(d) Lower rate for labour

The cost estimates have been based on Tk55 per day for unskilled labour. These estimates conventionally include a percentage for contractors' profit. Contractors normally pay labour at most the current market wage rate, taking the difference as profit. However, since the market wage rate in Gaibandha is very low (Tk20-30), and since if LCS groups are employed the contractors' profit would be reduced, actual cost savings could be made. If the costs were based on a rate for unskilled labour of Tk40 instead of Tk55, the IRR would increase to 11%.

(e) Hazard analysis

This sensitivity run explores a hypothetical extreme event causing embankment failure. It assumes failure shortly after completion of all parts of the project. Resulting damages are assumed roughly equivalent to actual damages during the 1988 flood, and are followed by a need for reconstruction (assumed at 50% of original construction costs), and a period of 4 years during which recovery back to full development takes place. The IRR under this scenario drops to 3.3%. Although the analysis is speculative, it serves to demonstrate the risks associated with failure of the structural elements of the project. The damages in such an extreme event would be similar without the proposed developments, but the return to the developments themselves would be lower.

The results of the sensitivity analyses confirm the analysis in the regional plan which shows that projects are more sensitive to proportionate changes in the level of benefits (especially agricultural benefits) than to changes in costs.

4.5 Partial Analysis of the Navigation Potential in the Gaibandha Project

The proposed measures to improve navigation in the area involve adaptation of regulators to allow boat passage, and re-excavation of some rivers and canals to allow boats to enter into the area.

The following canal/river stretches have been suggested for re-excavation:

Masankura to Pirgacha	-	15 km
Matherhat canal to Sunderganj	-	31.8 km
Manas to Bamandanga	-	37.2 km.

The following structures would need to be adapted/constructed to allow navigation:

(a) Mirganj regulator
(b) Masankura regulator
(c) Sarai regulator
(d) Sunderganj crossing compartment road
(e) Manas regulator
(f) Bamandanga beel outlet.

The benefits gained would be in terms of expanded capacity to move goods from and to the interior of the project area during the monsoon and post-monsoon period, and the cheaper freight rates involved compared with the main alternative form of long-distance trade, trucks. Goods could be moved by small boats between the area and the main ports on the Brahmaputra, Jorgach Bazar to the north (Chilmari thana) and Fulchari ghat to the south (Fulchari thana).

Since the data base on current goods movements is uncertain, an attempt has been made to analyse whether the proposed navigation measures are likely to attract enough cargo to make them economically viable. Economic analysis was used to determine the stream of annual net benefits that would be required for the proposals to reach breakeven point. The minimum volumes of cargo that would have to be carried by boat were then calculated by working back from the net benefit figure. The calculations are explained below.

(a) Costs

Construction/adaptation of 6 structures	=	Tk52.8 mn
Re-excavation of 84km river/canal	=	Tk67.2 mn
Total cost	=	Tk120 mn.
25% contingency	=	Tk 30 mn
Engineering/supervision @ 15%	=	Tk 22.5 mn
Grand Total	=	Tk152.5 mn.

Applying conversion factors to get economic costs:

6 structures @ Tk 52.8 mn x 0.87	=	Tk 47 mn
Re-excavation @ Tk 67.2 mn x 0.65	=	Tk 43.7 mn
Total economic cost	=	Tk 90.7 mn.
Annual O&M cost @5%	=	Tk4.54 mn.

(b) Benefits

Breakeven net return (economic prices) (assumes build-up over 3 years after construction, and 12% discount rate).	=	Tk21 mn.
Freight rate differential between boat and truck for goods moved Gaibandha-Dhaka	=	Tk15 per md. (Tk405 per m.t.)
Freight rate differential (economic prices)	=	Tk15 x 0.87
	=	Tk13 per md.
Annual movement of goods required for breakeven	=	Tk21 mn/Tk13
	=	1.61 mn md. (59,630 m.t.).

Assume 70% cargo-load of paddy, 30% of jute, i.e.
41,741 m.t. paddy
17,889 m.t. jute.

Assume av. yield of 4.5 m.t./ha. paddy,
assume av. yield of 1.7 m.t./ha. jute.

Area required to supply produce for carriage by boat
=41,741/4.5 = 9,276 ha. paddy
17,889/1.7 = 10,523 ha. jute.

