial establishment costs, a maintenance cost has been calculated. Maintenance costs were assumed to be 5% of the landholders' original contribution per year beginning at year 10.

Table 3 lists the actual costs incurred in nominal terms by source, and in nominal and present values for each year and in total. The total nominal expenditure of \$1,456,169 has a present value of \$945,622.

(b) Public Benefits

(i) Road Repair

The Parkes Shire Council estimates that flood damage like that incurred in 1982 would cost \$108,000 to repair in 1988/89, and that similar levels of damage could be expected once every 10 years. The saving of repair cost has been incorporated in the analysis by averaging the cost over 10 years. The Shire also estimates that routine annual work of \$20,000 (1988/89) in the form of re-sheeting and maintenance has been avoided due to the project being implemented. The benefits are phased in from year 1 to year 5, due to only partial completion of the project, after which they remain constant.

(ii) Silo Savings

In 1982, the silo at Gobondery was flooded, with the loss of \$60,000 worth of grain. This represents a loss of \$70,000 in 1983/84 dollars due to a 1 in 20 year rainfall event, or \$3,500 per year. The benefits to the silo from the project are assumed not to start flowing until year 5, when all the structural works are completed.

(iii) State Rail Authority Savings

The SRA estimates that the flood damage incurred in 1982 would cost approximately \$100,000 to fix in 1983/89. Given the rain that caused the

flood was a 1 in 20 year event, the damage is assumed to be \$5,000 per year in 1988/89 dollars, or \$3,400 per year in 1983/84 dollars.

(iv) Improved Techniques

Through the implementation of the project, improved flume construction techniques have been developed. It is estimated that these techniques will reduce the cost of flume construction in the Macquarie Region of the SCS alone by \$15,000 (1987/88) per year, or \$11,000 per year in 1983/84 dollars. This benefit is not included in the analysis until year 5, when all of the structural works were finished.

(c) Private Benefits

(i) Land value

This item reflects the capitalised value of future production benefits available to the landholder on the sale of his or her property. To avoid double-counting, this item has been incorporated only at the end of the evaluation period. As no research has been conducted into the effect of soil conservation works on land values in the Macquarie Region, estimated current values have been used for the purposes of this analysis. (Valuations courtesy of the State Bank Regional Valuer, Dubbo).

Grazing: 410ha upgraded from 2nd to 1st class, ie.
from \$135/ha to \$187.50/ha.

Cropping: 1840ha upgraded from poor 2nd to good 2nd class, ie.
from \$198/ha to \$300/ha.

The total increase in land value is thus:
 $[410 * (187.50 - 135)] + [1840 * (300 - 198)] = \$207,975$

As this is a nominal value, it must be deflated to 1983/84 dollars. The value of the increase in land value is thus \$141,548 (incorporated in year 25).

(ii) Productivity - traditional rotation

Grazing: The 410ha of treated grazing land will have carrying capacity increased from 2 sheep per 3 acres (1.67 dse/ha) to 2.5 sheep per 3 acres (2.08 dse/ha). The gross margin for sheep is assumed to remain at \$30/dse.

The total benefit is $(410 * 0.41 * 30) = \$5043$ per year. The grazing land is completely rested for the 1st year after treatment, with carrying capacity increasing to 50% of max in the 2nd year, 75% in the 3rd year and 100% in the 4th year. Half of the grazing land was treated in 1986/87 and the remainder in 1987/88.

Cropping: The 1840ha of treated cropping land will have wheat yields increased from 5 bags (1.03 t/ha) to 7 bags (1.44 t/ha), ie. by 0.41 t/ha. The gross margin therefore increases from \$57.58/ha to \$108.83/ha, ie. by \$51.25/ha. As the land is cropped 2 years in 5, the benefit will be:

$$(1840 * 1/2.5 * 51.25) = \$37,720 \text{ per year.}$$

The cropping land will also have its grazing capacity raised by 0.41 dse/ha (as with the grazing land) in 3 years out of 5. The benefit is thus:
 $(1840 * 3/5 * 0.41 * 30) = \$13,579$ per year

