

ANNEX-2
Geotechnical Investigation Report

A Brief Report on Geotechnical Investigation

A geotechnical investigation was carried out at two locations of the proposed tunnel section along the trunk sewer line of the proposed sewerage system beside the urban lakeshore of the Study Area.

One bore hole of 10 m (BH-1) depth is conducted at Sahid Chowk, whereas another of 5 m (BH-2) depth is conducted at Baidam Chowk (see Fig II-1 in the following page).

The location of the holes are such that they fall under the proposed tunnel section. The distance between the two locations is nearly 1 km (950 m).

Strata

At Baidam Chowk (BH2), a top soil of silty clay with fine gravels and boulders is struck up to 1.5m followed by conglomerate. At Sahid Chowk (BH 1) the over burden of sandy silty with gravel and boulders was struck upto 5m followed again by conglomerate.

From the observation of the only two holes it can be broadly concluded that the depth of over burden is decreasing towards the Phewa Lake, however it is difficult to confirm based on only two holes.

As a reference, from our previous investigation at Pokhara Airport, the conglomerate is found about a meter below the ground at several locations.

It is also observed that at and around the periphery of Phewa Lake, exposed hammocks of conglomerate can be seen at several places.

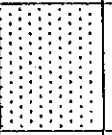
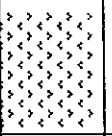
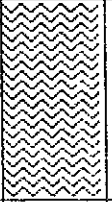

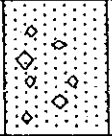
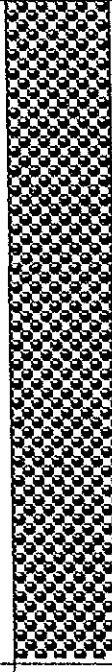
The conglomerate consists mostly of calcareous aggregate cemented with marl. The size of aggregate varies from cobbles to fine gravel. Different cycles of sedimentation starting from coarse ending to fine are observed, and various degree of porosity are found. The rock is physically and chemically weak. Physically the rock is very weak under water. It was found that the rock can bear 50.0 kg/cm² in dry state and 20.0 kg/cm² when wet, whereas, a limestone has 90 kg/cm². Chemically rock consists principally of carbonates and clayminerals.

Detail log is attached herewith.

BORE HOLE LOG

PROJECT : Phewa Lake Env. Pres.
 CLIENT : JICA

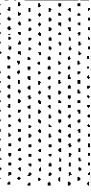

BORE HOLE: 1
 LOCATION: Sahid Chowk

Scale	B Elevation	Depth m	Thickness m	Symbol	Classification m	SOIL DESCRIPTION	Water Table m	Scale
1		1.0	1.0		GP	Top soil, silty clay followed by sandy gravel & gravel	NA	1
2		2.0	1.0		SM	Sandy silty with gravel & lime mixed clay		2
3		3.5	1.5		GP	Weathered boulders of sand & limestone wth gravel & sand		3
4		4.0	0.5		GP	Sandy silt with lime stone boulders		4
5		5.0	1.0		GP	Layers of sandy clay mixed with limestone boulders		5
6		10.0	5.0		Rock	Conglomerate		6
7							7	
8							8	
9							9	
10							10	

BORE HOLE LOG

PROJECT : Phewa Lake Env. Pres.
 CLIENT : JICA

BORE HOLE: 2
 LOCATION: Baldam Chowk

Scale	Elevation m	Depth m	Thickness m	Symbol	Classification m	SOIL DESCRIPTION	Water Table m	Scale
0								0
1		1.5	1.5		GP	Top soil clay with fine gravels & boulders		1
2								2
3			3.5		Rock	Layers of sandy clay, fine sand with suspended gravels (Conglomerate)		3
4								4
5		5.0						5
6								6
7								7
8								8
9								9
10								10

TEST RESULT SUMMARY SHEET

Bore Hole No.: 1

Project: Phewa Lake Project

Location: Pokhara

S.No.	Depth m	Soil Classification	Sieve analysis % passing ASTM					Atterberg Limits			Natural Moisture Content %	SPT blows	Sp. Gr.
			Gravel	Sand		Silt	Clay	L.L.	P.L.	P.I.			
				Coarse to medium	Fine								
1	0 - 1	GP	45	35	20	-	-	-	-	-	5		2.63
2	7 - 8	GP	47	43	14	6	-	22	NP	-	10		2.62
3	9 - 10	GP	35	35	22	8	-	24	NP	-	9		2.66

TEST RESULT SUMMARY SHEET

Bore Hole No.: 2

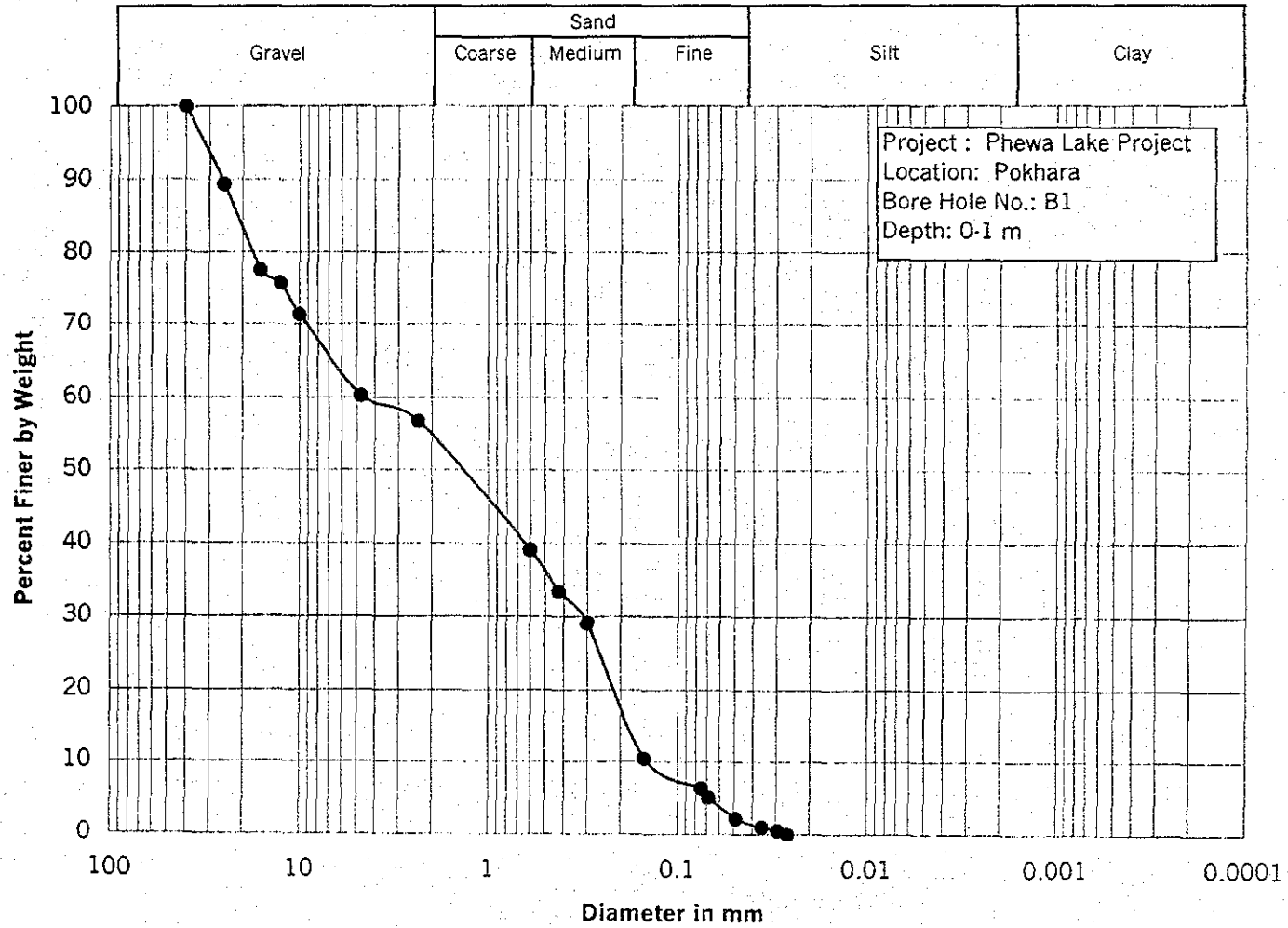
Project: Phewa Lake Project

Location: Pokhara

S.No.	Depth m	Soil Classification	Sieve analysis % passing ASTM					Atterberg Limits			Natural Moisture Content %	SPT blows	Sp. Gr.
			Gravel	Sand		Silt	Clay	L.L.	P.L.	P.I.			
				Coarse to medium	Fine								
1	2 - 3	GW	52	40	8	-	-	-	-	-	6		2.63
2	4 - 5	GW	48	28	12	8	-	21	NP	-	11.5		2.63