Current areas under these crops in the project area (1989 BBS statistics):

All paddy - 75,577 ha.
Boro/aus - 30,964 ha.
Jute - 11,517 ha.

Proportion of total output required to be shipped out of the area:

All paddy - 12%
Boro/aus - 30%
Jute - 91%.

(c) Discussion and Conclusions

The above calculations only give a rough guide to possibilities, but they suggest that further detailed study of navigation potential might be justified. The calculations have been made considering only two commodities, although these are the most important bulk exports out of the area. However, increased trade out of the area can be expected to stimulate trade into the area, so that potential sources of cargo are greater than considered here. In terms of the volumes of paddy and jute requiring to be shipped, it is not clear that they will be reached. The paddy volume is not large in relation to the total paddy area, but Gaibandha is not a major paddy exporter. Most jute is exported out of the area, but at present much of the jute is carried by truck.

The scope of any navigation improvement requires more detailed work. The works costed in this analysis may not all be necessary, and the navigation concept could be changed, e.g. transhipment points could be created at the site of the regulators so that small boats could still operate inside them.

Apart from the potential for economic benefits, there are also significant potential gains in terms of local income and employment.

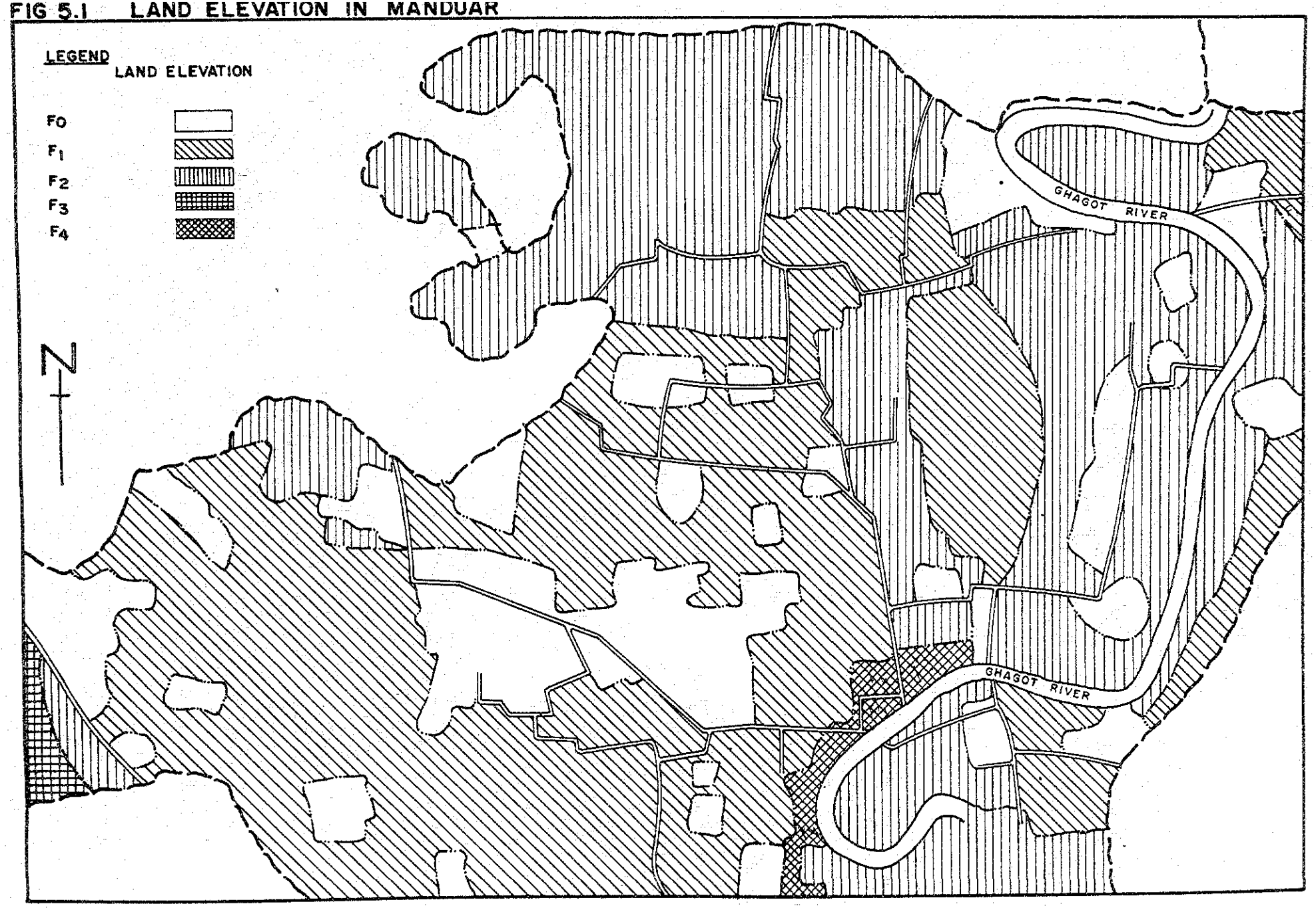
In summary, the scope for navigation should be explored in detail in the next phase of project preparation.