The benefit from increased production on the cropping ground is thus:

$$\$37,720 + \$13,720 = \$51,299 \text{ per year}$$

Cropping land will experience an increase in yield in the year of treatment. 50% of the area was treated in 1986/87, with the remainder in 1987/88. The total benefit due to increased productivity is therefore:

$$\$5043 + \$51,299 = \$56,342 \text{ (present value } \$42,983)$$

(iii) Productivity - preferred rotation

The calculations above assume that the traditional rotation of wheat/pasture is maintained. However, an alternative rotation includes grain legumes to build up soil fertility and structure. It has been estimated that on the clear ground, i.e. free of excess stone, the wheat yield following a pea crop could increase to between 10 and 12 bags per acre (2.06 t/ha to 2.47 t/ha). In this analysis, a yield of 2.00 t/ha following a pea crop was used.

YEAR	1	2	3	4	5	6
Traditional Rotation	Wht	Wht	Past.	Past.	Past.	
Preferred Rotation	Wht	Peas	Wht	Past.	Past.	Past

The expected gross margin from the traditional rotation of one wheat crop each 2.5 years is \$148,989 after the project. For the recommended rotations, the stony land must be managed differently to the clear land, as stony land is not very suitable for harvesting grain legumes, which do not grow as tall as traditional cereals.

With the introduction of grain legumes, the average annual expected gross margins for the rotation are:

$$\begin{aligned} \text{Stony: } 368 \text{ ha} * \$37.44/\text{ha} &= \$29,798 \\ \text{Clear: } 1472 \text{ ha} * \$97.10/\text{ha} &= \$142,936 \\ \text{Total Gross Margin} &= \$172,734 \end{aligned}$$

The increase in expected gross margin due to the introduction of grain legumes is thus:

$$\$172,734 - \$148,989 = \$23,745 \text{ per year (1988/89)}$$

(iv) Flood Damage Avoided

As a result of the implementation of the project, fences in flow-lines are no longer subject to flood damage. It is estimated that 200m of fencing was in need of replacement on each property every 1 to 2 years (average 1.5 years) and the total cost (materials + labour) is \$4.00/m. The annual cost of repairs to fences is therefore:

$$(200 * 11 * 1/1.5 * 4) = \$5,867 \text{ per year (1988/89)}$$

A house, which was previously subject to flood damage once every 5 years, is now safe from this risk. The estimated value of the damage avoided is \$2,500 per event or an average of \$500 per year (1988/89).

(d) Off-site Benefits

The project has been of significant demonstration value, having helped to give the SCS and soil conservation in general a higher profile in the wider community. Some flow on has been experienced with a higher demand for the SCS Plant Hire Service from landholders who have seen the effects of the project.

Comparison

The costs and benefits of the project for the 25 year evaluation period, assuming continuation of traditional cropping rotations, are summarised in Table 3 and detailed in Table 4. Table 5 presents details of costs and benefits assuming adoption of recommended cropping rotations.

TABLE 3: PRESENT VALUE OF COSTS AND BENEFITS
GOBONDERY SOIL CONSERVATION PROJECT*

Item	1983-84 Dollars

Costs related to:	
Capital	923800
Maintenance	21800

Total Costs	945600
Benefits related to:	
Production increase	398100
Land value	41800
Shire savings	257000
SRA savings	44700
Fencing savings	50700
House flood savings	4300
Silo savings	36900
Access, phone, water	+
Improved techniques	130100

Total Benefits	963600

NET PRESENT VALUE	18000 plus

* Discount rate 5% and evaluation period 25 years

+ Positive, not calculated

On the basis of the assumptions and methodology outlined above, the project is estimated to have a net present value of -\$243700 for an analysis over 15 years. Over an evaluation period of 25 years the project is estimated to have a net present value of \$18000. With the introduction of legumes into the

rotation, the net present value of the project is -\$126600 over 15 years and \$195100 over 25 years. In addition, a number of identified benefits have not been valued for various reasons. As can be seen from Figure 1, in economic terms, the project is shown to break even between years 24 and 25 for the traditional rotation, and in year 20 with a legume based rotation.