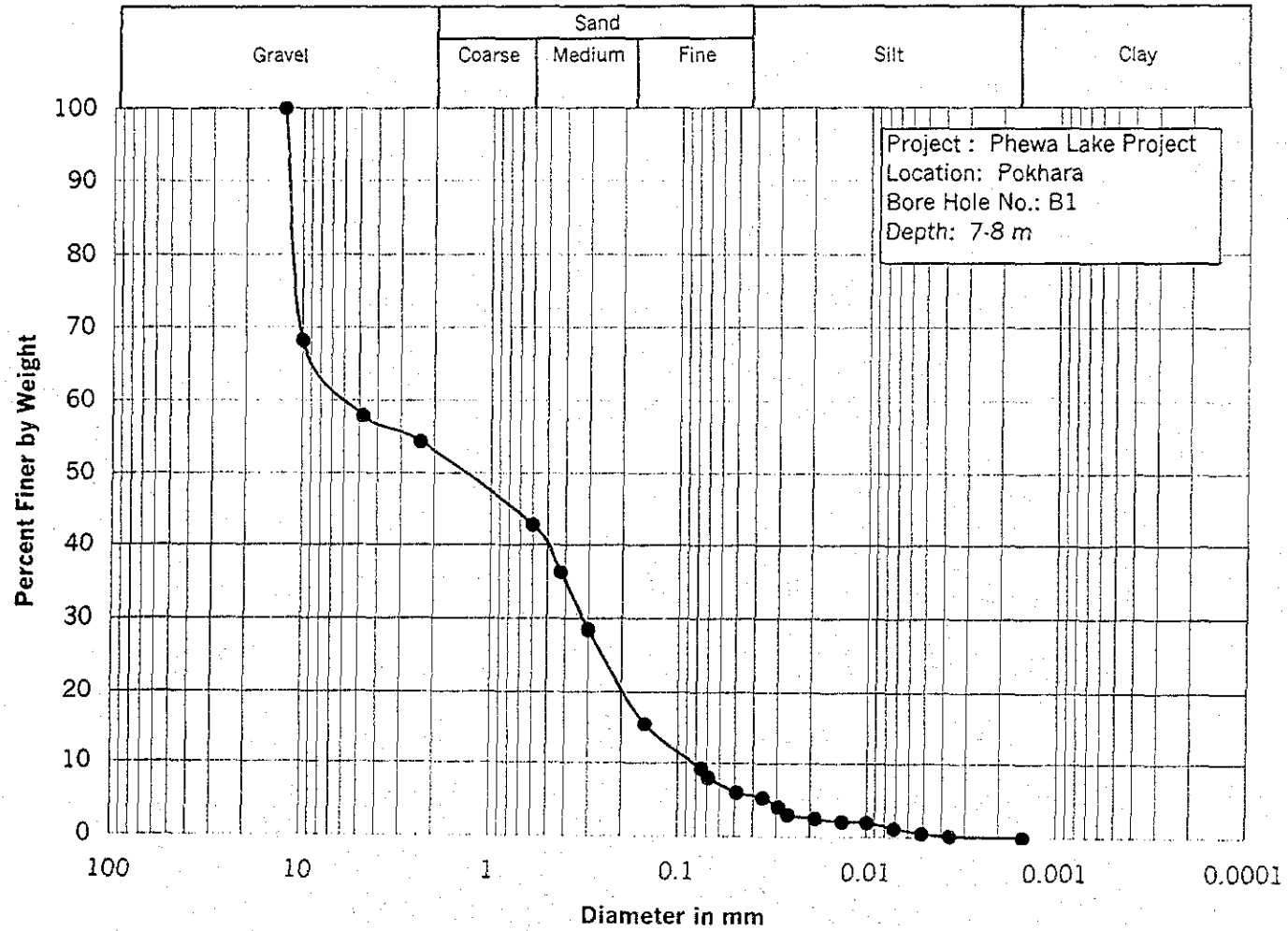
GRAIN SIZE DISTRIBUTION

Indian Standard Grain Size Classification



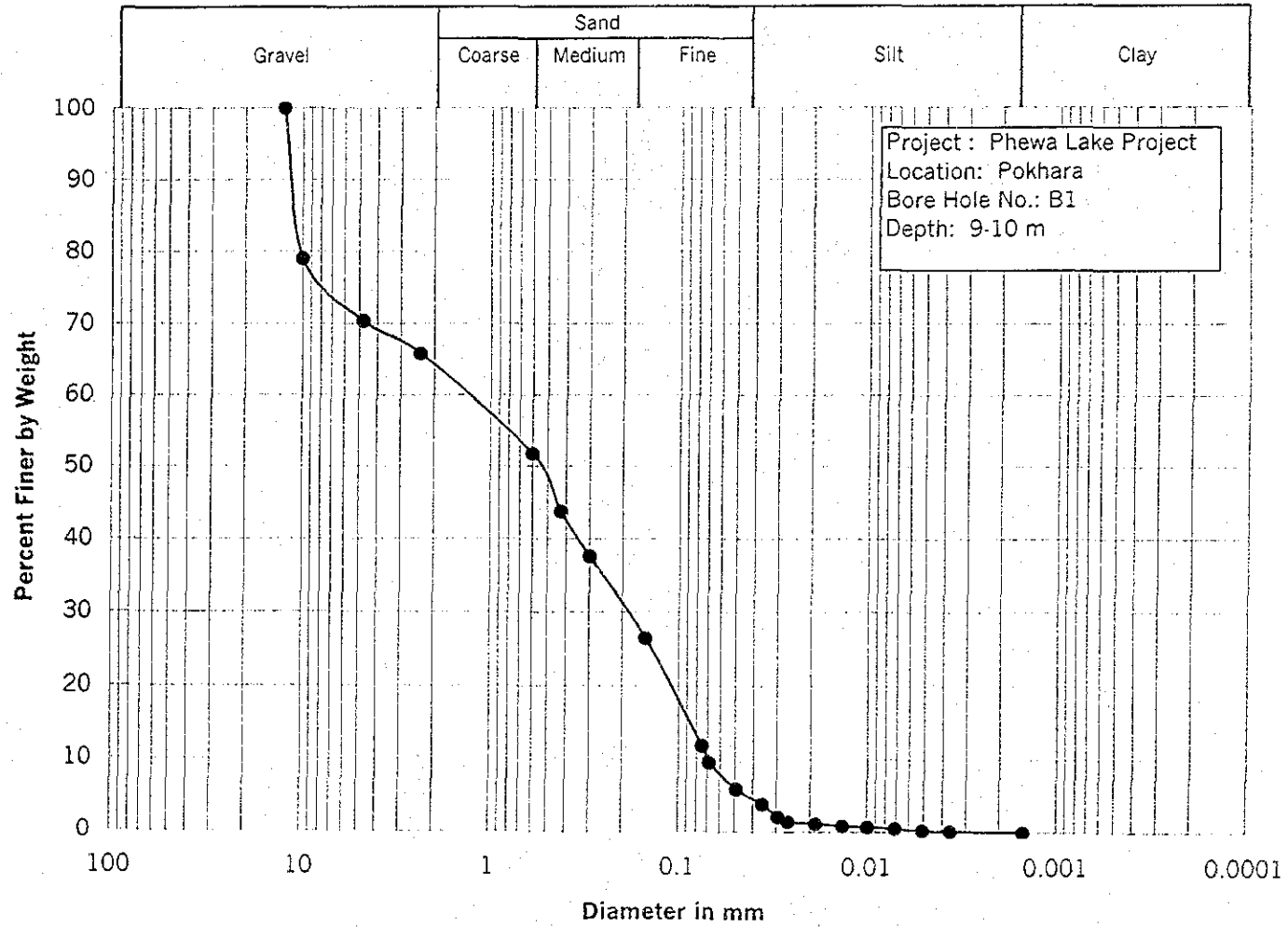
GRAIN SIZE DISTRIBUTION

Indian Standard Grain Size Classification



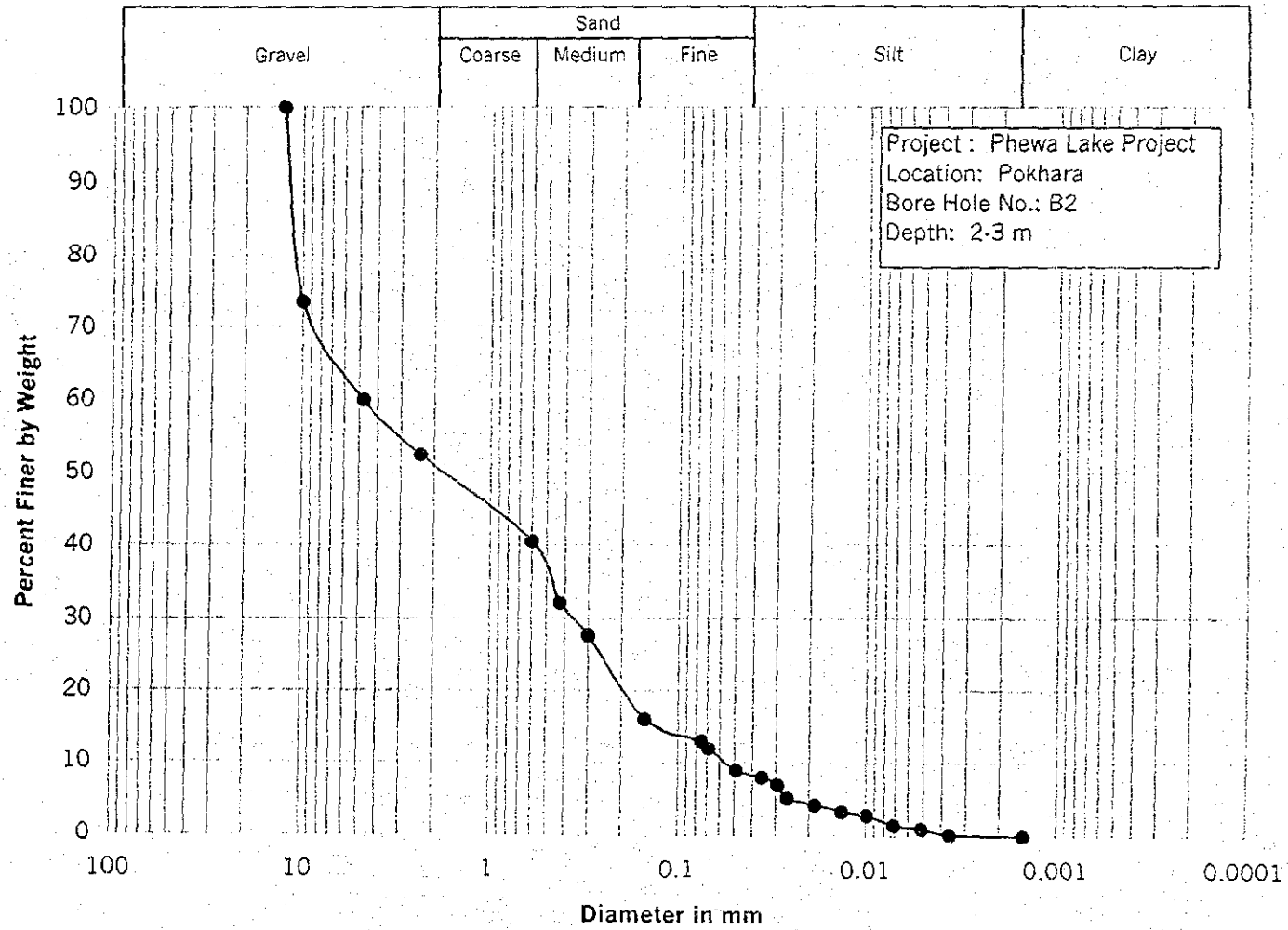
GRAIN SIZE DISTRIBUTION

Indian Standard Grain Size Classification



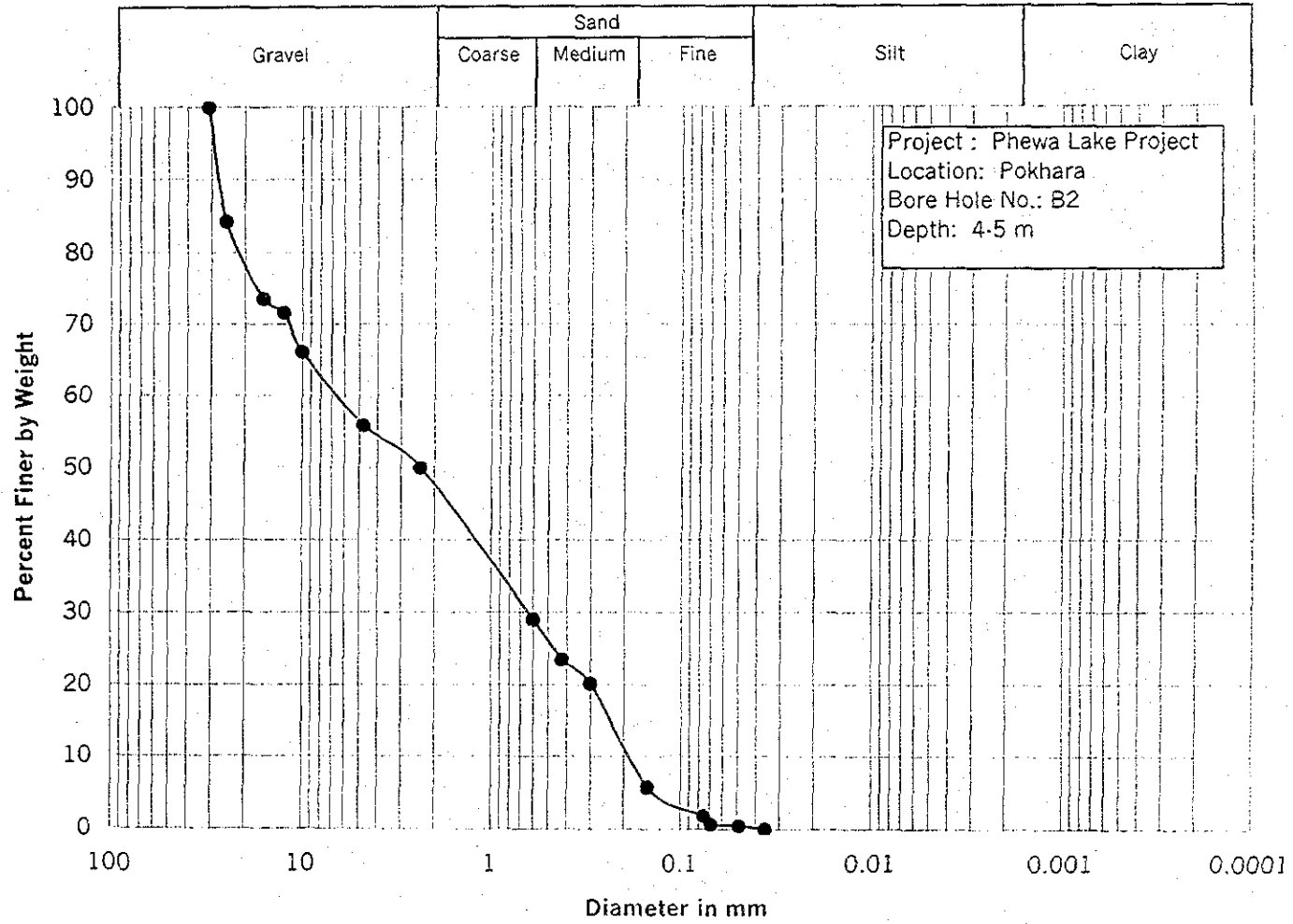
GRAIN SIZE DISTRIBUTION

Indian Standard Grain Size Classification



GRAIN SIZE DISTRIBUTION

Indian Standard Grain Size Classification



ANNEX-3
Economic Analysis

**BASIC ASSUMPTIONS FOR
ECONOMIC ANALYSIS**

Methodology of Computing Net Present Value, Benefit-Cost Ratio, and Internal Rate of Return

Method of economic analysis

The method of computing Net Present Value, Benefit-Cost Ratio, and Internal Rate of Return is explained in the following sections.

Net Present Value (NPV)

The Net Present Value is calculated by using the discount rate. When discount rate is used, which quantifies the preference for present consumption over future, it reduces costs and benefits for different years. The surplus of income over cost reduced to present period provides an indicator to make investment decision.

The NPV of an investment project is determined by discounting the cash inflows back to the present at the required rate of return, R , and then subtracting the discounted cash outflows, so that

$$NPV = \sum_{t=1}^{t=T} \left(\frac{B_t}{(1+R_d)^t} - \frac{C_t}{(1+R_d)^t} \right)$$

Where,

- T = the last year of the project life
- C_t = the annual economic cost flow of the project in year t ,
- B_t = the annual benefit flow derived from the project in year t , and
- R_d = a specific discount rate

If the sum of these discounted cash flows is greater than zero, the investment in the project is worthwhile. Naturally, the higher the NPV of a project, the better it is (The bigger the better principle.) The selection process of the project should be arranged in terms of descending NPV. The major problem with NPV is which discount rate to choose? The problem is solved through iteration process described in the computation of Internal Rate of Return. NPV does not provide us with information on rate of return on investment. For this, another indicator called Benefit Cost Ratio (BCR) is used.

Benefit-Cost Ratio (B/C Ratio)

To obtain benefit-cost ratio, the present value of benefit is divided by present value of cost. The ratio between the two gives us Benefit/Cost ratio, i.e, benefit per rupee of cost.

The Benefit/Cost ratio is defined by the following formula:

$$B/C = \frac{\sum_{t=1}^{t=T} \frac{B_t}{(1+R_d)^t}}{\sum_{t=1}^{t=T} \frac{Comr}{(1+R_d)^t}}$$

Where,

- T = the last year of the project life
 Comr = the annual OM cost and replacement cost in year t,
 B_t = the annual benefits in year t, and
 R_d = a specific discount rate

If BCR is more than unity, an investment in project is worthwhile. Projects with higher BCR are selected from descending order. In a single project, the rule is to select the project if its BCR is higher.

For the NPV (Net Present Value), this figure shows the cash balance at the end of the project life calculated with a specific discount rate through the cash flow, at 8% as applied in the case of economic analysis for this Project.

Internal Rate of Return (IRR)

The internal rate of return (IRR) is the rate at which an investment is repaid by proceeds from a project. It is the rate for an investment project, which equates the present value of the expected cash inflows with the present value of the expected cash outflow.

The internal rate of return (IRR) is calculated by using the tabulated annual average benefits and the annually demarcated project costs, and used as an index in case of considering the economic viability. The IRR is defined by the following formula:

$$\sum_{t=1}^{t=T} \frac{C_t}{(1+R)^t} = \sum_{t=1}^{t=T} \frac{B_t}{(1+R)^t}$$

Where,

- T = the last year of the project life
 C_t = the annual economic cost flow of the project in year t,
 B_t = the annual benefit flow derived from the project in year t, and

R = the economic internal Rate of Return (IRR)

IRR is derived through iteration process. Discount rate is raised or lowered to arrive at a state where NPV becomes zero. There may be a number of combinations of discount rates one of which is the IRR at which NPV is zero.

However, IRR itself does not, on its own provide a criterion for selection of projects. It also has to be compared with market rate of interest, or social rate of interest, or the required rate of return. The required rate of return is the minimum return that is expected to earn on project. Therefore accepting a project with an IRR in excess of the required rate of return should result in an increase in the wealth of the society. In this case, the following investment decisions can be applicable.

The IRR computed is compared with the required rate of return (market rate of interest or social discount rate). If the calculated rate exceeds the required rate, then the project is accepted.

In case of multiple projects, the projects are ranked in descending order of values of IRR so that a set of projects is selected for which IRR is greater, subject to available fund.

Assumptions made for the Economic Analysis

Twenty three tables have been formulated to cover the economic analysis. Estimates of costs and benefits have been made on the basis of assumptions based on the data generated during the time of the study. The assumptions made in preparing each table have been presented here to make the readers clear on the information generated in each table. Therefore the description is made on the basis of the tables.

Tourist Projection

the average per annum growth rate of tourists visiting pokhara used to be 6 to 8 percent before 2001. but due to unprecedented situation, the growth rate has declined in the year 2001. it is hoped that after 2002 the law and order situation within the country will improve and the regional and international situation will also be normalized. this will help in the growth rate of tourists. however, it is assumed that the growth rate would be around 2 percent for three years(2003-05). with the improvement in the quality of water body of phewa lake, and better environment in the surrounding area, the growth rate can increase to 6 per annum. thus, it is assumed that there will be the growth of tourists by 3 percent per annum from 2006-2015, and after 2016 the increased rate of additional 1% annual growth is taken considering the fact that there will be a normal growth of tourists after 2016. please refer appendix table an 1.

Tourist Protection is done comparing the cases with and without the project intervention. Due to severe drop in the rate of tourist arrival in 2001 it is assumed that the Pokhara in 2002 will remain the same. It is also assumed that the growth rate of tourist will not be so high even after 2002. If some appropriate measures are not taken. The assumption of the growth rate of tourist is taken in a more conservative way up 4 percent per annum growth.

The expected income from tourist revenue is taken from the total member of tourists visiting Pokhara, through the entry fee is the new concept introduced by the project.

The net movement in the numbers of tourists is also projected to assess the contribution of the project in attracting tourists and there by generating more income from the visitors. Moderate estimate of expenditure made by non-SAARC, SAARC and Nepali visitors has been taken into consideration.

Length of Stay

It is assumed that with project tourist will stay longer in Phewa, because the natural environment will be clean. The differences in the internal rate of return in two cases with and without project have been identified.

Tourist Entry Fee Vs Hotel Tax

The justification for levying tourist entry fee is already explained in chapter 13 of the main report. In Nepal, in order to collect income from the tourists, hotel tax and entertainment tax were levied prior to the levying of value added tax (VAT) in 1998. Now the tourists pay 10 percent of VAT to the government and 2 percent for the support of activities of Nepal Tourism Board (NTB). NTB uses this fund for the promotion of tourism and providing services to the tourists. With the implementation of VAT, the proposition for levying hotel tax will not be possible. The government is committed to implement VAT. In addition on many occasions, budget-tourists stay in lodges where the rate of tariff vary and such records are not properly kept. It was found that frequently such the rates are drastically reduced. While interacting with the hoteliers during the field visit and public hearing it was found that the hoteliers are hesitant to collect additional tax from the tourists. The DDC municipality and VDC officials are ready to levy entry fee. It is assumed that levying of tourist entry fee of Rs. 200 per person per entry during a visit is found to be appropriate for the non-SAARC tourist and Rs. 50 for tourists from SAARC countries.

Number of Nepali visitors

Data on exact number of Nepali visitors to Pokhara are not available but it was informed during the interactive meeting with the officials of tourism office, travel agents, and hoteliers that the Nepali visitors as tourists to Pokhara is equal to the total number of the foreign visitors. Thus it is assumed that the number of Nepali visitors is equal to total foreign visitors. It is further assumed that with the increase in income of the people living in other urban areas of Nepal and particularly in the city of Kathmandu valley, more Nepalese will visit to Pokhara. So it is estimated that there will be a steady growth in the Nepali visitors to Pokhara.

Share of Benefit of Phewa

The expenditure increase by the tourists is shared by Phewa, Mountain, sight seeing, trekking, cultural tourism. But authentic data are not yet available. However during the field visit, the perspectives of the local people were collected. It was found that Phewa contributes between 40 percent to 60 percent. To be on safe side, the share of Phewa is assumed as 20 percent of the increased benefit.

Share of Increased Benefit from the Improved Phewa

The focus group discussions with the different stakeholders involved in tourism activities have indicated that the factors responsible for attracting more tourists in Phewa Lake area and their share to the total earnings will be as follows:

Improvement in the Water Body with Better System o Sewerage	40%
Improved Infrastructure Facilities in the Surrounding Area	30%
Tourist Facilities available in the Lake Side Area	30%

Phewa Lake Conservation Center

Since this being the institution to generate and disseminate information on Phewa, it needs financial support from PLECC. Thus the cost aspect of the centre is being presented in the financial analysis.

Phewa Lake trust Fund

It is proposed that PLTF will be the financing institution for the conservation of Phewa. It is operated by a small number of staff and the major part of the revenue raised will be spent for development purposes. Thus the cost structure and fund flow analysis of the fund has been prepared.

The following base tables are used to conduct economic analysis of the hardware and software components:

Table AN 1 : Tourist Projection and Estimated Income from Tourist Entry fee
Table AN 2 : Valuation of Economic Benefits from Increased Number of Tourists
Table AN 3 : Estimates of Economic Benefits from Increased Number of Tourists
Table AN 4 : Population and Household Projection of Sewerage Catchments Area of Phewa
Table AN 5 : Cost Structure of Phewa Conservation Centre
Table AN 6 : Cost Structure and Fund Flow of Phewa Lake Trust Fund

The Tables AN 1 to AN 6 are presented below.