5. Farm-Level Changes in Cropping and Income Distribution

The final analysis makes use again of the agro-economic survey. One of the six villages has been analysed to examine income distributional effects of the shifts in flood phases and cropping patterns resulting from the project. It should be stressed that this analysis is a provisional one, since the existing data cannot be used to say precisely what the shift in flood phase at village level will be. Nonetheless it is considered a useful indicative analysis of the types of change that may occur.

The village, Manduar, is located on the Ghagot right bank (see Fig. 5.1.) and is subject to inundation from spills out of the Ghagot River. Sealing of the Teesta Right embankment will reduce spills in this area, and some general reduction in water levels and changes in flood phasing can therefore be expected.

FIG 5.1 LAND ELEVATION IN MANDUAR



There are a total of 209 households in the village, with the following distribution:

Category	No.	% all hhs
Landless labour	62	30
Pure tenants	25	12
Small farmers	83	40
Medium farmers	34	16
Large farmers	5	2

A sample of farm households was selected, as follows:

	No. in sample
Pure tenants	5
Small farmers	15
Medium farmers	10
Large farmers	5

Basic agro-economic data were collected from the sample farmers, including data on the flood phase distribution of owned and operated land. The flood phase data, and data on cropping patterns, are the basic data sets required to analyse possible shifts in cropping pattern and income distribution between farm size categories. These data sets are available for present condition: in addition, information is needed on the likely shifts in flood phase distribution as a result of flood control.

The following flood phase distribution was recorded for the sample farmers:

	F0	F1	F2	F3
Tenants	21	31	21	27
Small farmers	15	32	45	8
Medium farmers	6	31	47	16
Large farmers	20	55	19	6
Total sample	13	41	36	10

There is considerable variation in the flood phase distribution between farm-size groups, and therefore the probability that different groups will benefit to different degrees from measures which will basically reduce the level of flooding on currently flooded land.

Cropping patterns were developed by flood phase on the basis of the survey results.

The next step in the analysis was to establish the degree of change in flood phases with-project. Since there is no model output at such a localised scale it was assumed that the scale and direction of shift would be similar to that expected for the project area as a whole. The proportionate shift in flood phase was then applied to the land of that flood phase within each farm-size group: therefore, if 25% of total F2 land was expected to shift to F1, this proportion would be applied to the F2 land held by each farm-size category. Those groups holding the biggest amounts of F2 land under present conditions would therefore experience the greatest shift and, probably, the greatest proportionate change in net incomes.

The assumed flood phase distribution under with-project conditions becomes:

	F0	F1	F2	F3
Tenants	28	30	20	22
Small farmers	20	31	42	7
Medium farmers	8	31	47	14
Large farmers	27	51	18	4

Source: For above tables: Consultants' Agro-economic Survey

In this case the main shift is some decline in F2 + F3 land, most of which goes to F0 land.

The changes in cropping patterns resulting from this shift in flood phasing were derived using the approach described earlier in the regional plan section of this volume. These changes are shown in Tables 5.1. to 5.5. for each farm-size group.

The resulting changes in net returns for a single farm household are also shown in the above tables, and the changes in income distribution at the village level are shown in Table 5.6. The village-level income distribution is calculated by multiplying the household-level net income figures by the number of households of that category in the village. The results are discussed here.