As Figure 2 shows, over 25 years, the present value of landholder benefits is \$494900, compared to a present value of landholder costs of \$163700. The net present value of the project to landholders is therefore \$331200. With a legume based rotation, the present value of landholder benefits is \$672000, which gives a net present value of \$508300.

The present value of contributions by Federal, State and Local government agencies on behalf of the community is \$781900, with benefits being \$468700 over 25 years. The deficit to the community of \$313200 is at least partly offset by identified but unmeasured benefits plus other potential benefits which have been ignored in this evaluation. These include any multiplier effects resulting from increased producer incomes and any intergenerational transfer value associated with the protection of the project area.

DISCUSSION AND CONCLUSIONS

The analysis suggests that the Gobondery Project would have positive net benefits to the community in the long term. This result would appear to be consistent with previous studies suggesting that benefits from soil conservation works are usually of a long term nature. Indeed, this would be one of the major justifications for the assistance from government agencies.

One important factor that should be noted is that the analysis compares the situation with and without the project. However, it could be realistically argued that the situation without the project would be one of continuing degradation, as compared to the stable level of degradation assumed in the analysis. Given the scenario of increasing degradation (hence falling production and increased damage to public property) without the project, it would appear that the estimates of the benefits derived from the project in this analysis are at least mildly conservative. It would be very difficult, however, to estimate the continuing level of degradation that would occur without the project.

The breakeven point of the project is sensitive to the introduction of more conservative rotations and farming practices. If the optimum rotation of minimum-till cropping combined with legumes is totally adopted, the project will break more quickly than if the traditional rotation and practices are maintained. Already there are signs that most of the farmers in the project are willing to implement at least some of the necessary changes to their practices.

Even though the benefits to private landholders are proportionately larger, and accrue more quickly, than those for the rest of the community, the impetus of government involvement is vital. The effectiveness of the project stems from the co-operation achieved between the participants. This meant that the

problem could be addressed as a whole, not just by a piece-meal approach. An individual landholder may spend considerable amounts of money trying to combat soil erosion on their own property, only to have raging floodwaters come through from a neighbour's property and ruin the work. Landholders are not as keen to try to address land degradation problems if they feel that their long-term investments are put at risk by neighbours neglecting to tackle their problems. If there is a community commitment to tackling the problem, then there is a much greater chance of success.

The benefits resulting from contributions by various governments and bodies appear to be less than the contributions that these organisations made. However, there are a number of benefits that could not be measured which would balance the scales somewhat. These external benefits were discussed in the previous section.

In conclusion, the analysis outlined in this paper suggests that the Gobondery Soil Conservation Project will produce positive net benefits to the community. These benefits, however, will accrue over a long period.

Year	1983/84	1	2	3	4	5	6	7	8	9	10	11	12	13
COSTS:														
Landholder	10420	26805	33703	36700	93372						562	2054	4038	6341
Shire		100000	100000	140000	95000									
SRA				25000	10000									
NSOP	61000	41862	75610	149497										
SCS	47800	58100	57700	36000	19000									
'01' NOM. COSTS	119220	226767	267013	387197	217372	0	0	0	0	0	562	2054	4038	6341
TOTAL NOM. COSTS (A)	119220	209969	228921	307369	159775	0	0	0	0	0	261	881	1603	2332
DISCOUNTED (C)	119220	199971	207638	265517	131447	0	0	0	0	0	160	515	893	1237
BENEFITS:														
Prod. increase				-6990	7829	31816	36170	38345	38345	38345	38345	38345	38345	38345
Imp. land value														
Shire savings		4192	8383	12575	16767	20959	20959	20959	20959	20959	20959	20959	20959	20959
SRA savings			3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403
Fencing savings		998	1996	2995	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993
House flood savings		85	170	255	340	340	340	340	340	340	340	340	340	340
Silo savings						3499	3499	3499	3499	3499	3499	3499	3499	3499
Access, phone, water	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Improved techniques		1470	2940	4410	7350	11025	11025	11025	11025	11025	11025	11025	11025	11025
TOTAL BENEFITS (B)	0	6745	16893	16648	39683	75035	79389	81565	81565	81565	81565	81565	81565	81565
DISCOUNTED (D)	0	5827	15323	14381	32647	58792	59241	57966	55206	52577	50074	47689	45418	43255
NET BENEFITS (B-A)	-119220	-220022	-250120	-370549	-177689	75035	79389	81565	81565	81565	81002	79510	77527	75220
DISCOUNTED (E)	-119220	-194144	-192315	-251136	-98800	58792	59241	57966	55206	52577	49914	47174	44525	42019
CUMULATIVE BENEFIT	-119220	-339242	-589362	-959911	-1137600	-1062565	-983176	-901612	-820047	-738482	-657480	-577970	-500443	-425219
DISCOUNTED (F)	-119220	-313364	-505679	-756816	-855616	-796824	-737583	-679616	-624410	-571833	-521919	-474745	-430220	-388201
Nom. Discount Rate	13.00%													
Inflation Rate	8.00%													
Real Discount Rate	5.00%													
Internal Rate of Return	4.74%													
Net Present Value	17958													
Benefit/Cost Ratio	0.02													