Table AN 1
Tourist Projection and Estimated Income from Tourist Entry Fee

Annex

1. Total Tourists Visiting Pokhara												
	2001				93731	(a)						
	Indian				15878	(b)						
	Non-Indian				77853	(c)						
2. Growth Rate (2003) per Annum					2%	(j)		2%				
3. Growth Rate (2004-2005) per annum					2%	(k)		2%				
4. Growth Rate (2006-2015) per annum					3%	(m)		6%				
5. Growth Rate (2016-2030) per annum					4%	(n)		5%				
6. Entry Fee (Rs.) for Non-SAARC Tourists					200	(o)						
7. Entry Fee (Rs.) for SAARC Tourists					50	(p)						

S.N.	Year	Without Project			With Project			Income (in '000 Rs.) From Tourist Entry Fee			
		Total Tourists	Non-Indian	Indian	Total Tourists	Non-Indian	Indian	Net Increment in Tourists	Non-SAARC	SAARC	Total Income
1	2001	93,731	77,853	15,878	93,731	77,853	15,878	0			
2	2002	93,731	77,853	15,878	93,731	77,853	15,878	0			
3	2003	95,606	79,410	16,196	95,606	79,410	16,196	0			
4	2004	97,518	80,998	16,519	97,518	80,998	16,519	0			
5	2005	99,468	82,618	16,850	99,468	82,618	16,850	0	16,524	842	17,366
6	2006	102,452	85,097	17,355	105,436	87,575	17,861	2,984	17,515	893	18,408
7	2007	105,526	87,650	17,876	111,762	92,830	18,933	6,237	18,566	947	19,513
8	2008	108,691	90,279	18,412	118,468	96,400	20,068	9,777	19,680	1,003	20,683
9	2009	111,952	92,988	18,965	125,576	104,304	21,273	13,624	20,861	1,064	21,924
10	2010	115,311	95,777	19,534	133,111	110,562	22,549	17,800	22,112	1,127	23,240
11	2011	118,770	98,650	20,120	141,097	117,196	23,902	22,327	23,439	1,195	24,634
12	2012	122,333	101,610	20,723	149,563	124,227	25,336	27,230	24,845	1,267	26,112
13	2013	126,003	104,658	21,345	158,537	131,681	26,856	32,534	26,336	1,343	27,679
14	2014	129,783	107,798	21,985	168,049	139,582	28,467	38,266	27,916	1,423	29,340
15	2015	133,677	111,032	22,645	178,132	147,957	30,176	44,455	29,591	1,509	31,100
16	2016	139,024	115,473	23,551	187,039	155,354	31,684	48,015	31,071	1,584	32,655
17	2017	144,585	120,092	24,493	196,391	163,122	33,269	51,806	32,624	1,663	34,288
18	2018	150,368	124,896	25,472	206,210	171,278	34,932	55,842	34,256	1,747	36,002
19	2019	156,383	129,892	26,491	216,521	179,842	36,679	60,138	35,968	1,834	37,802
20	2020	162,638	135,087	27,551	227,347	188,834	38,512	64,709	37,767	1,926	39,692
21	2021	169,144	140,491	28,653	238,714	198,276	40,438	69,570	39,655	2,022	41,677
22	2022	175,910	146,111	29,799	250,650	208,190	42,460	74,740	41,638	2,123	43,761
23	2023	182,946	151,955	30,991	263,182	218,599	44,583	80,236	43,720	2,229	45,949
24	2024	190,264	158,033	32,231	276,341	229,529	46,812	86,078	45,906	2,341	48,246
25	2025	197,874	164,354	33,520	290,159	241,006	49,153	92,284	48,201	2,458	50,659
26	2026	205,789	170,929	34,861	304,667	253,056	51,610	98,877	50,611	2,581	53,192
27	2027	214,021	177,766	36,255	319,900	265,709	54,191	105,879	53,142	2,710	55,851
28	2028	222,582	184,876	37,705	335,895	278,994	56,900	113,313	55,799	2,845	58,644
29	2029	231,485	192,271	39,213	352,690	292,944	59,745	121,205	58,589	2,987	61,576
30	2030	240,744	199,962	40,782	370,324	307,591	62,733	129,580	61,518	3,137	64,655

Note for Table AN 1

Number of tourists is assumed to remain constant in 2002

Calculation of Tourist Growth in Income from Entry Fee (With Project)

Non-Indian,2003 = Non-Indian(-1) + Non-Indian(-1) x (j)

Non-Indian,2004-5 = Non-Indian(-1) + Non-Indian(-1) x (k)

Non-Indian,2006-15 = Non-Indian(-1) + Non-Indian(-1) x (m)

Non-Indian,2016-30 = Non-Indian(-1) + Non-Indian(-1) x (n)

Indian,2003 = Indian(-1) + Indian(-1) x (j)

Indian,2004-5 = Indian(-1) + Indian(-1) x (k)

Indian,2006-15 = Indian(-1) + Indian(-1) x (m)

Indian,2016-30 = Indian(-1) + Indian(-1) x (n)

Income from Non-SAARC,2005 = (Non-Indian,2005) x (o)

Income from SAARC,2005 = (Indian,2005) x (p)

Total Income = SAARC Income + Non-SAARC Income

(a) = (b) + (c)

Indian, 2002=Indian, 2001

Non-Indian,2002 = Non-Indian,2001

Total Tourists=Non-Indian+Indian

Calculation of tourist growth without project is the same as that of with project

Table AN 2
Valuation of Economic Benefits from Increased Number of Tourists

Annex

Average Expenditure by	Rs. Per Day	\$ Per Day				
1. Non-SAARC Tourists	3040	40				
2. SAARC Tourists	800	11				
3. Nepali Visitors	500	7				
	2002-2003	2004-2005	2006-2015	2016-2030		
Avg Length of Stay (in Days)	2.5	2.5	3	3.5		
	2002-2003	2004-2005	2006-2015	2016-2030		
Estimated growth rate of visitors						
1. Foreigners	2%	2%	6%	5%		
2. Nepali	5%	6%	7%	8%		
	Estd. Increased No. of Visitors With Project			Economic Valuation (In '000 Rs.)		
	<u>2004</u>	<u>2006</u>	<u>2016</u>	<u>2004</u>	<u>2006</u>	<u>2016</u>
Non-SAARC	0	2,479	39,881	0	22,604	424,336
SAARC (Indian)	0	505	8,134	0	1,213	22,774
Total Foreign Visitors	0	2,984	48,015	0	23,818	447,111
Nepali Visitors (equal to total foreign visitors)	0	2,984	48,015	0	758	14,234
Grand Total	0	5,968	96,030	0	24,576	461,345
Conversion Factors						
Construction Conversion Factor(CCF)	0.79					
Standard Conversion Factor(SCF)	0.95					
Percentage of HH to be served	50%					

Note

Per Visit Expenditure = Per Day Expenditure x Average Length of Stay (in days)

Estimated Number of Visitors (2002) is extracted from Table AN 1

Nepali Visitors equals to Total Foreign Visitors

Economic Valuation for Non-SAARC Tourists = Estimated number of Visitors (Non-SAARC) x per Visit Expenditure

Economic Valuation for SAARC (Indian) = Estimated No. of Visitors SAARC Indian x per Visit Expenditure

Total Foreign Visitors = Non-SAARC + SAARC Indian

Economic Valuation of Nepali Visitors = Estimated No. of Nepali Visitors x Average Expenditure by Nepali Visitors

Grand Total = Total Foreign Visitors + Nepali Visitors

Table AN 3
Estimates of Economic Benefits From Increased Number of Tourists
 (Based on Table AN 2)

Annex

Improvement in the Water Body with Better System of Sewerage	40%
Improved Infrastructure Facilities in the Surrounding Area	30%
Tourist Facilities available in the Lake Side Area	30%
Share of Phewa in the Increased Benefit	20%

Estimation of the Share of Increased Benefit by Different Components

S.N.	Year	Benefits from		Total Benefits	Share of Phewa in the Increased Benefit			Tourist Services & Facilities
		Foreign Visitors	Nepali Visitors (in '000 Rs)		Improved Sewerage	Improved Infrastructure	Tourist Services & Facilities	
1	2004	0	0	0	0			
2	2005	0	0	0	0	0	0	0
3	2006	23,818	758	24,576	4,915	1,966	1,475	1,475
4	2007	25,247	811	26,058	5,212	2,085	1,563	1,563
5	2008	26,761	868	27,629	5,526	2,210	1,658	1,658
6	2009	28,367	929	29,296	5,859	2,344	1,758	1,758
7	2010	30,069	994	31,063	6,213	2,485	1,864	1,864
8	2011	31,873	1,063	32,937	6,587	2,635	1,976	1,976
9	2012	33,786	1,138	34,924	6,985	2,794	2,095	2,095
10	2013	35,813	1,218	37,030	7,406	2,962	2,222	2,222
11	2014	37,962	1,303	39,264	7,853	3,141	2,356	2,356
12	2015	40,239	1,394	41,633	8,327	3,331	2,498	2,498
13	2016	447,111	14,234	461,345	92,269	36,908	27,681	27,681
14	2017	469,466	15,373	484,839	96,968	38,787	29,090	29,090
15	2018	492,939	16,603	509,542	101,908	40,763	30,573	30,573
16	2019	517,586	17,931	535,517	107,103	42,841	32,131	32,131
17	2020	543,466	19,365	562,831	112,566	45,026	33,770	33,770
18	2021	570,639	20,914	591,553	118,311	47,324	35,493	35,493
19	2022	599,171	22,588	621,759	124,352	49,741	37,306	37,306
20	2023	629,130	24,395	653,524	130,705	52,282	39,211	39,211
21	2024	660,586	26,346	686,932	137,386	54,955	41,216	41,216
22	2025	693,615	28,454	722,069	144,414	57,766	43,324	43,324
23	2026	728,296	30,730	759,026	151,805	60,722	45,542	45,542
24	2027	764,711	33,189	797,899	159,580	63,832	47,874	47,874
25	2028	802,946	35,844	838,790	167,758	67,103	50,327	50,327
26	2029	843,094	38,711	881,805	176,361	70,544	52,908	52,908
27	2030	885,249	41,808	927,057	185,411	74,165	55,623	55,623

Note

Benefits from Foreign Visitors(2003) = Valuation of Foreign Visitors times Estimated growth rate of foreign visitors for 2003
 Benefits from Foreign Visitors(2004-5)=Valuation of Foreign Visitors(t-1) times (1+Estimated growth rate of foreign visitors for 2004-5)
 Benefits from Foreign Visitors(2006-15) =Benefits from Foreign Visitors (t-1) [1+ Estimated growth rate of foreign visitors for 2006-15]
 Benefits from Foreign Visitors(2016-30) =Benefits from Foreign Visitors (t-1) [1+ Estimated growth rate of foreign visitors for 2016-30]
 Benefits from Nepali Visitors(2003) = Valuation of Nepali Visitors times Estimated growth rate of Nepali Visitors for 2003
 Benefits from Nepali Visitors(2004-5) =Benefits from Nepali Visitors (t-1) [1+ Estimated growth rate of Nepali Visitors for 2004-5]
 Benefits from Nepali Visitors(2006-15) =Benefits from Nepali Visitors (t-1) [1+ Estimated growth rate of Nepali Visitors for 2006-16]
 Benefits from Nepali Visitors(2016-30) =Benefits from Nepali Visitors (t-1) [1+ Estimated growth rate of Nepali Visitors for 2016-30]
 Total Benefits= Benefits from Foreign Visitors + Benefits from Nepali Visitors
 Share of Phewa in the increased benefit is assumed 50% of the total benefit
 Out of the Phewa share in the increased benefit,40% is assumed to accrue due to improved sewerage, 30% due to improved infrastructure and 30% due to tourists services and facilities

Table AN 4

Annex

Population and Household Projection of Sewerage Catchment Area, Phewa

2. Population Growth Rate:		
	2001-15	4.30%
	2015-30	3.4%
3. Household Size		6.2

Year	Population	H/H
2001	49,561	7994
2002	51,693	8,338
2003	53,916	8,696
2004	56,235	9,070
2005	58,654	9,460
2006	61,176	9,867
2007	63,807	10,292
2008	66,552	10,734
2009	69,414	11,196
2010	72,400	11,677
2011	75,514	12,180
2012	78,761	12,703
2013	82,149	13,250
2014	85,682	13,820
2015	89,367	14,414
2016	92,406	14,904
2017	95,548	15,411
2018	98,796	15,935
2019	102,155	16,477
2020	105,629	17,037
2021	109,220	17,616
2022	112,933	18,215
2023	116,773	18,834
2024	120,743	19,475
2025	124,849	20,137
2026	129,094	20,822
2027	133,483	21,529
2028	138,021	22,261
2029	142,714	23,018
2030	147,566	23,801

Table AN 5
Cost Structure of Phewa Conservation Center

Annex

Initial cost (in Thousand Rs.)	4,800
Increment cost/annum from 2nd year of the project	2%
Replacement cost per first ten years	30%
Share of other revenue in the revenue from entry fee	0.5%

S. N.	Year	Costs (in '000 Rs.)			Revenue (in '000 Rs)		
		Initial Cost	Repl. Cost	O&M Cost	Total Cost	Revenue Earned by the Center	Net Cash Flow
1	2003	4,800			4,800		(4,800)
2	2004			300	300	0	(300)
3	2005			1,191	1,191	87	(1,104)
4	2006			1,215	1,215	92	(1,123)
5	2007			1,239	1,239	98	(1,142)
6	2008			1,264	1,264	103	(1,160)
7	2009			1,289	1,289	110	(1,180)
8	2010			1,315	1,315	116	(1,199)
9	2011			1,341	1,341	123	(1,218)
10	2012		1,440	1,368	2,808	131	(2,678)
11	2013			1,395	1,395	138	(1,257)
12	2014			1,423	1,423	147	(1,277)
13	2015			1,452	1,452	156	(1,296)
14	2016			1,481	1,481	163	(1,318)
15	2017			1,510	1,510	171	(1,339)
16	2018			1,541	1,541	180	(1,361)
17	2019			1,571	1,571	189	(1,382)
18	2020			1,603	1,603	198	(1,404)
19	2021		1,440	1,635	3,075	208	(2,867)
20	2022			1,668	1,668	219	(1,449)
21	2023			1,701	1,701	230	(1,471)
22	2024			1,735	1,735	241	(1,494)
23	2025			1,770	1,770	253	(1,516)
24	2026			1,805	1,805	266	(1,539)
25	2027			1,841	1,841	279	(1,562)
26	2028			1,878	1,878	293	(1,585)
27	2029			1,916	1,916	308	(1,608)
28	2030			1,954	1,954	323	(1,631)

Note

Replacement Cost for 2012 & 2021 = Initial Cost for 2003 x Replacement Cost per first 10 years
O&M Cost from 2006 = O&M Cost (t-1) times [1 + Increment cost per annum from 2nd year of the project]
Total Cost = Initial Cost + Replacement Cost + O&M Cost
Revenue is estimated as 0.5% of the total revenue from tourist entry fee
Cash Flow = Total Revenue - Total Cost

Table AN 6
Cost Structure and Fund Flow of Phewa Lake Trust Fund

Annex

Costs (in '000 Rs)			
Capital Cost	1,000	Share of Other Incomes in Total Income from Entry Fee	10%
Salary Cost	1,300	Annual Increase in Costs	2.5%
O&M Cost	200		
Other Costs	300		
Total Costs	2,800		

S.N.	Year	Costs (In Rs.)					Revenue (In Rs.)			
		Capital	Salary	O&M	Others	Total Cost	Entry Fee	Others	Total Rev.	Cash Flow
1	2003	1,000	1,300	200	300	2,800				(2,800)
2	2004	1,025	1,333	205	308	2,870				(2,870)
3	2005	1,051	1,366	210	315	2,942	17,366	1,737	19,103	16,161
4	2006	1,077	1,400	215	323	3,015	18,408	1,841	20,249	17,234
5	2007	1,104	1,435	221	331	3,091	19,513	1,951	21,464	18,373
6	2008	1,131	1,471	226	339	3,168	20,683	2,068	22,752	19,584
7	2009	1,160	1,508	232	348	3,247	21,924	2,192	24,117	20,870
8	2010	1,189	1,545	238	357	3,328	23,240	2,324	25,564	22,235
9	2011	1,218	1,584	244	366	3,412	24,634	2,463	27,098	23,686
10	2012	1,249	1,624	250	375	3,497	26,112	2,611	28,723	25,227
11	2013	1,280	1,664	256	384	3,584	27,679	2,768	30,447	26,863
12	2014	1,312	1,706	262	394	3,674	29,340	2,934	32,274	28,600
13	2015	1,345	1,748	269	403	3,766	31,100	3,110	34,210	30,444
14	2016	1,379	1,792	276	414	3,860	32,655	3,266	35,921	32,061
15	2017	1,413	1,837	283	424	3,956	34,288	3,429	37,717	33,760
16	2018	1,448	1,883	290	434	4,055	36,002	3,600	39,602	35,547
17	2019	1,485	1,930	297	445	4,157	37,802	3,780	41,583	37,426
18	2020	1,522	1,978	304	456	4,261	39,692	3,969	43,662	39,401
19	2021	1,560	2,028	312	468	4,367	41,677	4,168	45,845	41,478
20	2022	1,599	2,078	320	480	4,476	43,761	4,376	48,137	43,661
21	2023	1,639	2,130	328	492	4,588	45,949	4,595	50,544	45,956
22	2024	1,680	2,183	336	504	4,703	48,246	4,825	53,071	48,368
23	2025	1,722	2,238	344	516	4,820	50,659	5,066	55,725	50,904
24	2026	1,765	2,294	353	529	4,941	53,192	5,319	58,511	53,570
25	2027	1,809	2,351	362	543	5,064	55,851	5,585	61,436	56,372
26	2028	1,854	2,410	371	556	5,191	58,644	5,864	64,508	59,317
27	2029	1,900	2,470	380	570	5,321	61,576	6,158	67,734	62,413
28	2030	1,948	2,532	390	584	5,454	64,655	6,465	71,120	65,667

Table AN 7

Annex

Assessment of Revenue from Income Generating Activities

Income from Tree Plantation (in '000 Rs.)

VDCs	Involved		Tree Plantati on/head	Total Trees	Wood Produced (in kg)	Income from Wood @Rs.1/ Kg
	Trai ned Nos.	in Plantati on				
Sarangkot	200	100	10	1,000	100,000	100
Kaskikot	200	100	10	1,000	100,000	100
Dhikur	200	100	10	1,000	100,000	100
Bhadaure	200	100	10	1,000	100,000	100
Chapakot	200	100	10	1,000	100,000	100
Pumdi	200	100	10	1,000	100,000	100
Total				6,000	600,000	600

Income from and Cost of Buffalo Keeping (in '000 Rs.)

VDCs	Involved		Buffalo Keeping /head	Total Buff	Milk/day (in ltr) @ 6 ltr/buff	Daily Income @ Rs. 13/ltr	Monthly Income	Yearly Income with Milking Period of 8 Mths	Cost of the Buff	Salvage Value of Buff and the value of two calf	Operation Cost of Milk/ltr @40% of the milk price/ltr
	Trai ned Nos.	in Buffalo Keeping									
Sarangkot	200	25	2	50	300	3.90	117	936	750	500	374
Kaskikot	200	25	2	50	300	3.90	117	936	750	500	374
Dhikur	200	25	2	50	300	3.90	117	936	750	500	374
Bhadaure	200	25	2	50	300	3.90	117	936	750	500	374
Chapakot	200	25	2	50	300	3.90	117	936	750	500	374
Pumdi	200	25	2	50	300	3.90	117	936	750	500	374
Total				300	1800	23	702	5,616	4,500	3,000	2,246
Total Income			8,616	Capital Cost			4,500	Operation Cost			2,246

Income from goat keeping (in '000 Rs.)