The only negative change in net income occurs for pure tenants. The reason is that, as they change from growing local t. aman to HYV t. aman, tenants are forced onto the market to purchase more inputs, since they generally cannot supply their own seeds, draught power or irrigation. Therefore intensification of production appears to make them worse off. If this is the case, it might be thought that tenants should not intensify production: however, they might then not be able to get land for sharecropping.

This may be a significant finding: it appears that tenants would be unlikely to benefit much, if at all, from intensification of production.

Other farm-size groups all increase net incomes, although not by very large amounts. Overall distribution of net income at village level remains almost the same.

Additional income to wage labourers increases, but only by 2%.

In summary, the changes brought about have small benefits for small, medium and large farmers, and appear to have negative consequences for tenants. Generally the changes that occur are not very large since the shift in flood phasing is also not very big.

This brief summary of results is indicative of an approach to analysis: the results themselves cannot be said to represent the changes likely to occur throughout the project area. Further analysis of results for the remaining survey villages will however allow more general conclusions to be drawn.

6. Project Financing Requirements

The final stage of the analysis has involved deriving the financing requirements for the Gaibandha project in its entirety, with phasing according to the schedule for construction laid down in the Main Volume.

TABLE 5.1 CROPPING PATTERNS AND NET RETURNS BY FARM-SIZE GROUP

FUTURE WITHOUT
TENANT FARMER

SHARE CROPPED LAND	PERFARM LAND (ACRES)	NET RETURN FULLCOST)	NET INCOME	NET RETURN CASH COST)	CASH COST	IRED LAB/ OTAL LAB.
NET LAND	3.13					
L BPRO						
HYVBORO	0.61	4410.86	4961.25	2925.60	5070.71	0.33
WHEAT	0.01	57.17	65.27	24.97	69.61	0.28
POTATO						
JUTE	0.07	240.49	278.77	73.92	284.97	0.49
B.AMAN						
LTAMAN	0.39	4263.49	4421.09	408.58	4517.23	0.47
HYVAMAN						
OIL						
OTHER						
TOTAL	1.09	8972.01	9726.38	3433.08	9942.52	0.37

CI

FUTURE WITH
TENANT FARMER

STANDARD FARMER

SHARE CROPPED LAND	PERFARM LAND (ACRES)	NET RETURN FULLCOST)	NET INCOME	NET RETURN (CASH COST)	CASH COST	IRED LAB/ OTAL LAB.
NET LAND	3.13					
L BPRO						
HYVBORO	0.61	4414.18	4964.98	2927.81	5074.53	0.33
WHEAT	0.01	55.35	63.19	24.18	67.39	0.28
POTATO						
JUTE	0.07	240.49	278.77	73.92	284.97	0.49
B.AMAN						
LTAMAN	0.22	2358.99	2446.19	226.07	2499.38	0.47
HYVAMAN	0.18	785.57	0.00	0.00	0.00	0.35
OIL						
OTHER						
TOTAL	1.13	7069.01	7753.13	3251.97	7926.27	0.36

CI

TABLE 5.2 CROPPING PATTERNS AND NET RETURNS BY FARM-SIZE GROUP

FUTURE WITHOUT
SMALL FARMS

OWN LAND	PERFARM LAND (ACRES)	NET RETURN FULLCOST)	NET INCOME	NET RETURN (CASH COST)	CASH COST	IRED LAB/ OTAL LAB.
HYVBORO	0.98	6589.99	7257.94	4079.41	7795.25	0.47
WHEAT	0.11	451.09	493.91	157.69	542.51	0.35
JUTE	0.11	330.37	392.63	100.57	414.41	0.49
LTAMAN	0.84	1162.17	1498.17	717.36	1858.53	0.47
HYVAMAN	0.20	1093.73	1200.16	239.87	1324.59	0.51
OIL	0.09	187.12	210.00	77.79	227.08	0.28
TOTAL	2.40	2706.99	3192.24	1114.92	3725.64	0.47
CI	206.00					