N.B. '*' denotes a benefit that couldn't be quantified, but is seen as being positive

DEVELOPMENT BUDGET:

TABLE 4 (cont)

Year	14	15	16	17	18	19	20	21	22	23	24	25	
COSTS:													
Landholder	11888	12839	13856	14976	16174	17468	18865	20374	22004	23765	25666	27719	439600
Shire													435000
SRA													35000
NSCP													327969
SCS													218600
TOTAL NOM. COSTS	11888	12839	13866	14976	16174	17468	18865	20374	22004	23765	25666	27719	1456169
TOTAL REAL COSTS (A)	4047	4047	4047	4047	4047	4047	4047	4047	4047	4047	4047	4047	1078901
DISCOUNTED (C)	2044	1947	1854	1766	1682	1602	1525	1453	1384	1318	1255	1195	945622
BENEFITS:													
Prod. increase	38345	38345	38345	38345	38345	38345	38345	38345	38345	38345	38345	38345	797388
Imp. land value													141548
Shire savings	20959	20959	20959	20959	20959	20959	20959	20959	20959	20959	20959	20959	482047
SRA savings	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	81670
Fencing savings	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	93835
House flood savings	340	340	340	340	340	340	340	340	340	340	340	340	7997
Silo savings	3499	3499	3499	3499	3499	3499	3499	3499	3499	3499	3499	3499	73479
Access, phone, water	*	*	*	*	*	*	*	*	*	*	*	*	*
Improved techniques	11025	11025	11025	11025	11025	11025	11025	11025	11025	11025	11025	11025	247705
TOTAL BENEFITS (B)	81565	81565	81565	81565	81565	81565	81565	81565	81565	81565	81565	223113	1925668
DISCOUNTED (D)	41196	39234	37366	35586	33892	32278	30741	29277	27883	26555	25291	23986	963580
NET BENEFITS (B A)	69676	68725	67598	66589	65391	64097	62699	61190	59560	57800	55899	195394	469500
DISCOUNTED (E)	39151	37287	35511	33820	32210	30676	29215	27824	26499	25237	24036	22891	17958
CUMULATIVE BENEFIT	-355543	-286818	-219110	152531	-87140	-23043	39657	100847	160407	218207	274106	469500	
DISCOUNTED (F)	-349049	-311762	-2762	242430	-210220	-179544	-150329	-122505	-96005	-70768	-46732	17958	