VDCs	Involved		Goat /head	Total Goats	Income (@Rs 2000/ Goat)	Cost @ Rs.1000/ goat	Salvage Value of goat (small kids & mother)	Operation cost/Year @Rs5/ goat/day	Attend nt Cost for grazing/ vdc	Net Income	
	Trai ned Nos.	in Goat Keeping									
Sarangkot	200	50	2	100	200	100	160	182.50	12	66	
Kaskikot	200	50	2	100	200	100	160	182.50	12	66	
Dhikur	200	50	2	100	200	100	160	182.50	12	66	
Bhadaure	200	50	2	100	200	100	160	182.50	12	66	
Chapakot	200	50	2	100	200	100	160	182.50	12	66	
Pumdi	200	50	2	100	200	100	160	182.50	12	66	
Total				600	1,200	600	960	1095.00	72	393	
Total Income			2,160	Capital Cost			600	Operation Cost			1,167

Income from Rural Poultry (in '000 Rs.)

VDCs	Involved		Per annum 3000/hh	Total Income	Cost @Rs200 0/hh	
	Trai ned Nos.	in Rural Poultry				
Sarangkot	200	100	3,000	300	200	
Kaskikot	200	100	3,000	300	200	
Dhikur	200	100	3,000	300	200	
Bhadaure	200	100	3,000	300	200	
Chapakot	200	100	3,000	300	200	
Pumdi	200	100	3,000	300	200	
Total				1,800	1,200	
Total Income			1,800	Operation Cost		1,200

Table AN 8

Cost and Revenue Components of the Project (Used in Part I, II, III)

S.N.	Year	Costs				Benefits Earned by Phewa From							
		Phewa Lake Conservation Center	Phewa Trust Fund	Sewage Treatment Component	Env Education for Soil Conservation	Community Empowerment and Income Gen Program	Tourist Entry Fee	Increased Number of Tourists	Phewa Lake Conservation Center	Phewa Lake Trust Fund	Sewage Treatment Component	Env Education for Soil Conservation	Community Empowerment and Income Gen Program
1	2001												
2	2002												
3	2003	4,560	2,660	110,998	409	12,319							1,135
4	2004	285	2,727	177,597	818	24,638							3,405
5	2005	1,131	2,795	155,397	818	24,638	16,498		82	1,650			6,810
6	2006	1,154	2,865	6,722	215	4,164	17,488	4,669	87	1,749	6,212	673	11,964
7	2007	1,177	2,936	6,722	226	4,184	18,537	4,951	93	1,854	6,665	687	12,588
8	2008	1,201	3,010	6,722	237	4,205	19,649	5,250	98	1,965	7,152	700	13,244
9	2009	1,225	3,085	6,722	249	4,226	20,828	5,566	104	2,083	7,674	714	13,937
10	2010	1,249	3,162	6,722	262	4,247	22,078	5,902	110	2,208	8,234	729	14,668
11	2011	1,274	3,241	11,802	275	4,269	23,402	6,258	117	2,340	8,805	743	15,438
12	2012	2,668	3,322	11,802	288	4,290	24,807	6,635	124	2,481	9,418	758	16,251
13	2013	1,326	3,405	11,802	303	4,312	26,295	7,036	131	2,630	10,076	773	17,110
14	2014	1,352	3,490	11,802	318	4,333	27,873	7,460	139	2,787	10,782	789	18,015
15	2015	1,379	3,577	11,802	334	4,355	29,545	7,910	148	2,955	11,540	805	18,972
16	2016	1,407	3,667	11,802	350	4,398	31,022	87,655	155	3,102	12,237	821	20,109
17	2017	1,435	3,759	11,802	368	4,442	32,573	92,119	163	3,257	12,979	837	21,342
18	2018	1,464	3,852	11,802	386	4,487	34,202	96,813	171	3,420	13,770	854	22,682
19	2019	1,493	3,949	11,802	406	4,532	35,912	101,748	180	3,591	14,612	871	24,144
20	2020	1,523	4,048	11,802	426	4,577	37,708	106,938	189	3,771	15,508	888	25,746
21	2021	2,921	4,149	16,881	447	4,623	39,593	112,395	198	3,959	16,463	906	27,506
22	2022	1,584	4,252	16,881	470	4,669	41,573	118,134	208	4,157	17,481	924	29,451
23	2023	1,616	4,359	16,881	493	4,716	43,652	124,170	218	4,365	18,564	943	31,607
24	2024	1,648	4,468	16,881	518	4,763	45,834	130,517	229	4,583	19,718	962	34,007
25	2025	1,681	4,579	16,881	544	4,810	48,126	137,193	241	4,813	20,946	981	36,693
26	2026	1,715	4,694	21,961	571	4,858	50,532	144,215	253	5,053	22,255	1,000	39,710
27	2027	1,749	4,811	21,961	599	4,907	53,059	151,601	265	5,306	23,649	1,020	43,115
28	2028	1,784	4,931	21,961	629	4,956	55,712	159,370	279	5,571	25,133	1,041	46,975
29	2029	1,820	5,055	21,961	661	5,006	58,497	167,543	292	5,850	26,714	1,062	51,370
30	2030	1,856	5,181	21,961	694	5,056	61,422	176,141	307	6,142	28,398	1,083	56,394

**ECONOMIC ANALYSIS FOR
SEWAGE TREATMENT SYSTEM**

Table 8:1-A
Economic Analysis of Sewerage System
(With Tunnel)

Without conversion factors

Capital Cost (in '000 Rs.)	486,100				
	Conv. Cost				
Labor Cost (in '000 Rs.)	111,270	111,270	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	374,830	25%	40%	35%
Total Converted Cost (in '000 Rs.)		486,100	121,525	194,440	170,135
O&M Cost (in Thousand Rs.)		7,076	12,423	17,770	23,117
50% of Drinking Water Conn. Charge Rs. 200/hh/month		100			
Annual Increment in Drinking Water Connection		3%			
Benefit From Fish Catch	MT/Yr.	Price(Rs/MT)	in '000 Rs.	Sensitivity	10%
Increment in Fish Catch/annum	98	100,000	9,800		0
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
Share of Phewa				20%	
Percentage of HH to be served				50%	
CCF	1			2002-3	2004-5
SCF	1			2.5	2.5
Discount Rate	7%			3	3.5
		Avg Length of Stay (in Days)			

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue Earned from Fish Catch	Benefits from the Increased		Discounted Cost	Benefit	
									No. of Visitors	Net Benefit			
1	2003		121,525		121,525				0	0	(121,525)	113,575	0
2	2004		194,440		194,440				0	0	(194,440)	169,831	0
3	2005		170,135		170,135				0	0	(170,135)	138,881	0
4	2006	4,934		7,076	7,076	1.20	5,920	588	1,966	8,474	1,398	5,398	6,465
5	2007	5,146		7,076	7,076	1.24	6,360	623	2,085	9,068	1,992	5,045	6,465
6	2008	5,367		7,076	7,076	1.27	6,833	661	2,210	9,704	2,628	4,715	6,466
7	2009	5,598		7,076	7,076	1.31	7,340	700	2,344	10,384	3,308	4,407	6,467
8	2010	5,839		7,076	7,076	1.35	7,886	742	2,485	11,113	4,037	4,118	6,468
9	2011	6,090		12,423	12,423	1.39	8,472	757	2,635	11,864	(559)	6,757	6,453
10	2012	6,352		12,423	12,423	1.43	9,101	772	2,794	12,667	244	6,315	6,439
11	2013	6,625		12,423	12,423	1.48	9,777	788	2,962	13,528	1,105	5,902	6,427
12	2014	6,910		12,423	12,423	1.52	10,504	804	3,141	14,449	2,026	5,516	6,415
13	2015	7,207		12,423	12,423	1.57	11,284	820	3,331	15,435	3,012	5,155	6,405
14	2016	7,452		12,423	12,423	1.61	12,018	820	36,908	49,745	37,322	4,818	19,292
15	2017	7,705		12,423	12,423	1.66	12,799	820	38,787	52,406	39,983	4,503	18,994
16	2018	7,967		12,423	12,423	1.71	13,632	820	40,763	55,215	42,792	4,208	18,703
17	2019	8,238		12,423	12,423	1.76	14,518	820	42,841	58,179	45,756	3,933	18,418
18	2020	8,518		12,423	12,423	1.82	15,462	820	45,026	61,308	48,885	3,675	18,139
19	2021	8,808		17,770	17,770	1.87	16,467	820	47,324	64,611	46,841	4,913	17,866
20	2022	9,108		17,770	17,770	1.93	17,538	820	49,741	68,098	50,328	4,592	17,598
21	2023	9,417		17,770	17,770	1.98	18,678	820	52,282	71,780	54,010	4,292	17,336
22	2024	9,737		17,770	17,770	2.04	19,893	820	54,955	75,667	57,897	4,011	17,079
23	2025	10,068		17,770	17,770	2.10	21,186	820	57,766	79,771	62,001	3,748	16,827
24	2026	10,411		23,117	23,117	2.17	22,564	820	60,722	84,105	60,989	4,557	16,581
25	2027	10,765		23,117	23,117	2.23	24,031	820	63,832	88,682	65,566	4,259	16,340
26	2028	11,131		23,117	23,117	2.30	25,593	820	67,103	93,516	70,399	3,981	16,103
27	2029	11,509		23,117	23,117	2.37	27,257	820	70,544	98,621	75,505	3,720	15,871
28	2030	11,900		23,117	23,117	2.44	29,030	820	74,165	104,014	80,897	3,477	15,644
											538,303	325,261	

Internal Rate of Return 3.00%
B/C Ratio 0.60
NPV (213,042)

Note

Benefit from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x [1+annual increment in drinking water connection]

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Sensitivity

1 = increase in cost by 10%

2 = decrease in revenue by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

0 = no sensitivity test

Table 8:1-B
Economic Analysis of Sewerage System
(With Tunnel)

With 10% increase in cost and without conversion factors

Capital Cost (in '000 Rs.)	486,100				
		Conv. Cost			
Labor Cost (in '000 Rs.)	111,270	111,270	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	374,830	25%	40%	35%
Total Converted Cost (in '000 Rs.)		486,100	121,525	194,440	170,135
O&M Cost (in Thousand Rs.)		7,076	2006-10	2011-20	2021-25
50% of Drinking Water Conn. Charge Rs. 200/hh/month		100	2006-10	2011-20	2021-25
Annual Increment in Drinking Water Connection		3%	2006-10	2011-20	2021-25
Benefit From Fish Catch	MT/Yr.	Price(Rs/MT)	in '000 Rs.	Sensitivity	10%
Increment in Fish Catch/annum	98	100,000	9,800		1
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
CCF	1				
SCF	1				
Discount Rate	7%				
		Share of Phewa		20%	
		Percentage of HH to be served		50%	
			Avg Length of Stay (in Days)	2002-3	2004-5
				2.5	2.5
				2006-15	2016-30
				3	3.5

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum			Benefits from the Increased			Discounted		
						Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue Earned from Fish Catch	No. of Visitors	Total Benefit	Net Benefit	Discounted Cost	Benefit	
1	2003		121,525		133,678					0	0	(133,678)	124,932	0
2	2004		194,440		213,884					0	0	(213,884)	186,815	0
3	2005		170,135		187,149					0	0	(187,149)	152,769	0
4	2006	4,934		7,076	7,784	1.20	5,920	588	1,966	8,474	691	5,938	6,465	
5	2007	5,146		7,076	7,784	1.24	6,360	623	2,085	9,068	1,284	5,550	6,465	
6	2008	5,367		7,076	7,784	1.27	6,833	561	2,210	9,704	1,920	5,187	6,466	
7	2009	5,598		7,076	7,784	1.31	7,340	700	2,344	10,384	2,601	4,847	6,467	
8	2010	5,839		7,076	7,784	1.35	7,886	742	2,485	11,113	3,329	4,530	6,468	
9	2011	6,090		12,423	13,665	1.39	8,472	757	2,635	11,864	(1,801)	7,433	6,453	
10	2012	6,352		12,423	13,665	1.43	9,101	772	2,794	12,667	(998)	6,947	6,439	
11	2013	6,625		12,423	13,665	1.48	9,777	788	2,962	13,528	(138)	6,492	6,427	
12	2014	6,910		12,423	13,665	1.52	10,504	804	3,141	14,449	783	6,068	6,415	
13	2015	7,207		12,423	13,665	1.57	11,284	820	3,331	15,435	1,769	5,671	6,405	
14	2016	7,452		12,423	13,665	1.61	12,018	820	36,908	49,745	36,080	5,300	19,292	
15	2017	7,705		12,423	13,665	1.66	12,799	820	38,787	52,406	38,741	4,953	18,994	
16	2018	7,967		12,423	13,665	1.71	13,632	820	40,763	55,215	41,549	4,629	18,703	
17	2019	8,238		12,423	13,665	1.76	14,518	820	42,841	58,179	44,514	4,326	18,418	
18	2020	8,518		12,423	13,665	1.82	15,462	820	45,026	61,308	47,643	4,043	18,139	
19	2021	8,808		17,770	19,547	1.87	16,467	820	47,324	64,611	45,064	5,405	17,866	
20	2022	9,108		17,770	19,547	1.93	17,538	820	49,741	68,098	48,551	5,051	17,598	
21	2023	9,417		17,770	19,547	1.98	18,678	820	52,282	71,780	52,233	4,721	17,336	
22	2024	9,737		17,770	19,547	2.04	19,893	820	54,955	75,667	56,120	4,412	17,079	
23	2025	10,068		17,770	19,547	2.10	21,186	820	57,766	79,771	60,224	4,123	16,827	
24	2026	10,411		23,117	25,428	2.17	22,564	820	60,722	84,105	58,677	5,013	16,581	
25	2027	10,765		23,117	25,428	2.23	24,031	820	63,832	88,682	63,254	4,685	16,340	
26	2028	11,131		23,117	25,428	2.30	25,593	820	67,103	93,516	68,088	4,379	16,103	
27	2029	11,509		23,117	25,428	2.37	27,257	820	70,544	98,621	73,193	4,092	15,871	
28	2030	11,900		23,117	25,428	2.44	29,030	820	74,165	104,014	78,585	3,824	15,644	
												592,134	325,261	

Internal Rate of Return 2.23%
B/C Ratio 0.55
NPV (266,872)

Note

Benefit from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x [1+annual increment in drinking water connection]

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Sensitivity

1 = increase in cost by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

2 = decrease in revenue by 10%

0 = no sensitivity test

Table 8:1-C
Economic Analysis of Sewerage System
(With Tunnel)

With 10% decrease in revenue and without conversion factors

Capital Cost (in '000 Rs.)	486,100				
		Conv. Cost			
Labor Cost (in '000 Rs.)	111,270	111,270	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	374,830	25%	40%	35%
Total Converted Cost (in '000 Rs.)		486,100	121,525	194,440	170,135
			2006-10	2011-20	2021-25
O&M Cost (in Thousand Rs.)		7,076	12,423	17,770	23,117
50% of Drinking Water Conn.Charge Rs. 200/hh/month		100			
Annual Increment in Drinking Water Connection		3%			
Benefit From Fish Catch		MT/Yr.	Price(Rs/MT)	in '000 Rs.	Sensitivity
Increment in Fish Catch/annum		98	100,000	9,800	10%
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
CCF	1				
SCF	1				
Discount Rate	7%				
		Share of Phewa		20%	
		Percentage of HH to be served		50%	
				2002-3	2004-5
		Avg Length of Stay (in Days)		2.5	2.5
				2006-15	2016-30
				3	3.5

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue Earned from Fish Catch	Benefits from the Increased		Discounted		
									No.of Visitors	Total Benefit		Net Benefit	Cost
1	2003		121,525		121,525				0	0	(121,525)	113,575	0
2	2004		194,440		194,440				0	0	(194,440)	169,831	0
3	2005		170,135		170,135				0	0	(170,135)	138,881	0
4	2006	4,934		7,076	7,076	1.20	5,920	588	1,966	7,627	551	5,398	5,819
5	2007	5,146		7,076	7,076	1.24	6,360	623	2,085	8,161	1,085	5,045	5,819
6	2008	5,367		7,076	7,076	1.27	6,833	661	2,210	8,733	1,657	4,715	5,819
7	2009	5,598		7,076	7,076	1.31	7,340	700	2,344	9,346	2,270	4,407	5,820
8	2010	5,839		7,076	7,076	1.35	7,886	742	2,485	10,002	2,926	4,118	5,821
9	2011	6,090		12,423	12,423	1.39	8,472	757	2,635	10,677	(1,745)	6,757	5,808
10	2012	6,352		12,423	12,423	1.43	9,101	772	2,794	11,401	(1,022)	6,315	5,795
11	2013	6,625		12,423	12,423	1.48	9,777	788	2,962	12,175	(248)	5,902	5,784
12	2014	6,910		12,423	12,423	1.52	10,504	804	3,141	13,004	581	5,516	5,774
13	2015	7,207		12,423	12,423	1.57	11,284	820	3,331	13,891	1,468	5,155	5,764
14	2016	7,452		12,423	12,423	1.61	12,018	820	36,908	44,771	32,348	4,818	17,363
15	2017	7,705		12,423	12,423	1.66	12,799	820	38,787	47,165	34,743	4,503	17,095
16	2018	7,967		12,423	12,423	1.71	13,632	820	40,763	49,693	37,270	4,208	16,833
17	2019	8,238		12,423	12,423	1.76	14,518	820	42,841	52,361	39,938	3,933	16,576
18	2020	8,518		12,423	12,423	1.82	15,462	820	45,026	55,177	42,754	3,675	16,325
19	2021	8,808		17,770	17,770	1.87	16,467	820	47,324	58,150	40,380	4,913	16,079
20	2022	9,108		17,770	17,770	1.93	17,538	820	49,741	61,288	43,519	4,592	15,838
21	2023	9,417		17,770	17,770	1.98	18,678	820	52,282	64,602	46,832	4,292	15,602
22	2024	9,737		17,770	17,770	2.04	19,893	820	54,955	68,100	50,330	4,011	15,371
23	2025	10,068		17,770	17,770	2.10	21,186	820	57,766	71,794	54,024	3,748	15,145
24	2026	10,411		23,117	23,117	2.17	22,564	820	60,722	75,695	52,578	4,557	14,923
25	2027	10,765		23,117	23,117	2.23	24,031	820	63,832	79,814	56,697	4,259	14,706
26	2028	11,131		23,117	23,117	2.30	25,593	820	67,103	84,164	61,048	3,981	14,493
27	2029	11,509		23,117	23,117	2.37	27,257	820	70,544	88,759	65,642	3,720	14,284
28	2030	11,900		23,117	23,117	2.44	29,030	820	74,165	93,612	70,496	3,477	14,079
												538,303	292,735