FUTURE WITH
SMALL FARMS

OWN LAND	PERFARM LAND (ACRES)	NET RETURN (FULLCOST)	NET INCOME	NET RETURN (CASH COST)	CASH COST	HIRED LAB/ TOTAL LAB.
HYVBORO	0.98	6589.99	7257.94	4079.41	7795.25	0.47
WHEAT	0.11	452.27	495.20	158.10	543.93	0.35
JUTE	0.11	330.37	392.63	100.57	414.41	0.49
LTAMAN	0.77	1059.79	1366.19	654.16	1694.81	0.47
HYVAMAN	0.33	1747.66	1917.72	383.29	2116.56	0.51
OIL	0.09	187.12	210.00	77.79	227.08	0.28
TOTAL	2.45	3324.95	3886.54	1215.81	4452.85	0.47
CI	211.00					

TABLE 5.3 CROPPING PATTERNS AND NET RETURNS BY FARM-SIZE GROUP

FUTURE WITHOUT
SMALL FARM SHARE CROPPED

SHARE CROPPED LAND	PERFARM LAND (ACRES)	NET RETURN FULLCOST)	NET INCOME	NET RETURN CASH COST)	CASH COST	IRED LAB/ OTAL LAB.
HYVBORO	0.59	3406.97	3856.89	2391.68	4180.72	0.40
WHEAT	0.00	0.00	0.00	0.00	0.00	0.13
JUTE	0.01	33.86	41.14	9.76	43.98	0.38
LTAMAN	0.53	1048.68	1346.60	433.05	1574.83	0.36
HYV AMAN	0.06	269.67	304.47	60.36	340.95	0.40
TOTAL	1.20	4759.18	5549.10	2894.85	6140.47	0.38

CI 197.69

FUTURE WITH

SHARE CROPPED LAND	PERFARM LAND (ACRES)	NET RETURN FULLCOST)	NET INCOME	NET RETURN CASH COST)	CASH COST	IRED LAB/ OTAL LAB.
HYVBORO	0.59	3406.97	3856.89	2391.68	4180.72	0.40
WHEAT	0.00	0.00	0.00	0.00	0.00	0.13
JUTE	0.01	33.86	41.14	9.76	43.98	0.38
LTAMAN	0.53	1048.68	1346.60	433.05	1574.83	0.36
HYV AMAN	0.06	269.67	304.47	60.36	340.95	0.40
TOTAL	1.20	4759.18	5549.10	2894.85	6140.47	0.38

CI 197.57

TABLE 5.4 CROPPING PATTERNS AND NET RETURNS BY FARM-SIZE GROUP

FUTURE WITHOUT
MEDIUM FARMERS

OWN LAND	ERFARM LAND (ACRES)	NET RETURN (FULLCOST)	NET INCOME	NET RETURN (CASH COST)	CASH COST	HIRED LAB/ TOTAL LAB.
LBORO	0.07					
HYVBORO	1.42	8132.26	8699.46	10045.15	5697.52	0.70
WHEAT	0.28	1040.02	1124.92	1250.85	386.58	0.50
POTATO	0.10					
JUTE	0.96	2730.43	3056.15	3368.46	921.60	0.67
LTAUS	0.05					
B.AUS	0.30	491.29	568.77	698.11	146.32	0.55
B.AMAN	0.23					
LTAMAN	2.01	2323.01	2684.45	3708.53	1028.10	0.63
HYVAMAN	0.37	2212.84	2300.44	2554.85	496.77	0.76
BANANA	0.07					
OTHERS	0.06					
OIL	0.06	149.89	160.33	179.18	50.46	0.44
TOTAL	5.96	17079.74	18594.52	21805.11	8727.34	0.65

CI 150.10

FUTURE WITH
MEDIUM FARMERS

OWN LAND	ERFARM LAND (ACRES)	NET RETURN (FULLCOST)	NET INCOME	NET RETURN (CASH COST)	CASH COST	HIRED LAB/ TOTAL LAB.
LBORO						
HYVBORO	1.42	8132.26	8699.46	10045.15	5697.52	0.70
WHEAT	0.28	1040.02	1124.92	1250.85	386.58	0.50
POTATO	0.10					
JUTE	0.96	2730.43	3056.15	3368.46	921.60	0.67
LTAUS	0.05					
B.AUS	0.30	491.29	568.77	698.11	146.32	0.55
B.AMAN	0.12					
LTAMAN	2.01	2323.01	2684.45	3708.53	1028.10	0.63
HYVAMAN	0.45	2728.16	2836.16	3149.81	612.45	0.76
BANANA	0.07					
OTHERS	0.06					
OIL	0.06	149.89	160.33	179.18	50.46	0.44
TOTAL	5.93	17595.06	19130.24	22400.08	8843.02	0.65