Year	1983/84	0	1	2	3	4	5	6	7	8	9	10	11	12	13
COSTS:															
Landholder	10420	26805	33703	36700	93372							562	2054	4038	6341
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NSCP	61000	41862	75610	149497											
SCS	47800	58100	57700	36000	19000										
TOTAL NOM. COSTS	119220	226767	267913	387197	217372	0	0	0	0	0	562	2054	4038	6341	
TOTAL REAL COSTS (A)	119220	209969	228921	307369	159775	0	0	0	0	0	261	881	1603	2332	
DISCOUNTED (C)	115220	199971	207638	265517	131447	0	0	0	0	0	160	515	893	1237	
BENEFITS:															
Prod. increase				6990	15910	47976	52330	54506	54506	54506	54506	54506	54506	54506	54506
Imp. land value															
Shire savings		4192	8383	12575	16767	20959	20959	20959	20959	20959	20959	20959	20959	20959	20959
SRA savings			3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403
Fencing savings		998	1996	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993
House flood savings		85	170	255	340	340	340	340	340	340	340	340	340	340	340
Silo savings						3499	3499	3499	3499	3499	3499	3499	3499	3499	3499
Access, phone, water	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Improved techniques		1470	2940	4410	7350	11025	11025	11025	11025	11025	11025	11025	11025	11025	11025
TOTAL BENEFITS (B)	0	6745	16833	16648	47763	91196	95549	97725	97725	97725	97725	97725	97725	97725	97725
DISCOUNTED (D)	0	5827	15323	14381	39295	71454	71300	69451	66144	62994	59995	57138	54417	51826	
NET BENEFITS (B-A)	119220	220022	250120	370549	169609	91196	95549	97725	97725	97725	97163	95671	93688	91384	
DISCOUNTED (E)	119220	194144	192315	251136	92152	71454	71300	69451	66144	62994	59835	56623	53524	50589	
CUMULATIVE BENEFIT	119220	333242	589362	959911	1129520	1038324	942775	845050	747325	649600	552437	456766	363079	271695	
DISCOUNTED (F)	119220	313364	505679	756816	848968	777514	706214	636762	570618	507524	447789	391166	337642	287053	
Nom. Discount Rate	13.00%														
Inflation Rate	8.00%														
Real Discount Rate	5.00%														
Internal Rate of Return	6.29%														
Net Present Value	195066														
Benefit/Cost Ratio	0.21														

N.B. (*) denote a benefit that couldn't be quantified, but is seen as being positive

DEVELOPMENT BUDGET:

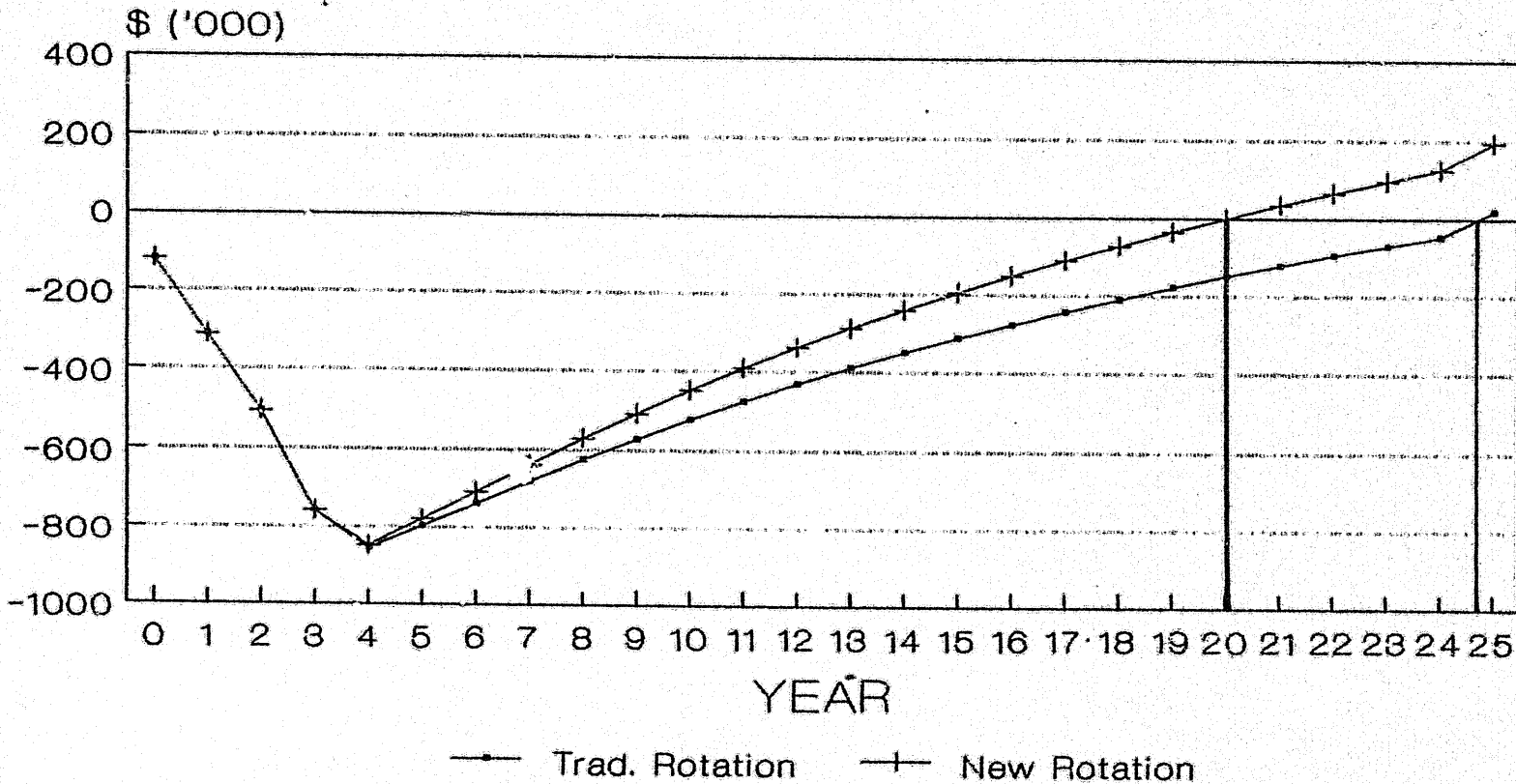
TABLE 5 (cont)