Internal Rate of Return 2.15%
B/C Ratio 0.54
NPV (245,568)

Note

Benefits from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x [1+annual increment in drinking water connection]

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Sensitivity

1 = increase in cost by 10%

2 = decrease in revenue by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

0 = no sensitivity test

Table 8:1-D
Economic Analysis of Sewerage System
(With Tunnel)

With 10% increase in cost and 10% decrease in revenue and without conversion factors

Capital Cost (in '000 Rs.)	486,100				
		Conv. Cost			
Labor Cost (in '000 Rs.)	111,270	111,270	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	374,830	25%	40%	35%
Total Converted Cost (in '000 Rs.)		486,100	121,525	194,440	170,135
		2006-10	2011-20	2021-25	2026-30
O&M Cost (in Thousand Rs.)		7,076	12,423	17,770	23,117
50% of Drinking Water Conn.Charge Rs. 200/hh/month		100			
Annual Increment in Drinking Water Connection		3%			
Benefit From Fish Catch	MT/Yr.	Price(Rs/MT)	in 000 Rs.	Sensitivity	10%
Increment in Fish Catch/annum	98	100,000	9,800		3
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
CCF	1			2002-3	2004-5
SCF	1			2006-15	2016-30
Discount Rate	7%			2.5	2.5
				3	3.5

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue Earned from Fish Catch	Benefits from the Increased		Discounted Cost	Discounted Benefit	
									No.of Visitors	Total Net Benefit			
1	2003		121,525		133,678				0	0	(133,678)	124,932	0
2	2004		194,440		213,884				0	0	(213,884)	186,815	0
3	2005		170,135		187,149				0	0	(187,149)	152,769	0
4	2006	4,934		7,076	7,784	1.20	5,920	588	1,966	7,627	(157)	5,938	5,819
5	2007	5,146		7,076	7,784	1.24	6,360	623	2,085	8,161	378	5,550	5,819
6	2008	5,367		7,076	7,784	1.27	6,833	661	2,210	8,733	950	5,187	5,819
7	2009	5,598		7,076	7,784	1.31	7,340	700	2,344	9,346	1,562	4,847	5,820
8	2010	5,839		7,076	7,784	1.35	7,886	742	2,485	10,002	2,218	4,530	5,821
9	2011	6,090		12,423	13,665	1.39	8,472	757	2,635	10,677	(2,988)	7,433	5,808
10	2012	6,352		12,423	13,665	1.43	9,101	772	2,794	11,401	(2,265)	6,947	5,795
11	2013	6,625		12,423	13,665	1.48	9,777	788	2,962	12,175	(1,490)	6,492	5,784
12	2014	6,910		12,423	13,665	1.52	10,504	804	3,141	13,004	(662)	6,068	5,774
13	2015	7,207		12,423	13,665	1.57	11,284	820	3,331	13,891	226	5,671	5,764
14	2016	7,452		12,423	13,665	1.61	12,018	820	36,908	44,771	31,105	5,300	17,363
15	2017	7,705		12,423	13,665	1.65	12,799	820	38,787	47,165	33,500	4,953	17,095
16	2018	7,967		12,423	13,665	1.71	13,632	820	40,763	49,693	36,028	4,629	16,833
17	2019	8,238		12,423	13,665	1.76	14,518	820	42,841	52,361	38,696	4,326	16,576
18	2020	8,518		12,423	13,665	1.82	15,462	820	45,026	55,177	41,512	4,043	16,325
19	2021	8,808		17,770	19,547	1.87	16,467	820	47,324	58,150	38,603	5,405	16,079
20	2022	9,108		17,770	19,547	1.93	17,538	820	49,741	61,288	41,742	5,051	15,838
21	2023	9,417		17,770	19,547	1.98	18,678	820	52,282	64,602	45,055	4,721	15,602
22	2024	9,737		17,770	19,547	2.04	19,893	820	54,955	68,100	48,553	4,412	15,371
23	2025	10,068		17,770	19,547	2.10	21,186	820	57,766	71,794	52,247	4,123	15,145
24	2026	10,411		23,117	25,428	2.17	22,564	820	60,722	75,695	50,266	5,013	14,923
25	2027	10,765		23,117	25,428	2.23	24,031	820	63,832	79,814	54,386	4,685	14,706
26	2028	11,131		23,117	25,428	2.30	25,593	820	67,103	84,164	58,736	4,379	14,493
27	2029	11,509		23,117	25,428	2.37	27,257	820	70,544	88,759	63,331	4,092	14,284
28	2030	11,900		23,117	25,428	2.44	29,030	820	74,165	93,612	68,184	3,824	14,079
											592,134	292,735	

Internal Rate of Return 1.37%
B/C Ratio 0.49
NPV (299,398)

Note

Benefit from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x [1+annual increment in drinking water connection]

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Sensitivity

1 = increase in cost by 10%

2 = decrease in revenue by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

0 = no sensitivity test

Table 8:1-E
Economic Analysis of Sewerage System
(With Tunnel)

With conversion factors

Capital Cost (in '000 Rs.)	486,100				
		Conv. Cost			
Labor Cost (in '000 Rs.)	111,270	87,903	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	356,089	25%	40%	35%
Total Converted Cost (in '000 Rs.)		443,992	110,998	177,597	155,397
			2006-10	2011-20	2021-25
O&M Cost (in Thousand Rs.)		6,722	11,802	16,881	21,961
50% of Drinking Water Conn. Charge Rs. 200/hh/month		100			
Annual Increment in Drinking Water Connection		3%			
Benefit From Fish Catch	MT/Yr.	Price(Rs/MT)	in '000 Rs.		Sensitivity
Increment in Fish Catch/annum	98	100,000	9,800		10%
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
			Share of Phewa	20%	
			Percentage of HH to be served	50%	
CCF	0.79			2002-3	2004-5
SCF	0.95			2006-15	2016-30
Discount Rate	7%		Avg Length of Stay (in Days)	2.5	2.5
				3	3.5

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue from Fish Catch	Benefits from the Increased		Discounted Cost	Discounted Benefit	
									No. of Visitors	Total Net Benefit			
1	2003		110,998		110,998				0	0	(110,998)	103,736	0
2	2004		177,597		177,597				0	0	(177,597)	155,120	0
3	2005		155,397		155,397				0	0	(155,397)	126,850	0
4	2006	4,934		6,722	6,722	1.20	5,624	588	1,868	8,080	1,358	5,128	6,164
5	2007	5,146		6,722	6,722	1.24	6,042	623	1,980	8,646	1,924	4,793	6,164
6	2008	5,367		6,722	6,722	1.27	6,491	661	2,100	9,252	2,529	4,479	6,165
7	2009	5,598		6,722	6,722	1.31	6,973	700	2,226	9,900	3,178	4,186	6,165
8	2010	5,839		6,722	6,722	1.35	7,491	742	2,361	10,595	3,872	3,912	6,166
9	2011	6,090		11,802	11,802	1.39	8,048	757	2,503	11,308	(493)	6,419	6,151
10	2012	6,352		11,802	11,802	1.43	8,646	772	2,654	12,073	271	5,999	6,137
11	2013	6,625		11,802	11,802	1.48	9,288	788	2,814	12,891	1,089	5,607	6,124
12	2014	6,910		11,802	11,802	1.52	9,979	804	2,984	13,766	1,964	5,240	6,112
13	2015	7,207		11,802	11,802	1.57	10,720	820	3,164	14,704	2,902	4,897	6,102
14	2016	7,452		11,802	11,802	1.61	11,417	820	35,062	47,299	35,497	4,577	18,343
15	2017	7,705		11,802	11,802	1.66	12,159	820	36,848	49,827	38,025	4,278	18,060
16	2018	7,967		11,802	11,802	1.71	12,950	820	38,725	52,495	40,693	3,998	17,782
17	2019	8,238		11,802	11,802	1.76	13,792	820	40,699	55,311	43,509	3,736	17,510
18	2020	8,518		11,802	11,802	1.82	14,689	820	42,775	58,284	46,482	3,492	17,244
19	2021	8,808		16,881	16,881	1.87	15,644	820	44,958	61,422	44,540	4,668	16,984
20	2022	9,108		16,881	16,881	1.93	16,661	820	47,254	64,734	47,853	4,362	16,729
21	2023	9,417		16,881	16,881	1.98	17,744	820	49,668	68,232	51,350	4,077	16,479
22	2024	9,737		16,881	16,881	2.04	18,898	820	52,207	71,924	55,043	3,810	16,234
23	2025	10,068		16,881	16,881	2.10	20,127	820	54,877	75,824	58,942	3,561	15,995
24	2026	10,411		21,961	21,961	2.17	21,435	820	57,686	79,941	57,980	4,329	15,760
25	2027	10,765		21,961	21,961	2.23	22,829	820	60,640	84,289	62,328	4,046	15,530
26	2028	11,131		21,961	21,961	2.30	24,314	820	63,748	88,881	66,920	3,782	15,305
27	2029	11,509		21,961	21,961	2.37	25,894	820	67,017	93,731	71,770	3,534	15,084
28	2030	11,900		21,961	21,961	2.44	27,578	820	70,456	98,854	76,893	3,303	14,868
											495,922	309,357	

Internal Rate of Return 3.22%

B/C Ratio 0.62

NPV (186,565)

Note

Benefits from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x [1+annual increment in drinking water connection]

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Sensitivity

1 = increase in cost by 10%

2 = decrease in revenue by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

0 = no sensitivity test

Table 8:1-F
Economic Analysis of Sewerage System
(With Tunnel)

With 10% increase in cost and conversion factors

Capital Cost (in '000 Rs.)	486,100				
		Conv. Cost			
Labor Cost (in '000 Rs.)	111,270	87,903	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	356,089	25%	40%	35%
Total Converted Cost (in '000 Rs.)		443,992	110,998	177,597	155,397
			2006-10	2011-20	2021-25
O&M Cost (in Thousand Rs.)		6,722	11,802	16,881	21,961
50% of Drinking Water Conn. Charge Rs. 200/hh/month		100			
Annual Increment in Drinking Water Connection		3%			
Benefit From Fish Catch		MT/Yr.	Price(Rs/MT)	in '000 Rs.	Sensitivity
Increment in Fish Catch/annum		98	100,000	9,800	10%
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
CCF	0.79				
SCF	0.95				
Discount Rate	7%				
		Share of Phewa		20%	
		Percentage of HH to be served		50%	
			2002-3	2004-5	2006-15
		Avg Length of Stay (in Days)	2.5	2.5	3
				2016-30	1

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue Earned from Fish Catch	Benefits from the Increased				
									No. of Visitors	Total Benefit	Net Benefit	Discounted Benefit	
1	2003		110,998		122,098				0	0	(122,098)	114,110	0
2	2004		177,597		195,356				0	0	(195,356)	170,632	0
3	2005		155,397		170,937				0	0	(170,937)	139,535	0
4	2006	4,934		6,722	7,394	1.20	5,624	588	1,868	8,080	686	5,641	6,164
5	2007	5,146		6,722	7,394	1.24	6,042	623	1,980	8,646	1,251	5,272	6,164
6	2008	5,367		6,722	7,394	1.27	6,491	661	2,100	9,252	1,857	4,927	6,165
7	2009	5,598		6,722	7,394	1.31	6,973	700	2,226	9,900	2,506	4,605	6,165
8	2010	5,839		6,722	7,394	1.35	7,491	742	2,361	10,595	3,200	4,304	6,166
9	2011	6,090		11,802	12,982	1.39	8,048	757	2,503	11,308	(1,673)	7,061	6,151
10	2012	6,352		11,802	12,982	1.43	8,646	772	2,654	12,073	(909)	6,599	6,137
11	2013	6,625		11,802	12,982	1.48	9,288	788	2,814	12,891	(91)	6,168	6,124
12	2014	6,910		11,802	12,982	1.52	9,979	804	2,984	13,766	784	5,764	6,112
13	2015	7,207		11,802	12,982	1.57	10,720	820	3,164	14,704	1,722	5,387	6,102
14	2016	7,452		11,802	12,982	1.61	11,417	820	35,062	47,299	34,317	5,035	18,343
15	2017	7,705		11,802	12,982	1.66	12,159	820	36,848	49,827	36,845	4,705	18,060
16	2018	7,967		11,802	12,982	1.71	12,950	820	38,725	52,495	39,513	4,397	17,782
17	2019	8,238		11,802	12,982	1.76	13,792	820	40,699	55,311	42,329	4,110	17,510
18	2020	8,518		11,802	12,982	1.82	14,689	820	42,775	58,284	45,302	3,841	17,244
19	2021	8,808		16,881	18,569	1.87	15,644	820	44,958	61,422	42,852	5,135	16,984
20	2022	9,108		16,881	18,569	1.93	16,661	820	47,254	64,734	46,165	4,799	16,729
21	2023	9,417		16,881	18,569	1.98	17,744	820	49,668	68,232	49,662	4,485	16,479
22	2024	9,737		16,881	18,569	2.04	18,898	820	52,207	71,924	53,355	4,191	16,234
23	2025	10,068		16,881	18,569	2.10	20,127	820	54,877	75,824	57,254	3,917	15,995
24	2026	10,411		21,961	24,157	2.17	21,435	820	57,686	79,941	55,784	4,762	15,760
25	2027	10,765		21,961	24,157	2.23	22,829	820	60,640	84,289	60,132	4,451	15,530
26	2028	11,131		21,961	24,157	2.30	24,314	820	63,748	88,881	64,724	4,160	15,305
27	2029	11,509		21,961	24,157	2.37	25,894	820	67,017	93,731	69,574	3,888	15,084
28	2030	11,900		21,961	24,157	2.44	27,578	820	70,456	98,854	74,697	3,633	14,868

545,514 309,357

Internal Rate of Return 2.45%

B/C Ratio 0.57

NPV (236,157)

Note

Benefits from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x (1+annual increment in drinking water connection)

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x (1+Increment in fish catch/annum)

Sensitivity

1 = increase in cost by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

2 = decrease in revenue by 10%

0 = no sensitivity test

Table 8:1-G
Economic Analysis of Sewerage System
(With Tunnel)

With 10% decrease in revenue and conversion factors

Capital Cost (in '000 Rs.)	486,100				
		Conv. Cost			
Labor Cost (in '000 Rs.)	111,270	87,903	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	356,089	25%	40%	35%
Total Converted Cost (in '000 Rs.)		443,992	110,998	177,597	155,397
			2006-10	2011-20	2021-25
O&M Cost (in Thousand Rs.)		6,722	11,802	16,881	21,961
50% of Drinking Water Conn. Charge Rs. 200/hh/month		100			
Annual Increment in Drinking Water Connection		3%			
Benefit From Fish Catch	MT/Yr.	Price(Rs/MT)	in '000 Rs.	Sensitivity	10%
Increment in Fish Catch/annum	98	100,000	9,800		2
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
			Share of Phewa	20%	
			Percentage of HH to be served	50%	
CCF	0.79			2002-3	2004-5
SCF	0.95			2.5	2.5
Discount Rate	7%			2006-15	2016-30
			Avg Length of Stay (in Days)	3	3.5

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue Earned from Fish Catch	Benefits from the Increased		Discounted Cost	Discounted Benefit	
									No. of Visitors	Total Benefit			Net Benefit
1	2003		110,998		110,998				0	0	(110,998)	103,736	0
2	2004		177,597		177,597				0	0	(177,597)	155,120	0
3	2005		155,397		155,397				0	0	(155,397)	126,850	0
4	2006	4,934		6,722	6,722	1.20	5,624	588	1,868	7,272	550	5,128	5,548
5	2007	5,146		6,722	6,722	1.24	6,042	623	1,980	7,781	1,059	4,793	5,548
6	2008	5,367		6,722	6,722	1.27	6,491	661	2,100	8,326	1,604	4,479	5,548
7	2009	5,598		6,722	6,722	1.31	6,973	700	2,226	8,910	2,188	4,186	5,549
8	2010	5,839		6,722	6,722	1.35	7,491	742	2,361	9,535	2,813	3,912	5,550
9	2011	6,090		11,802	11,802	1.39	8,048	757	2,503	10,178	(1,624)	6,419	5,536
10	2012	6,352		11,802	11,802	1.43	8,646	772	2,654	10,865	(936)	5,999	5,523
11	2013	6,625		11,802	11,802	1.48	9,288	788	2,814	11,602	(200)	5,607	5,512
12	2014	6,910		11,802	11,802	1.52	9,979	804	2,984	12,390	588	5,240	5,501
13	2015	7,207		11,802	11,802	1.57	10,720	820	3,164	13,233	1,432	4,897	5,491
14	2016	7,452		11,802	11,802	1.61	11,417	820	35,062	42,569	30,767	4,577	16,509
15	2017	7,705		11,802	11,802	1.66	12,159	820	36,848	44,844	33,042	4,278	16,254
16	2018	7,967		11,802	11,802	1.71	12,950	820	38,725	47,245	35,444	3,998	16,004
17	2019	8,238		11,802	11,802	1.76	13,792	820	40,699	49,780	37,978	3,736	15,759
18	2020	8,518		11,802	11,802	1.82	14,689	820	42,775	52,455	40,653	3,492	15,520
19	2021	8,808		16,881	16,881	1.87	15,644	820	44,958	55,279	38,398	4,668	15,285
20	2022	9,108		16,881	16,881	1.93	16,661	820	47,254	58,261	41,380	4,362	15,056
21	2023	9,417		16,881	16,881	1.98	17,744	820	49,668	61,409	44,527	4,077	14,831
22	2024	9,737		16,881	16,881	2.04	18,898	820	52,207	64,732	47,851	3,810	14,611
23	2025	10,068		16,881	16,881	2.10	20,127	820	54,877	68,241	51,360	3,561	14,395
24	2026	10,411		21,961	21,961	2.17	21,435	820	57,686	71,947	49,986	4,329	14,184
25	2027	10,765		21,961	21,961	2.23	22,829	820	60,640	75,860	53,899	4,046	13,977
26	2028	11,131		21,961	21,961	2.30	24,314	820	63,748	79,993	58,032	3,782	13,774
27	2029	11,509		21,961	21,961	2.37	25,894	820	67,017	84,358	62,397	3,534	13,576
28	2030	11,900		21,961	21,961	2.44	27,578	820	70,456	88,969	67,008	3,303	13,381
											495,922	278,421	