CI 149.45 0.00

TABLE 5.5 CROPPING PATTERNS AND NET RETURNS BY FARM-SIZE GROUP

FUTUREWITHOUT PERFARM
LARGE FARMERS

OWN LAND	PERFARM LAND (ACRES)	NET RETURN FULLCOST)	NET INCOME	NET RETURN (CASH COST)	CASH COST	IRED LAB/ OTAL LAB.
HYVBORO	2.87	15910.06	16483.26	11148.74	19962.58	0.85
WHEAT	0.40	1482.61	1530.61	594.40	1820.61	0.79
PULSES	0.07	377.95	385.87	30.62	411.87	0.68
POTATO	0.17					
ONION	0.04					
JUTE	0.93	2655.39	2804.51	1085.78	3087.84	0.85
LTAUS	0.53					
B.AUS	0.00	0.00	0.00	0.00	0.00	0.58
LTAMAN	2.99	3695.29	4053.61	3057.66	6099.02	0.86
HYVAMAN	0.00	0.00	0.00	0.00	0.00	0.85
OIL	0.26	536.82	579.06	228.62	685.98	0.60
TOTAL	8.25	24658.13	25836.93	16145.83	32067.92	0.85

CI 124.25

FUTURE WITH PERFARM

OWN LAND	PERFARM LAND (ACRES)	NET RETURN FULLCOST)	NET INCOME	NET RETURN (CASH COST)	CASH COST	IRED LAB/ OTAL LAB.
HYVBORO	2.87	15910.06	16483.26	11148.74	19962.58	0.85
WHEAT	0.40	1482.61	1530.61	594.40	1820.61	0.79
PULSES	0.07	377.95	385.87	30.62	411.87	0.68
POTATO	0.17					
ONION	0.04					
JUTE	0.93	2655.39	2804.51	1085.78	3087.84	0.85
LTAUS	0.53					
B.AUS	0.00	0.00	0.00	0.00	0.00	0.58
LTAMAN	2.53	3130.98	3434.58	2590.72	5167.63	0.86
HYVAMAN	0.46	2000.43	2091.58	748.79	2408.33	0.85
OIL	0.26	536.82	579.06	228.62	685.98	0.60
TOTAL	8.25	26094.24	27309.47	16427.68	33544.85	0.85

CI 124.25

TABLE 5.6 CHANGES IN NET INCOME BY FARM-SIZE GROUP: MANDUAR VILLAGE

NET INCOME AT VILLAGE LEVEL (TK.)

	Future Without	% Total	Future with	% Total	% Change
Tenants	81,375	4	66,675	3	-0.18%
Small Farmers	1,020,804	51	1,073,014	52	+ 5%
Medium Farmers	741,404	37	761,600	37	+ 3%
Large Farmers	160,340	8	167,725	8	+ 4%
	2,003,923		2,069,014		+ 3%
Landless Labourer					

Note:
Tenant net income is after deduction of 50% share of crop of landlord.

The financing requirements are shown in Table 6.1. Total proposed expenditure is Tk. 1.67 bn, of which almost 75% is local expenditure, a large proportion of which will be paid to local labourers.

The project costs comprise about 50% of proposed expenditure under the short-and medium-term components of the NW regional plan. The expenditure, however, is phased over a long period, and includes works (sealing of the TRE) which will have a wide regional impact.

Table 6.1 Project Financing Schedule (tk. mn.)

Year	Foreign	Local	Total
1	12.06	29.61	41.67
2	12.06	42.37	54.43
3	59.85	158.27	218.13
4	115.32	284.52	399.84
5	133.83	336.33	470.16
6	56.28	174.18	230.45
7	13.99	77.35	91.34
8	5.52	30.03	35.55
9	11.88	29.81	41.69
10	18.41	41.93	60.34
11	8.37	18.12	26.49
Total	447.56	1222.52	1670.08
$mn	12.43	33.96	46.39