Year	14	15	16	17	18	19	20	21	22	23	24	25	
COSTS:													
Landholder	11888	12939	13866	14976	16174	17468	18865	20374	22004	23765	25666	27719	438600
Shire													435000
SRA													35000
NSOP													327969
SCS													218600
TOTAL NOM. COSTS	11888	12839	13866	14976	16174	17466	18865	20374	22004	23765	25666	27719	1456169
TOTAL REAL COSTS (A)	4047	4047	4047	4047	4047	4047	4047	4047	4047	4047	4047	4047	1078901
DISCOUNTED (C)	2044	1947	1854	1766	1682	1602	1525	1453	1384	1318	1255	1195	345622
BENEFITS:													
Prod. increase	54506	54506	54506	54506	54506	54506	54506	54506	54506	54506	54506	54506	1144837
Imp. land value													141548
Shire savings	20959	20959	20959	20959	20959	20959	20959	20959	20959	20959	20959	20959	482047
SRA savings	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	3403	81670
Fencing savings	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	3993	93835
House flood savings	340	340	340	340	340	340	340	340	340	340	340	340	7997
Silo savings	3499	3499	3499	3499	3499	3499	3499	3499	3499	3499	3499	3499	73479
Access, phone, water	*	*	*	*	*	*	*	*	*	*	*	*	*
Improved techniques	11025	11025	11025	11025	11025	11025	11025	11025	11025	11025	11025	11025	247705
TOTAL BENEFITS (B)	97725	97725	97725	97725	97725	97725	97725	97725	97725	97725	97725	239273	2273118
DISCOUNTED (D)	49358	47007	44769	42637	40607	38673	36832	35078	33407	31816	30301	28658	1140688
NET BENEFITS (B-A)	85837	84886	83859	82749	81551	80257	78860	77351	75721	73960	72059	211554	816949
DISCOUNTED (E)	47314	45061	42915	40871	38925	37071	35306	33625	32024	30499	29046	27463	195066
CUMULATIVE BENEFIT	185858	100972	17114	65674	147187	227444	306304	383655	459375	533336	605395	816349	
DISCOUNTED (F)	239739	194678	151764	110893	71968	34896	410	34034	66058	96557	125603	195066	