Internal Rate of Return 2.37%
B/C Ratio 0.56
NPV (217,501)

Note

Benefit from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x [1+annual increment in drinking water connection]

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Sensitivity

1 = increase in cost by 10%

2 = decrease in revenue by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

0 = no sensitivity test

Table 8:1-H
Economic Analysis of Sewerage System
(With Tunnel)

With 10% increase in cost, 10% decrease in revenue and conversion factors

Capital Cost (in '000 Rs.)	486,100				
		Conv. Cost			
Labor Cost (in '000 Rs.)	111,270	87,903	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	374,830	356,089	25%	40%	35%
Tota Converted Cost (in '000 Rs.)		443,992	110,998	177,597	155,397
O&M Cost (in Thousand Rs.)		6,722	2006-10	2011-20	2021-25
50% of Drinking Water Conn.Charge Rs. 200/hh/month		100	2026-30		
Annual Increment in Drinking Water Connection		3%			
Benefit From Fish Catch	MT/Yr.	Price(Rs/MT)	in 000 Rs.	Sensitivity	10%
Increment in Fish Catch/annum	98	100,000	9,800		3
2006-2010	6%				
2011-2015	2%				
2016-2030	No Increment				
CCF	0.79			20%	
SCF	0.95			50%	
Discount Rate	7%				
			Share of Phewa		
			Percentage of HH to be served		
				2002-3	2004-5
				2.5	2.5
					2006-15
					3
					2016-30
					3.5

S.N.	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum			Benefits			Discounted	
						Tariff for Sewage Conn.	Revenue from Sewage Conn.	Additional Revenue Earned from Fish Catch	No. of Visitors	Total Benefit	Net Benefit	Discounted Cost	Benefit
1	2003		110,998		122,098				0	0	(122,098)	114,110	0
2	2004		177,597		195,356				0	0	(195,356)	170,632	0
3	2005		155,397		170,937				0	0	(170,937)	139,535	0
4	2006	4,934		6,722	7,394	1.20	5,624	588	1,868	7,272	(122)	5,641	5,548
5	2007	5,146		6,722	7,394	1.24	6,042	623	1,980	7,781	387	5,272	5,548
6	2008	5,367		6,722	7,394	1.27	6,491	661	2,100	8,326	932	4,927	5,548
7	2009	5,598		6,722	7,394	1.31	6,973	700	2,226	8,910	1,516	4,605	5,549
8	2010	5,839		6,722	7,394	1.35	7,491	742	2,361	9,535	2,141	4,304	5,550
9	2011	6,090		11,802	12,982	1.39	8,048	757	2,503	10,178	(2,804)	7,061	5,536
10	2012	6,352		11,802	12,982	1.43	8,646	772	2,654	10,865	(2,117)	6,599	5,523
11	2013	6,625		11,802	12,982	1.48	9,288	788	2,814	11,602	(1,380)	6,168	5,512
12	2014	6,910		11,802	12,982	1.52	9,979	804	2,984	12,390	(592)	5,764	5,501
13	2015	7,207		11,802	12,982	1.57	10,720	820	3,164	13,233	251	5,387	5,491
14	2016	7,452		11,802	12,982	1.61	11,417	820	35,062	42,569	29,587	5,035	16,509
15	2017	7,705		11,802	12,982	1.66	12,159	820	36,848	44,844	31,862	4,705	16,254
16	2018	7,967		11,802	12,982	1.71	12,950	820	38,725	47,245	34,263	4,397	16,004
17	2019	8,238		11,802	12,982	1.76	13,792	820	40,699	49,780	36,798	4,110	15,759
18	2020	8,518		11,802	12,982	1.82	14,689	820	42,775	52,455	39,473	3,841	15,520
19	2021	8,808		16,881	18,569	1.87	15,644	820	44,958	55,279	36,710	5,135	15,285
20	2022	9,108		16,881	18,569	1.93	16,661	820	47,254	58,261	39,691	4,799	15,056
21	2023	9,417		16,881	18,569	1.98	17,744	820	49,668	61,409	42,839	4,485	14,831
22	2024	9,737		16,881	18,569	2.04	18,898	820	52,207	64,732	46,163	4,191	14,611
23	2025	10,068		16,881	18,569	2.10	20,127	820	54,877	68,241	49,672	3,917	14,395
24	2026	10,411		21,961	24,157	2.17	21,435	820	57,686	71,947	47,790	4,762	14,184
25	2027	10,765		21,961	24,157	2.23	22,829	820	60,640	75,860	51,703	4,451	13,977
26	2028	11,131		21,961	24,157	2.30	24,314	820	63,748	79,993	55,836	4,160	13,774
27	2029	11,509		21,961	24,157	2.37	25,894	820	67,017	84,358	60,201	3,888	13,576
28	2030	11,900		21,961	24,157	2.44	27,578	820	70,456	88,969	64,812	3,633	13,381
											545,514	278,421	

Internal Rate of Return 1.58%

B/C Ratio 0.51

NPV (267,093)

Note

Benefit from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage connection for 2006 = 40% of drinking water connection charge x hh to be served for 2006

Revenue earned from sewage connection for 2007 = Revenue earned from sewage conn. (t-1) x [1+annual increment in drinking water connection]

Additional revenue earned from fish catch for 2006 = Benefit from fish catch x Increment in fish catch per annum

Additional revenue earned from fish catch from 2007-15 = Additional revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Sensitivity

1 = increase in cost by 10%

2 = decrease in revenue by 10%

3 = increase in cost by 10% and decrease in revenue by 10%

0 = no sensitivity test

Table 8:2-A
Economic Analysis of Sewerage System
(Gravity with Cut and Fill)

Without conversion factors

Percentage Share of Sewerage Cost			2003	2004	2005	
Capital Cost (in Thousand Rs.)	221,500		55,375	88,600	77,525	
		Conv. Cost				
Labor Cost (in '000 Rs.)	74,900	74,900	2003	2004	2005	
Material Cost (K-Cost minus L-Cost in '000 Rs.)	146,600	146,600	25%	40%	35%	
Total Converted Cost (in '000 Rs.)	221,500	221,500	55,375	88,600	77,525	
Compensation Cost	50%	110,750	27,688	44,300	38,763	
Total Capital Cost	332,250		83,063	132,900	116,288	
O&M Cost (in Thousand Rs.)			2006-10	2011-20	2021-25	2026-30
			4,166	6,802	9,039	11,475
50% of Drinking Water Conn. Charge Rs. 200/hh/month			100			
Annual Increment in Drinking Water Connection			3%			
		MT/Yr.	Price (Rs/MT)	in '000 Rs.		
Benefit From Fish Catch		98	100,000	9,800		
Increment in Fish Catch/Year						
2006-2010	6%			Share of Phewa 20%		
2011-2015	2%			Percentage of HH to be served 50%		
2016-2030	No Change					
CCF	1			2002-03	2004-05	2006-15
SCF	1			2.5	2.5	3
				Avg Length of Stay (in Days)		
				Discount Rate 7%		

Costs (in '000 Rs.)			Revenue (in '000 Rs.)										
S.N	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage	Revenue Addnl. from Sewage Conn.	Benefits from the Revenue Increased Number of Visitors	Total Benefit	Net Benefit	Discounted Cost	Discounted Benefit	
1	2003		83,063		83,063				0	(83,063)	77,629	0	
2	2004		132,900		132,900				0	(132,900)	116,080	0	
3	2005		116,288		116,288				0	(116,288)	94,925	0	
4	2006	4,934		4,166	4,166	1.20	5,920	588	1,966	8,474	4,309	3,178	6,465
5	2007	5,146		4,166	4,166	1.24	6,360	623	2,085	9,068	4,902	2,970	6,465
6	2008	5,367		4,166	4,166	1.27	6,833	661	2,210	9,704	5,538	2,776	6,466
7	2009	5,598		4,166	4,166	1.31	7,340	700	2,344	10,384	6,219	2,594	6,467
8	2010	5,839		4,166	4,166	1.35	7,886	742	2,485	11,113	6,947	2,425	6,468
9	2011	6,090		6,602	6,602	1.39	8,472	757	2,635	11,864	5,262	3,591	6,453
10	2012	6,352		6,602	6,602	1.43	9,101	772	2,794	12,667	6,065	3,356	6,439
11	2013	6,625		6,602	6,602	1.48	9,777	788	2,962	13,528	6,925	3,137	6,427
12	2014	6,910		6,602	6,602	1.52	10,504	804	3,141	14,449	7,846	2,931	6,415
13	2015	7,207		6,602	6,602	1.57	11,284	820	3,331	15,435	8,832	2,740	6,405
14	2016	7,452		6,602	6,602	1.61	12,018	820	36,908	49,745	43,143	2,560	19,292
15	2017	7,705		6,602	6,602	1.66	12,799	820	38,787	52,406	45,804	2,393	18,994
16	2018	7,967		6,602	6,602	1.71	13,632	820	40,763	55,215	48,612	2,236	18,703
17	2019	8,238		6,602	6,602	1.76	14,518	820	42,841	58,179	51,577	2,090	18,418
18	2020	8,518		6,602	6,602	1.82	15,462	820	45,026	61,308	54,706	1,953	18,139
19	2021	8,808		9,039	9,039	1.87	16,467	820	47,324	64,611	55,572	2,499	17,866
20	2022	9,108		9,039	9,039	1.93	17,538	820	49,741	68,098	58,059	2,336	17,598
21	2023	9,417		9,039	9,039	1.98	18,678	820	52,282	71,780	62,741	2,183	17,336
22	2024	9,737		9,039	9,039	2.04	19,893	820	54,955	75,667	66,628	2,040	17,079
23	2025	10,068		9,039	9,039	2.10	21,186	820	57,766	79,771	70,733	1,907	16,827
24	2026	10,411		11,475	11,475	2.17	22,564	820	60,722	84,105	72,630	2,262	16,581
25	2027	10,765		11,475	11,475	2.23	24,031	820	63,832	88,682	77,207	2,114	16,340
26	2028	11,131		11,475	11,475	2.30	25,593	820	67,103	93,516	82,041	1,976	16,103
27	2029	11,509		11,475	11,475	2.37	27,257	820	70,544	98,621	87,146	1,847	15,871
28	2030	11,900		11,475	11,475	2.44	29,030	820	74,165	104,014	92,538	1,726	15,644
Total											350,455	325,261	

Internal Rate of Return 6.43%
B/C Ratio 0.93
NPV (25,194)

Note:

Benefits from Fish Catch = Kg/day x days x Rs.

Revenue earned from sewage connection = per annum tariff for sewage connection x hh to be served

Additional revenue earned from fish catch from 2007-10 = Benefit from fish catch (t-1) x Increment in fish catch per annum for 2007-10

Addnl revenue earned from fish catch from 2011-15 = Addnl revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Table 8:2-B
Economic Analysis of Sewerage System
(Gravity with Cut and Fill)

With conversion factors

		2003	2004	2005			2003	2004	2005				
Percentage Share of Sewerage Cost			25%	40%	35%								
Capital Cost (in Thousand Rs.)		221,500	55,375	88,600	77,525								
			Conv. Cost										
Labor Cost (in '000 Rs.)		74,900	59,171	2003	2004	2005							
Material Cost (K-Cost minus L-Cost in '000 Rs.)		146,600	139,270	25%	40%	35%							
Total Converted Cost (in '000 Rs.)		221,500	198,441	49,610	79,376	69,454							
Compensation Cost		50%	110,750	24,805	39,688	34,727							
Total Capital Cost		332,250	74,415	119,065	104,182								
O&M Cost (in Thousand Rs.)			2006-10	2011-20	2021-25	2026-30							
			3,957	6,272	8,587	10,901							
50% of Drinking Water Conn. Charge Rs. 200/hh/month			100										
Annual Increment in Drinking Water Connection			3%										
		<u>MT/Yr.</u>	<u>Price (Rs/MT)</u>	<u>in '000 Rs.</u>									
Benefit From Fish Catch		98	100,000	9,800									
Increment in Fish Catch/Year													
	2006-2010	6%	Share of Phewa	20%									
	2011-2015	2%	Percentage of HH to be served	50%									
	2016-2030	No Change			2002-03	2004-05	2006-15	2016-30					
CCF	0.79		Avg Length of Stay (in Days)	2.5	2.5	3	3.5						
SCF	0.95		Discount Rate	7%									
		<u>Costs (in '000 Rs.)</u>	<u>Revenue (in '000 Rs.)</u>										
S.N	Year	HHs to be served	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewerage Conn.	Revenue Addnl. from Sewage Conn.	Benefits from the Revenue Increased Number of Visitors	Total Benefit	Discount led Cost	Benefit		
1	2003		74,415		74,415				0	(74,415)	69,547	0	
2	2004		119,065		119,065				0	(119,065)	103,996	0	
3	2005		104,182		104,182				0	(104,182)	85,043	0	
4	2006	4,934		3,957	3,957	1.20	5,624	559	1,868	8,051	4,093	3,019	6,142
5	2007	5,146		3,957	3,957	1.24	6,042	592	1,980	8,615	4,657	2,822	6,142
6	2008	5,367		3,957	3,957	1.27	6,491	628	2,100	9,219	5,261	2,637	6,143
7	2009	5,598		3,957	3,957	1.31	6,973	665	2,226	9,865	5,908	2,465	6,144
8	2010	5,839		3,957	3,957	1.35	7,491	705	2,361	10,558	6,600	2,303	6,145
9	2011	6,090		6,272	6,272	1.39	8,048	719	2,503	11,271	4,999	3,412	6,130
10	2012	6,352		6,272	6,272	1.43	8,646	734	2,654	12,034	5,762	3,188	6,117
11	2013	6,625		6,272	6,272	1.48	9,288	748	2,814	12,851	6,579	2,980	6,106
12	2014	6,910		6,272	6,272	1.52	9,979	763	2,984	13,726	7,454	2,785	6,095
13	2015	7,207		6,272	6,272	1.57	10,720	779	3,164	14,663	8,391	2,603	6,085
14	2016	7,452		6,272	6,272	1.61	11,417	779	35,062	47,258	40,986	2,432	18,327
15	2017	7,705		6,272	6,272	1.66	12,159	779	36,848	49,786	43,514	2,273	18,045
16	2018	7,967		6,272	6,272	1.71	12,950	779	38,725	52,454	46,182	2,125	17,768
17	2019	8,238		6,272	6,272	1.76	13,792	779	40,699	55,270	48,998	1,986	17,497
18	2020	8,518		6,272	6,272	1.82	14,689	779	42,775	58,243	51,970	1,856	17,232
19	2021	8,808		8,587	8,587	1.87	15,644	779	44,958	61,381	52,794	2,374	16,972
20	2022	9,108		8,587	8,587	1.93	16,661	779	47,254	64,693	56,107	2,219	16,718
21	2023	9,417		8,587	8,587	1.98	17,744	779	49,668	68,191	59,604	2,074	16,469
22	2024	9,737		8,587	8,587	2.04	18,898	779	52,207	71,884	63,297	1,938	16,225
23	2025	10,068		8,587	8,587	2.10	20,127	779	54,877	75,783	67,196	1,811	15,986
24	2026	10,411		10,901	10,901	2.17	21,435	779	57,686	79,900	68,999	2,149	15,752
25	2027	10,765		10,901	10,901	2.23	22,829	779	60,640	84,248	73,347	2,009	15,523
26	2028	11,131		10,901	10,901	2.30	24,314	779	63,748	88,840	77,939	1,877	15,298
27	2029	11,509		10,901	10,901	2.37	25,894	779	67,017	93,690	82,789	1,754	15,078
28	2030	11,900		10,901	10,901	2.44	27,578	779	70,456	98,813	87,912	1,640	14,862
										Total	317,316	308,998	
		Internal Rate of Return		6.80%									
		B/C Ratio		0.97									
		NPV		(8,318)									

Note:

Benefit from Fish Catch = Kg/day x days x Rs.

Revenue earned from sewage connection = per annum tariff for sewage connection x hh to be served

Additional revenue earned from fish catch from 2007-10 = Benefit from fish catch (t-1) x Increment in fish catch per annum for 2007-10

Addnl revenue earned from fish catch from 2011-15 = Addnl revenue earned from fish catch(t-1) x [1+Increment in fish catch/annum]

Table 8:3-A
Economic Analysis of Sewerage System

(With Mechanical Treatment Facilities)
Without conversion factors

Capital Cost (in Thousand Rs.)	436,320				
Labor Cost (in '000 Rs.)	43,632	43,632	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	392,688	392,688	25%	40%	35%
Total Converted Cost (in '000 Rs.)	436,320	436,320	109,080	174,528	152,712
	2003	2004-30			
O&M Cost (in Thousand Rs.)	2,038	8,152			
50% of Drinking Water Conn. Charge Rs. 200/hh/month	100				
Annual Increment in Drinking Water Connection	3%				
Benefit From Fish Catch	<u>MT/Year</u>	<u>Price (Rs/MT)</u>	<u>in '000 Rs.</u>		
Increment in Fish Catch/annum	98	100,000	9,800		
2004-2010	6%				
2011-2015	2%	Share of Phewa	20%		
2016-2030	No Change	Percentage of HH to be served	50%		
			2002-3	2004-5	2006-15 016-30
CCF	1	Avg Length of Stay(Days)	2.5	2.5	3 3.5
SCF	1	Discount Rate	7%		
	<u>Costs (in '000 Rs.)</u>		<u>Revenue (in '000 Rs.)</u>		

S.N.	Year	HHs of the catchment	Costs (in '000 Rs.)			Revenue (in '000 Rs.)							Discounted Cost	Discounted Benefit	
			Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue Earned from Sewage Conn.	Addnl Revenue Earned from Fish Catch	Benefits from the Increased Number of Visitors	Total Benefit	Net Benefit				
1	2003		436,320	2,038	438,358							0	(438,358)	409,680	0
2	2004		0	8,152	8,152			588	0	588		(7,564)	7,120	514	
3	2005	4,730	0	8,152	8,152	1.20	5,676	623	0	6,299		(1,853)	6,655	5,142	
4	2006	4,934		8,152	8,152	1.24	6,098	661	1,966	8,725		572	6,219	6,656	
5	2007	5,146		8,152	8,152	1.27	6,551	700	2,085	9,336		1,184	5,812	6,656	
6	2008	5,367		8,152	8,152	1.31	7,038	742	2,210	9,990		1,838	5,432	6,657	
7	2009	5,598		8,152	8,152	1.35	7,561	787	2,344	10,691		2,539	5,077	6,658	
8	2010	5,839		8,152	8,152	1.39	8,122	834	2,485	11,441		3,289	4,745	6,659	
9	2011	6,090		8,152	8,152	1.43	8,726	851	2,635	12,212		4,059	4,434	6,642	
10	2012	6,352		8,152	8,152	1.48	9,374	868	2,794	13,036		4,884	4,144	6,627	
11	2013	6,625	436,320	8,152	444,472	1.52	10,071	885	2,962	13,918	(430,554)	211,166	6,612		
12	2014	6,910		8,152	8,152	1.57	10,819	903	3,141	14,863		6,711	3,620	6,599	
13	2015	7,207		8,152	8,152	1.61	11,623	921	3,331	15,874		7,722	3,383	6,587	
14	2016	7,452		8,152	8,152	1.66	12,379	921	36,908	50,207		42,055	3,162	19,471	
15	2017	7,705		8,152	8,152	1.71	13,183	921	38,787	52,891		44,739	2,955	19,170	
16	2018	7,967		8,152	8,152	1.76	14,041	921	40,763	55,725		47,573	2,761	18,876	
17	2019	8,238		8,152	8,152	1.82	14,953	921	42,841	58,716		50,564	2,581	18,588	
18	2020	8,518		8,152	8,152	1.87	15,926	921	45,026	61,873		53,721	2,412	18,306	
19	2021	8,808		8,152	8,152	1.93	16,961	921	47,324	65,206		57,054	2,254	18,030	
20	2022	9,108		8,152	8,152	1.98	18,064	921	49,741	68,726		60,573	2,107	17,760	
21	2023	9,417	436,320	8,152	444,472	2.04	19,239	921	52,282	72,441	(372,031)	107,346	17,496		
22	2024	9,737		8,152	8,152	2.10	20,489	921	54,955	76,365		68,213	1,840	17,237	
23	2025	10,068		8,152	8,152	2.17	21,822	921	57,766	80,508		72,356	1,720	16,983	
24	2026	10,411		8,152	8,152	2.23	23,241	921	60,722	84,884		76,731	1,607	16,735	
25	2027	10,765		8,152	8,152	2.30	24,752	921	63,832	89,504		81,352	1,502	16,491	
26	2028	11,131		8,152	8,152	2.37	26,361	921	67,103	94,385		86,233	1,404	16,253	
27	2029	11,509		8,152	8,152	2.44	28,075	921	70,544	99,540		91,388	1,312	16,019	
28	2030	11,900		8,152	8,152	2.51	29,900	921	74,165	104,986		96,834	1,226	15,790	
												Total	809,733	287,152	

Internal Rate of Return #DIV/0!
B/C Ratio 0.35
NPV (522,581)

Note

Benefis from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage conn. for 2005 = Revenue earned from sewage conn. (t-1) x [1+annual increment in DW conn.]

Additional revenue earned from fish catch for 2004 = Benefit from fish catch x Increment in fish catch per annum

Addnl revenue earned from fish catch from 2005-2015 = Addnl revenue from fish catch(t-1) x [1+Increment in fish catch/annum

Table 8:3-B
Economic Analysis of Sewerage System

(With Mechanical Treatment Facilities)

With conversion factors

Capital Cost (in Thousand Rs.)	436,320				
Labor Cost (in '000 Rs.)	43,632	34,469	2003	2004	2005
Material Cost (K-Cost minus L-Cost in '000 Rs.)	392,688	373,054	25%	40%	35%
Total Converted Cost (in '000 Rs.)	436,320	407,523	101,881	163,009	142,633
2003 2004-30					
O&M Cost (in Thousand Rs.)	1,936	7,745			
50% of Drinking Water Conn. Charge Rs. 200/hh/month	100				
Annual Increment in Drinking Water Connection	3%				
Benefit From Fish Catch		MT/Year	Price (Rs/MT)	In '000 Rs.	
Increment in Fish Catch/annum		98	100,000	9,800	
2004-2010	6%				
2011-2015	2%	Share of Phewa	20%		
2016-2030	No Change	Percentage of HH to be served	50%		
2002-3 2004-5 2006-15 016-30					
CCF	0.79	Avg Length of Stay(Days)	2.5	2.5	3 3.5
SCF	0.95	Discount Rate	7%		

Costs (in '000 Rs.)					Revenue (in '000 Rs.)									
S.N.	Year	HHS of the catchment	Capital Cost	O&M Cost	Total Cost	Per Annum Tariff for Sewage Conn.	Revenue Earned from Sewage Conn.	Addnl Revenue Earned from Fish Catch	Benefits from the Increased Number of Visitors	Total Benefit	Net Benefit	Discount ed Cost	Discount ed Benefit	
1	2003		407,523	1,936	409,459						0	(409,459)	382,672	0
2	2004		0	7,745	7,745			559	0	559	(7,186)	6,764	488	
3	2005	4,730	0	7,745	7,745	1.20	5,392	592	0	5,984	(1,760)	6,322	4,885	
4	2006	4,934		7,745	7,745	1.24	5,793	628	1,868	8,288	544	5,908	6,323	
5	2007	5,146		7,745	7,745	1.27	6,223	665	1,980	8,869	1,125	5,522	6,324	
6	2008	5,367		7,745	7,745	1.31	6,686	705	2,100	9,491	1,746	5,161	6,324	
7	2009	5,598		7,745	7,745	1.35	7,183	748	2,226	10,157	2,412	4,823	6,325	
8	2010	5,839		7,745	7,745	1.39	7,716	792	2,361	10,869	3,125	4,507	6,326	
9	2011	6,090		7,745	7,745	1.43	8,290	808	2,503	11,601	3,856	4,213	6,310	
10	2012	6,352		7,745	7,745	1.48	8,905	824	2,654	12,384	4,640	3,937	6,295	
11	2013	6,625	407,523	7,745	415,267	1.52	9,567	841	2,814	13,222	(402,045)	197,291	6,282	
12	2014	6,910		7,745	7,745	1.57	10,278	858	2,984	14,120	6,375	3,439	6,269	
13	2015	7,207		7,745	7,745	1.61	11,042	875	3,164	15,081	7,336	3,214	6,258	
14	2016	7,452		7,745	7,745	1.66	11,760	875	35,062	47,697	39,952	3,003	18,498	
15	2017	7,705		7,745	7,745	1.71	12,524	875	36,848	50,247	42,502	2,807	18,212	
16	2018	7,967		7,745	7,745	1.76	13,339	875	38,725	52,939	45,194	2,623	17,932	
17	2019	8,238		7,745	7,745	1.82	14,206	875	40,699	55,780	48,035	2,452	17,659	
18	2020	8,518		7,745	7,745	1.87	15,129	875	42,775	58,779	51,035	2,291	17,391	
19	2021	8,808		7,745	7,745	1.93	16,113	875	44,958	61,946	54,202	2,141	17,129	
20	2022	9,108		7,745	7,745	1.98	17,161	875	47,254	65,289	57,545	2,001	16,872	
21	2023	9,417	407,523	7,745	415,267	2.04	18,277	875	49,668	68,819	(346,448)	100,293	16,621	
22	2024	9,737		7,745	7,745	2.10	19,465	875	52,207	72,547	64,802	1,748	16,375	
23	2025	10,068		7,745	7,745	2.17	20,731	875	54,877	76,483	68,738	1,634	16,134	
24	2026	10,411		7,745	7,745	2.23	22,078	875	57,686	80,639	72,895	1,527	15,898	
25	2027	10,765		7,745	7,745	2.30	23,514	875	60,640	85,029	77,285	1,427	15,667	
26	2028	11,131		7,745	7,745	2.37	25,043	875	63,748	89,666	81,921	1,334	15,440	
27	2029	11,509		7,745	7,745	2.44	26,671	875	67,017	94,563	86,819	1,246	15,218	
28	2030	11,900		7,745	7,745	2.51	28,405	875	70,456	99,737	91,992	1,165	15,001	
Total											757,719	272,795		

Internal Rate of Return

#DIV/0!

B/C Ratio

0.36

NPV

(484,925)

Note

Benefis from Fish Catch = MT/annum x Price/MT

Revenue earned from sewage conn.for 2005 = Revenue earned from sewage conn. (t-1) x [1+annual increment in DW conn.]

Additional revenue earned from fish catch for 2004 = Benefit from fish catch x Increment in fish catch per annum

Addnl revenue earned from fish catch from 2005-2015 = Addnl revenue from fish catch(t-1) x [1+Increment in fish catch/annum

**ECONOMIC ANALYSIS FOR
SOFTWARE PROJECTS WITH
ENVIRONMENTAL EDUCATION
AND MANAGEMENT COST**

Table III:1-B(a)
On-Farm Conservation Project

(Inclusive of Environment Education and Management Cost and Without Conversion Factor)

Productivity and Farm-Gate Price		Increment in Benefits	5%
Productivity of Traditional Variety of Maize MT/ha:	1.4	Discount Rate	7%
Productivity of Improved Variety of Maize MT/ha	1.9	Operation Cost	5%
Average Farm-Gate Price (in Rs.) of Maize per Kg	8.62	Increment Operation Cost	2%
		Benefit from Other Crops	50%

Benefit Components (in Thousand Rs/hectare)

Revenue per ha of Traditional Variety of Maize	12
Revenue per ha of Improved Variety of Maize	16
Incremental Benefit per hectare	4
SCF	1

Cost Components (in Thousand Rs.)

Farm Conservation(in 20 ha)	800	Converted	800
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S.N	Year	Costs (in '000 Rs.)				Benefits (in 000 Rs.)					
		Capital Cost	Env. Edu. & Mgmt. Cost	O&M Cost	Total Cost	Farm Conserva tion (in 20 ha)	Other Crops	Total Benefit	Cash Flow	Discounted Cost	Discounted Benefit
1	2003	320	477		797			0	(797)	744	0
2	2004	320	477		797			0	(797)	696	0
3	2005	160	238		398			0	(398)	325	0
4	2006			40	40	81	40	121	81	31	93
5	2007			41	41	85	43	128	87	29	91
6	2008			42	42	89	45	134	92	28	89
7	2009			42	42	94	47	141	98	26	88
8	2010			43	43	98	49	148	104	25	86
9	2011			44	44	103	52	155	111	24	84
10	2012			45	45	109	54	163	118	23	83
11	2013			46	46	114	57	171	125	22	81
12	2014			47	47	120	60	179	133	21	80
13	2015			48	48	126	63	188	141	20	78
14	2016			49	49	132	66	198	149	19	77
15	2017			50	50	139	69	208	158	18	75
16	2018			51	51	145	73	218	167	17	74
17	2019			52	52	153	76	229	177	16	73
18	2020			53	53	160	80	241	188	16	71
19	2021			54	54	168	84	253	199	15	70
20	2022			55	55	177	88	265	210	14	69
21	2023			56	56	186	93	278	222	14	67
22	2024			57	57	195	97	292	235	13	66
23	2025			58	58	205	102	307	249	12	65
24	2026			59	59	215	107	322	263	12	64
25	2027			61	61	226	113	338	278	11	62
26	2028			62	62	237	118	355	294	11	61
27	2029			63	63	249	124	373	310	10	60
28	2030			64	64	261	131	392	327	10	59
Total		800		1,281				5,798		2,221	1,865
								Internal Rate of Return			5.31%
								B/C Ratio			0.84
								NPV			(356)

Note

The capital costs column derived from the cost components has been divided for 2003, 2004, and 2006 as 40%, 40%, and 20% respectively

O&M cost for 2006 has been taken as 5% of the Sub-Total of cost for 2006

From 2007 to 2030, the O&M cost has been increased by the growth of 2% per annum

Economic benefits of farm conservation for 2006 is calculated by multiplying incremental benefit per hectare by the area (20 ha)

Economic benefits of farm conservation from 2007-2030 has been increased by the growth of 5% per year

Table III:1-B(b)
On-Farm Conservation Project

(Inclusive of Environment Education and Management Cost and With Conversion Factor)

Productivity and Farm-Gate Price		Increment in Benefits	5%
Productivity of Traditional Variety of Maize MT/ha:	1.4	Discount Rate	7%
Productivity of Improved Variety of Maize MT/ha	1.9	Operation Cost	5%
Average Farm-Gate Price (in Rs.) of Maize per Kg	8.62	Increment Operation Cost	2%
		Benefit from Other Crops	50%

Benefit Components (in Thousand Rs/hectare)

Revenue per ha of Traditional Variety of Maize	12
Revenue per ha of Improved Variety of Maize	16
Incremental Benefit per hectare	4
SCF	0.95

Cost Components (in Thousand Rs.)

Farm Conservation(in 20 ha)	800	Converted	760
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S.N	Year	Costs (in '000 Rs.)				Benefits (in 000 Rs.)						
		Capital Cost	Env. Edu. & Mgmt. Cost	O&M Cost	Total Cost	Farm Conserva tion (in 20 ha)	Benefit from Other Crops	Total Benefit	Cash Flow	Discounted Cost	Discounted Benefit	
1	2003	304	472		776			0	(776)	725	0	
2	2004	304	472		776			0	(776)	678	0	
3	2005	152	236		388			0	(388)	317	0	
4	2006			40	40	77	38	115	75	31	88	
5	2007			41	41	81	40	121	80	29	86	
6	2008			42	42	85	42	127	86	28	85	
7	2009			42	42	89	45	134	91	26	83	
8	2010			43	43	94	47	140	97	25	82	
9	2011			44	44	98	49	147	103	24	80	
10	2012			45	45	103	52	155	110	23	79	
11	2013			46	46	108	54	162	116	22	77	
12	2014			47	47	114	57	171	124	21	76	
13	2015			48	48	119	60	179	131	20	74	
14	2016			49	49	125	63	188	139	19	73	
15	2017			50	50	132	66	197	148	18	72	
16	2018			51	51	138	69	207	157	17	70	
17	2019			52	52	145	73	218	166	16	69	
18	2020			53	53	152	76	229	176	16	68	
19	2021			54	54	160	80	240	186	15	66	
20	2022			55	55	168	84	252	197	14	65	
21	2023			56	56	176	88	265	209	14	64	
22	2024			57	57	185	93	278	221	13	63	
23	2025			58	58	194	97	292	233	12	62	
24	2026			59	59	204	102	306	247	12	60	
25	2027			61	61	214	107	322	261	11	59	
26	2028			62	62	225	113	338	276	11	58	
27	2029			63	63	236	118	354	291	10	57	
28	2030			64	64	248	124	372	308	10	56	
Total		760		1,281				5,508		2,175	1,771	
Internal Rate of Return								5.01%				
B/C Ratio								0.81				
NPV								(403)				

Note

The capital costs column derived from the cost components has been divided for 2003, 2004, and 2006 as 40%, 40%, and 20% respectively

O&M cost for 2006 has been taken as 5% of the Sub-Total of cost for 2006

From 2007 to 2030, the O&M cost has been increased by the growth of 2% per annum

Economic benefits of farm conservation for 2006 is calculated by multiplying incremental benefit per hectare by the area (20 ha)

Economic benefits of farm conservation from 2007-2030 has been increased by the growth of 5% per year

Table III:2-B(a)
Goat Raising Project

(Inclusive of Environment Education and Management Cost, Without Conversion Factor)

No. of households engaged in goat raising	720	Increment in Benefits	5%
Number of goats per household	2	Discount Rate	7%
Total goat-lets purchased	1440	Operation Cost	5%
Purchase price of goat-let (in '000 Rs.)	1.0		
Number of goats sold/annum/hh	1	Increment in feeding Cos	2%
Total goat sold/annum	720	Percentage of goat sold	50%
Sales price of adult goat for meat (in '000 Rs.)	2.0		
No. of mother goats repl. at interval of 6 yrs	1008	Benefit from sales of manure	5%
Salvage price of mother goat	500	SCF	1
Benefit from the sales of goats (in '000 Rs.)	1		