Figure 1

GOBONDERY PROJECT

Discounted Cumulative Net Benefits

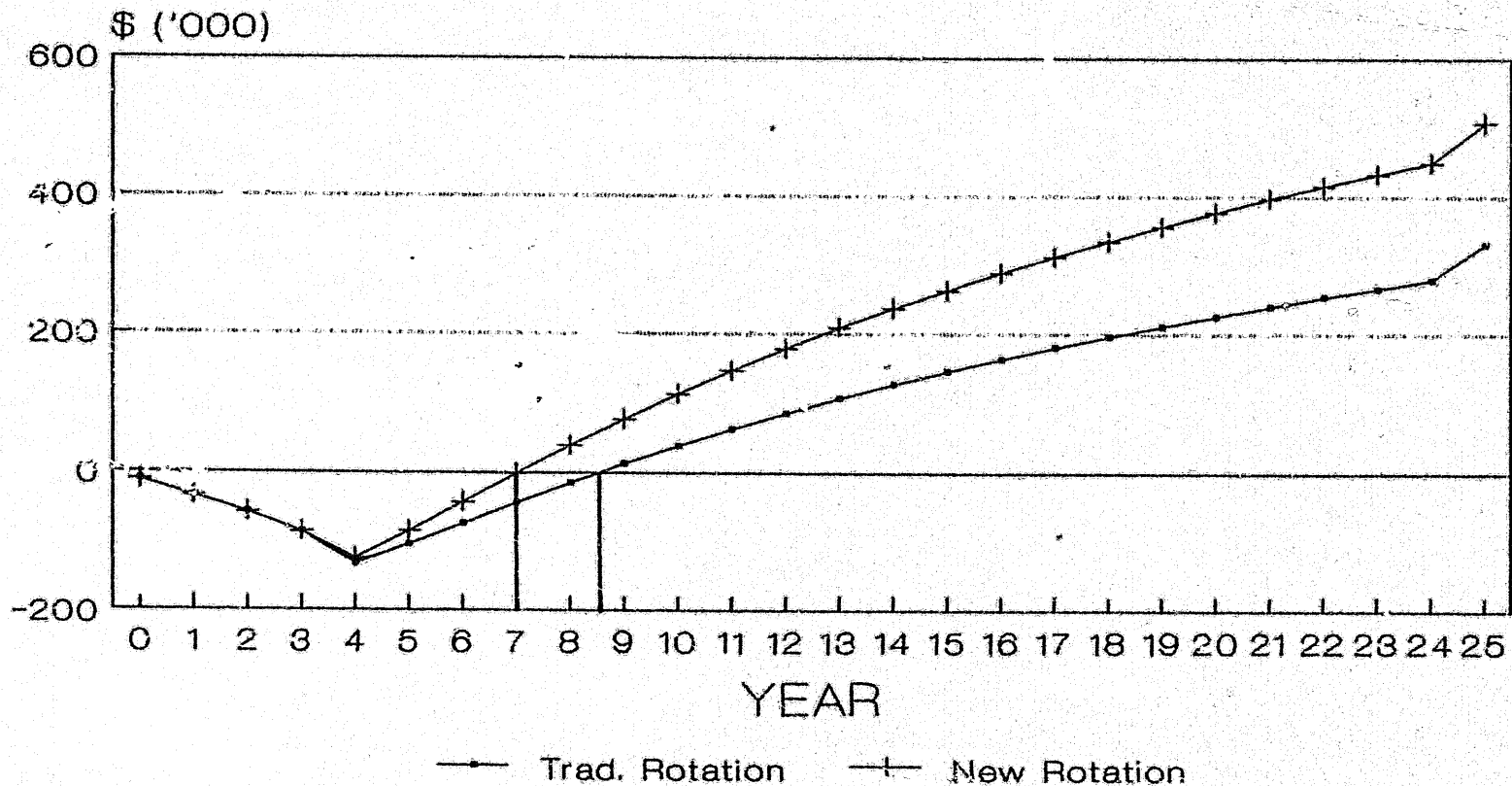


% Real Discount Rate

Figure 2

GOBONDERY PROJECT

Disc. Cum. Net Benefits to Landholders



5% Real Discount Rate