S.N.	Year	Costs (in '000 Rs.)				Benefits (In 000 Rs.)						
		Capital Cost	Env. Edu & Mgmt Cost	Feeding Expenses	Total Cost	Benefit from sales of adult goat	Benefit from manure	Income from sales of mother goats	Total Benefit	Cash Flow	Discounted Cost	Discounted Benefit
1	2003	576	477	631	1,683				0	(1,683)	1,573	0
2	2004	576	477	631	1,683	576	29		605	(1,079)	1,470	528
3	2005	288	238	315	842	1,152	58		1,210	368	687	987
4	2006			1,577	1,577	1,440	72		1,512	(65)	1,203	1,153
5	2007			1,608	1,608	1,512	76		1,588	(21)	1,147	1,132
6	2008			1,641	1,641	1,588	79		1,667	26	1,093	1,111
7	2009			1,673	1,673	1,667	83	504	2,254	581	1,042	1,404
8	2010			1,707	1,707	1,750	88		1,838	131	993	1,070
9	2011			1,741	1,741	1,838	92		1,930	189	947	1,050
10	2012			1,776	1,776	1,930	96		2,026	250	903	1,030
11	2013			1,811	1,811	2,026	101		2,128	316	861	1,011
12	2014			1,847	1,847	2,128	106		2,234	386	820	992
13	2015			1,884	1,884	2,234	112	504	2,850	965	782	1,182
14	2016			1,922	1,922	2,346	117		2,463	541	745	955
15	2017			1,961	1,961	2,463	123		2,586	625	711	937
16	2018			2,000	2,000	2,586	129		2,715	716	677	920
17	2019			2,040	2,040	2,715	136		2,851	811	646	903
18	2020			2,081	2,081	2,851	143		2,994	913	616	886
19	2021			2,122	2,122	2,994	150	504	3,647	1,525	587	1,009
20	2022			2,165	2,165	3,143	157		3,301	1,136	559	853
21	2023			2,208	2,208	3,301	165		3,466	1,258	533	837
22	2024			2,252	2,252	3,466	173		3,639	1,387	508	821
23	2025			2,297	2,297	3,639	182		3,821	1,524	485	806
24	2026			2,343	2,343	3,821	191		4,012	1,669	462	791
25	2027			2,390	2,390	4,012	201	504	4,716	2,326	440	869
26	2028			2,438	2,438	4,212	211		4,423	1,985	420	762
27	2029			2,486	2,486	4,423	221		4,644	2,158	400	747
28	2030			2,536	2,536	4,644	232		4,876	2,340	381	733
Total		1,440		52,082					75,994		21,692	25,479

Internal Rate of Return 13.51%

B/C Ratio 1.17

NPV 3,787

Note

The capital cost column derived from the cost components has been divided for 2003, 2004, and 2005 as 40%, 40%, and 20% respectively

O&M cost for 2006 has been taken as 5% of the Sub-Total of cost for 2006

From 2007 to 2030, the feeding cost has been increased by the growth of 2% per annum

Table III:2-B(b)
Goat Raising Project

(Inclusive of Environment Education and Management Cost, With Conversion Factor)

No. of households engaged in goat raising	720	Increment in Benefits	5%
Number of goats per household	2	Discount Rate	7%
Total goat-lets purchased	1440	Operation Cost	5%
Purchase price of goat-let (in '000 Rs.)	1.0		
Number of goats sold/annum/hh	1	Increment in feeding Cos	2%
Total goat sold/annum	720	Percentage of goat sold	50%
Sales price of adult goat for meat (in '000 Rs.)	2.0		
No. of mother goats repl. at interval of 6 yrs	1008	Benefit from sales of manure	5%
Salvage price of mother goat	500	SCF	0.95
Benefit from the sales of goats (in '000 Rs.)	1		
		Number of goats	
		2003	2004
Expense for addnl feeding/hh/goat/day (Rs.)	3.0	40%	40%
Total expenses for addnl feeding/hh/ann(Rs.)	2,190	Purchased	20%
Feeding expenses/goat/annum (Rs.)	1095	576	288
Cost Components (in Thousand Rs.)		Sold	144
Initial cost	1,440	Converted	720
	1368	273.6	136.8
		273.6	136.8
			684
			100%
			1440
			720
			684

S.N.	Year	Costs (in '000 Rs.)				Benefits (in 000 Rs.)						
		Capital Cost	Env. Edu & Mgmt Cost	Feeding Expenses	Total Cost	Benefit from sales of adult goat	Income from Benefit from manure	Income from sales of mother goats	Total Benefit	Cash Flow	Discounted Cost	Discounted Benefit
1	2003	547	467	631	1,645				0	(1,645)	1,538	0
2	2004	547	467	631	1,645	547	27		575	(1,071)	1,437	502
3	2005	274	234	315	823	1,094	55		1,149	327	671	938
4	2006			1,577	1,577	1,368	68		1,436	(140)	1,203	1,096
5	2007			1,608	1,608	1,436	72		1,508	(100)	1,147	1,075
6	2008			1,641	1,641	1,508	75		1,584	(57)	1,093	1,055
7	2009			1,673	1,673	1,584	79	504	2,167	493	1,042	1,349
8	2010			1,707	1,707	1,663	83		1,746	39	993	1,016
9	2011			1,741	1,741	1,746	87		1,833	92	947	997
10	2012			1,776	1,776	1,833	92		1,925	149	903	979
11	2013			1,811	1,811	1,925	96		2,021	210	861	960
12	2014			1,847	1,847	2,021	101		2,122	275	820	942
13	2015			1,884	1,884	2,122	106	504	2,732	848	782	1,134
14	2016			1,922	1,922	2,228	111		2,340	418	745	907
15	2017			1,961	1,961	2,340	117		2,457	496	711	890
16	2018			2,000	2,000	2,457	123		2,580	580	677	874
17	2019			2,040	2,040	2,580	129		2,709	669	646	857
18	2020			2,081	2,081	2,709	135		2,844	763	616	841
19	2021			2,122	2,122	2,844	142	504	3,490	1,368	587	965
20	2022			2,165	2,165	2,986	149		3,135	971	559	810
21	2023			2,208	2,208	3,135	157		3,292	1,084	533	795
22	2024			2,252	2,252	3,292	165		3,457	1,205	508	780
23	2025			2,297	2,297	3,457	173		3,630	1,333	485	766
24	2026			2,343	2,343	3,630	181		3,811	1,468	462	751
25	2027			2,390	2,390	3,811	191	504	4,506	2,116	440	830
26	2028			2,438	2,438	4,002	200		4,202	1,764	420	724
27	2029			2,486	2,486	4,202	210		4,412	1,925	400	710
28	2030			2,536	2,536	4,412	221		4,633	2,096	381	697
Total		1,368		52,082					72,295		21,607	24,243

Internal Rate of Return 11.68%

B/C Ratio 1.12

NPV 2,635

Note

The capital cost column derived from the cost components has been divided for 2003, 2004, and 2005 as 40%, 40%, and 20% respectively

O&M cost for 2006 has been taken as 5% of the Sub-Total of cost for 2006

From 2007 to 2030, the feeding cost has been increased by the growth of 2% per annum

Table III:3-B(a)
Washing and Laundry Place

(Inclusive of Environment Education and Management Cost, Without Conversion Factor)

Construction of Laundry Place	10	Increment in Benefit	5%
Construction cost per unit (in '000 Rs.)	150	Discount Rate	7%
Number of participants	40	O&M Cost	15%
Participants per unit of laundry place	4	Increment Operation	5%
		Other benefits	5%
Per capita/day income from wash	100	SCF	1
Washing days per week	2	Cost components	
Per annum washing days	104	2003	2004
Per annum income of the group	416	30%	30%
		450	450
			600
Cost Components (in Thousand Rs.)	Converted		
Cost for washing and laundry place	1,500	1500	450
		450	600

		Costs (in '000 Rs.)			Benefits (in 000 Rs.)						
		Env. Edu. &		Per	Other	Total	Cash	Discounted	Discounted		
S.N.	Year	Capital Cost	Mgmt Cost							Total Cost	Benefit
1	2003	450	486	936		0	(936)	875	0		
2	2004	450	486	936	125	125	(812)	818	109		
3	2005	600	243	843	250	250	(594)	688	204		
4	2006			225	225	416	21	437	212	172	333
5	2007			236	236	437	22	459	222	168	327
6	2008			248	248	459	23	482	234	165	321
7	2009			260	260	482	24	506	245	162	315
8	2010			273	273	506	25	531	257	159	309
9	2011			287	287	531	27	557	270	156	303
10	2012			302	302	557	28	585	284	153	298
11	2013			317	317	585	29	615	298	150	292
12	2014			332	332	615	31	645	313	148	287
13	2015			349	349	645	32	678	329	145	281
14	2016			367	367	678	34	712	345	142	276
15	2017			385	385	712	36	747	362	139	271
16	2018			404	404	747	37	784	380	137	266
17	2019			424	424	784	39	824	399	134	261
18	2020			445	445	824	41	865	419	132	256
19	2021			468	468	865	43	908	440	129	251
20	2022			491	491	908	45	953	462	127	246
21	2023			516	516	953	48	1,001	485	125	242
22	2024			541	541	1,001	50	1,051	510	122	237
23	2025			569	569	1,051	53	1,104	535	120	233
24	2026			597	597	1,104	55	1,159	562	118	228
25	2027			627	627	1,159	58	1,217	590	115	224
26	2028			658	658	1,217	61	1,278	620	113	220
27	2029			691	691	1,278	64	1,342	651	111	216
28	2030			726	726	1,342	67	1,409	683	109	212
Total		1,500	10,739			21,222		5,835		7,017	
		Internal Rate of Return				11.01%					
		B/C Ratio				1.20					
		NPV				1,182					

Note

The capital cost column derived from the cost components has been divided for 2003, 2004, and 2006 as 40%, 40%, and 20% respectively

O&M cost for 2006 has been taken as 5% of the capital cost for 2006

From 2007 to 2030, the O&M cost has been increased by the growth of 5% per annum

Per annum income for 2004 is taken as 30% of the per annum income of the group

Per annum income for 2005 is taken as 60% of the per annum income of the group

Table III:3-B(b)
Washing and Laundry Place

(Inclusive of Environment Education and Management Cost, With Conversion Factor)

Construction of Laundry Place	10	Increment in Benefit	5%
Construction cost per unit (in '000 Rs.)	150	Discount Rate	7%
Number of participants	40	O&M Cost	15%
Participants per unit of laundry place	4	Increment Operation	5%
		Other benefits	5%
Per capita/day income from wash	100	SCF	0.95
Washing days per week	2	Cost components	
Per annum washing days	104	2003	2004
Per annum income of the group	416	30%	30%
		450	450
Cost Components (in Thousand Rs.)	Converted		
Cost for washing and laundry place	1,500	1425	427.5
		427.5	570

S.N.	Year	Costs (in '000 Rs.)			Benefits (in 000 Rs.)						
		Capital Cost	Env. Edu. & Mgmt Cost	O&M Cost	Per annum Total Cost	Per annum Income	Other Benefit	Total Benefit	Cash Flow	Discounted Cost	Discounted Benefit
1	2003	428	477		904			0	(904)	845	0
2	2004	428	477		904	125		125	(779)	790	109
3	2005	570	238		808	250		250	(559)	660	204
4	2006			214	214	395	20	415	201	163	317
5	2007			224	224	415	21	436	211	160	311
6	2008			236	236	436	22	457	222	157	305
7	2009			247	247	457	23	480	233	154	299
8	2010			260	260	480	24	504	245	151	294
9	2011			273	273	504	25	530	257	148	288
10	2012			286	286	530	26	556	270	146	283
11	2013			301	301	556	28	584	283	143	277
12	2014			316	316	584	29	613	297	140	272
13	2015			332	332	613	31	644	312	138	267
14	2016			348	348	644	32	676	328	135	262
15	2017			366	366	676	34	710	344	133	257
16	2018			384	384	710	35	745	361	130	252
17	2019			403	403	745	37	782	379	128	248
18	2020			423	423	782	39	822	398	125	243
19	2021			444	444	822	41	863	418	123	239
20	2022			467	467	863	43	906	439	121	234
21	2023			490	490	906	45	951	461	118	230
22	2024			514	514	951	48	999	484	116	225
23	2025			540	540	999	50	1,049	508	114	221
24	2026			567	567	1,049	52	1,101	534	112	217
25	2027			595	595	1,101	55	1,156	561	110	213
26	2028			625	625	1,156	58	1,214	589	108	209
27	2029			657	657	1,214	61	1,275	618	106	205
28	2030			689	689	1,275	64	1,338	649	104	201
Total		1,425		10,202				20,179		5,575	6,682
								10.92%			
								1.20			
								1,107			

Note

The capital cost column derived from the cost components has been divided for 2003, 2004, and 2006 as 40%, 40%, and 20% respectively

O&M cost for 2006 has been taken as 5% of the capital cost for 2006

From 2007 to 2030, the O&M cost has been increased by the growth of 5% per annum

Per annum income for 2004 is taken as 30% of the per annum income of the group

Per annum income for 2005 is taken as 60% of the per annum income of the group

Table III:4-B(a)
Integrated Analysis of the Software Components

(Inclusive of Environment Education and Management Cost)

Without Conversion

Discount Rate 7%

S.N.	Year	Total Cost (in 000 Rs.)	Total Benefit (in '000 Rs.)	Cash Flow	Discounted Cost	Discounted Benefit
1	2003	3,436	0	(3,436)	3,211	0
2	2004	3,436	730	(2,706)	3,001	637
3	2005	2,093	1,459	(634)	1,708	1,191
4	2006	1,842	2,070	228	1,405	1,579
5	2007	1,885	2,174	288	1,344	1,550
6	2008	1,930	2,282	352	1,286	1,521
7	2009	1,976	2,901	924	1,231	1,806
8	2010	2,024	2,516	493	1,178	1,465
9	2011	2,072	2,642	570	1,127	1,437
10	2012	2,122	2,774	652	1,079	1,410
11	2013	2,174	2,913	739	1,033	1,384
12	2014	2,227	3,059	832	989	1,358
13	2015	2,281	3,716	1,434	947	1,542
14	2016	2,337	3,372	1,035	906	1,308
15	2017	2,395	3,541	1,146	868	1,283
16	2018	2,455	3,718	1,263	831	1,259
17	2019	2,516	3,904	1,388	796	1,236
18	2020	2,579	4,099	1,520	763	1,213
19	2021	2,644	4,808	2,164	731	1,329
20	2022	2,711	4,519	1,809	700	1,168
21	2023	2,780	4,745	1,966	671	1,146
22	2024	2,851	4,982	2,132	643	1,125
23	2025	2,924	5,232	2,308	617	1,104
24	2026	2,999	5,493	2,494	591	1,083
25	2027	3,077	6,272	3,194	567	1,156
26	2028	3,158	6,056	2,898	544	1,043
27	2029	3,241	6,359	3,118	522	1,023
28	2030	3,326	6,677	3,351	500	1,004
Total		71,490	103,014		29,791	34,361
	IRR	11.08%	B/C Ratio	1.15	NPV	4,570
					Rs.	Dollars
	Total Capital Cost (in '000 Rs.)				3,740	49
	Average Capital Cost/annum (in '000 Rs.)				1,247	16
	Total O&M cost (in '000 Rs.)				64,102	843
	Average O&M cost/annum (in '000 Rs.)				2,289	30
	Total Benefit (in '000 Rs.)				103,014	1,355
	Fund Available for Project				30,780	405
	Fund Needed for Env. Edu & Training				15,200	200
	Management and Training Cost				14,820	195
	Total				60,800	800
	Remaining fund for projects				27,040	356
	No of projects that can be formulated based on the sample project					21.69
	Sample projects					3.00
	Total projects					24.69
	Project/capita share of env. education cost				616	8.10
	Project/capita share of mgmt. and training cost				600	7.90
	Total				1,216	

Table III:4-B(b)
Integrated Analysis of the Software Components
(Inclusive of Environment Education and Management Cost)
With Conversion

Discount Rate 7%

S.N.	Year	Total Cost (in '000 Rs.)	Total Benefit (in '000 Rs.)	Cash Flow	Discounted Cost	Discounted Benefit
1	2003	3,296	0	(3,296)	3,080	0
2	2004	3,296	699	(2,596)	2,878	611
3	2005	2,004	1,399	(605)	1,636	1,142
4	2006	1,831	1,967	136	1,397	1,500
5	2007	1,874	2,065	192	1,336	1,472
6	2008	1,918	2,168	251	1,278	1,445
7	2009	1,963	2,781	818	1,223	1,732
8	2010	2,010	2,391	381	1,170	1,391
9	2011	2,058	2,510	452	1,119	1,365
10	2012	2,107	2,636	528	1,071	1,340
11	2013	2,158	2,767	609	1,025	1,315
12	2014	2,210	2,906	696	981	1,290
13	2015	2,264	3,555	1,291	939	1,475
14	2016	2,319	3,204	885	899	1,242
15	2017	2,376	3,364	988	861	1,219
16	2018	2,434	3,532	1,098	825	1,196
17	2019	2,495	3,709	1,214	790	1,174
18	2020	2,557	3,894	1,338	756	1,152
19	2021	2,620	4,593	1,972	725	1,270
20	2022	2,686	4,293	1,607	694	1,109
21	2023	2,754	4,508	1,754	665	1,089
22	2024	2,824	4,733	1,910	637	1,068
23	2025	2,896	4,970	2,074	611	1,048
24	2026	2,970	5,218	2,249	585	1,029
25	2027	3,046	5,983	2,937	561	1,102
26	2028	3,125	5,753	2,629	538	991
27	2029	3,206	6,041	2,835	516	972
28	2030	3,290	6,343	3,053	495	954
Total		70,583	97,982		29,292	32,696
	IRR	10.21%	B/C Ratio	1.12	NPV	3,404
					Rs.	Dollars
		Total Capital Cost (in '000 Rs.)			3,553	47
		Average Capital Cost/annum (in '000 Rs.)			1,184	16
		Total O&M cost (in '000 Rs.)			63,565	836
		Average O&M cost/annum (in '000 Rs.)			2,270	30
		Total Benefit (in '000 Rs.)			97,982	1,289
		Fund Available for Project			30,780	405
		Fund Needed for Env. Edu & Training Management and Training Cost			15,200	200
		Total			14,820	195
		Remaining fund for projects			60,800	800
					27,227	358
		No of projects that can be formulated based on the sample project				22.99
		Sample projects				3.00
		Total projects				25.99
		Project/capita share of env. education cost			585	7.70
		Project/capita share of mgmt. and training cost			570	7.50
		Total			1,155	