BEFORE THE GUJARAT ELECTRICITY REGULATORY COMMISSION
AHMEDABAD
I.A. NO. 8 OF 2016
IN
CASE NO. 1024/2010

IN THE MATTER OF:

M/s Tarini Infrastructure Ltd. **...APPLICANT/ PETITIONER**

Versus

Gujarat Urja Vikas Nigam Ltd. & Ors. **...RESPONDENTS**

CONSOLIDATED VOLUME OF DOCUMENTS

VOLUME II

(Page No. 273 to 560)

PAPER BOOK

[FOR INDEX KINDLY SEE INSIDE]

HEMANT SINGH/ MATRUGUPTA MISHRA/ SHIKHA OHRI
ADVOCATES FOR THE PETITIONER

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THROUGH

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DATED: 05.06.2017

Power Potential Studies In 75% Dependable Year
1989-90 is the 75% dependable year

F.R.L =	79.86 M
M.D.D.L =	61.6 M
Storage Capacity at FRL	567.8 MCM
Storage Capacity at MDDL	64.5 MCM

SHP-II (Dam Toe SHP at the RBHR)		
Combined Efficiency		83.6%
Rated Head		13.00
Rated Discharge		24.39
Limits	Max Head	16.25
	Min Head	8.45
	Max Discharge	24.39
	Min Discharge	9.755
Installed capacity (KW)		2600
Tail Water Level		58.5
Head Losses		2.5

SHP-I (At the Existing Penstock Outlet)		
Combined Efficiency		83.6%
Rated Head		27.00
Rated Discharge		13.55
Limits	Max Head	33.75
	Min Head	17.55
	Max Discharge	13.55
	Min Discharge	2.710
Installed capacity (KW)		3000
Tail Water Level		49.25
Head Losses		1.5

Month	Initial Level	Initial Storage	Inflow for Year 1989-90	Total Storage	Live Capacity	SHP-II								SHP-I							Unused Spill without generation	Total Withdrawal (Col 9+16+22)	Final Storage (Col 5-23)	Final level of Reservoir (Area cap Curve)	Average level of Resevoir (avg of col 2 & 25)	SHP-II		SHP-I		Spill Over (Uncontrolled water)
						Min RBHR Release for Year 1989-90	Additional Release for power-II	Total Release from SHP-II	Utilised water for Power from SHP-II	Net Head for SHP-II (col 28)	Max Power generated from SHP-II	Restricted Power Generated	Generated Units from SHP-II	Balance Live Cap	Released water for SHP-I	Utilised water From SHP-I	Net Head for SHP-I (col 30)	Max Power generated from SHP-I	Restricted Power Generated	Generated Units-I from SHP-I						Net Head Available (Col 26-TWL-Losses)	Net Head used	Net Head Available (Col 26-TWL-Losses)	Net Head used	
	m	MCM	MCM	MCM	MCM	MCM	MCM	MCM	MCM	m	KW	KW	GWh	MCM	MCM	MCM	m	KW	KW	GWh	MCM	MCM	MCM	m	m	m	m	m	m	MCM
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
June	61.60	64.50	0.00	64.50	0.00	0.00		0.00	0.00	0.00	0	0	0.000	0.00		0.00	0.00	0	0	0.000		0.00	64.50	61.60	61.60	0.60	0.00	10.65	0.00	0.00
	61.60	64.50	26.20	90.70	26.20	4.20		4.20	0.00	0.00	0	0	0.000	22.00		0.00	0.00	0	0	0.000		4.20	86.50	62.97	62.28	1.28	0.00	11.53	0.00	0.00
	62.97	86.50	0.00	86.50	22.00	6.56		6.56	0.00	0.00	0	0	0.000	15.44		0.00	0.00	0	0	0.000		6.56	79.94	62.63	62.80	1.80	0.00	12.05	0.00	0.00
July	62.63	79.94	47.11	127.05	62.55	1.46		1.46	0.00	0.00	0	0	0.000	61.09		0.00	0.00	0	0	0.000		1.46	125.59	65.21	63.92	2.92	0.00	13.17	0.00	0.00
	65.21	125.59	107.05	232.64	168.14	3.06		3.06	0.00	0.00	0	0	0.000	165.08		0.00	0.00	0	0	0.000		3.06	229.58	70.02	67.61	6.61	0.00	16.86	0.00	0.00
	70.02	229.58	562.99	792.58	728.08	0.57	22.62	23.19	23.18	13.94	2788	2600	0.686	704.89	12.88	12.88	24.19	2688	2688	0.710		36.07	567.76	79.86	74.94	13.94	13.94	24.19	24.19	188.75
August	79.86	567.76	115.84	683.60	619.10	3.36	17.72	21.08	21.07	16.25	3250	2600	0.624	598.02	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	83.05
	79.86	567.76	224.63	792.39	727.89	0.00	21.08	21.08	21.07	16.25	3250	2600	0.624	706.81	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	191.85
	79.86	567.76	520.70	1088.46	1023.96	0.00	23.19	23.19	23.18	16.25	3250	2600	0.686	1000.77	12.88	12.88	29.11	3234	3000	0.792		36.07	567.76	79.86	79.86	18.86	16.25	29.11	29.11	484.63
Sept.	79.86	567.76	123.38	691.14	626.64	0.00	21.08	21.08	21.07	16.25	3250	2600	0.624	605.56	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	90.60
	79.86	567.76	40.06	607.82	543.32	0.00	21.08	21.08	21.07	16.25	3250	2600	0.624	522.24	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	7.27
	79.86	567.76	160.61	728.37	663.87	0.88	20.20	21.08	21.07	16.25	3250	2600	0.624	642.79	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	127.82
Oct	79.86	567.76	115.87	683.63	619.13	0.34	20.74	21.08	21.07	16.25	3250	2600	0.624	598.05	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	83.08
	79.86	567.76	15.44	583.20	518.70	2.24	18.84	21.08	21.07	16.25	3250	2600	0.624	497.62	11.71	11.71	28.90	3211	3000	0.720		32.79	550.41	79.45	79.65	18.65	16.25	28.90	28.90	0.00
	79.45	550.41	7.81	558.22	493.72	0.37	22.62	23.19	23.18	16.25	3250	2600	0.686	470.53	12.88	12.88	28.37	3153	3000	0.792		36.07	522.15	79.80	79.12	18.12	16.25	28.37	28.37	0.00
Nov.	78.80	522.15	0.00	522.16	457.66	2.30	18.78	21.08	21.07	16.25	3250	2600	0.624	436.58	11.71	11.71	27.69	3076	3000	0.720		32.79	489.37	78.07	78.44	17.44	16.25	27.69	27.69	0.00
	78.07	489.37	1.51	490.88	426.38	1.52	19.56	21.08	21.07	16.25	3250	2600	0.624	405.30	11.71	11.71	26.94	2993	2993	0.718		32.79	458.09	77.30	77.69	16.69	16.25	26.94	26.94	0.00
	77.30	458.09	0.00	458.09	393.59	0.24	20.84	21.08	21.07	15.91	3181	2600	0.624	372.51	11.71	11.71	26.16	2906	2906	0.697		32.79	425.31	76.52	76.91	15.91	15.91	26.16	26.16	0.00
Dec.	76.52	425.31	0.00	425.31	360.81	2.81	18.27	21.08	21.07	15.05	3010	2600	0.624	339.73	11.71	11.71	25.30	2811	2811	0.675		32.79	392.53	75.58	76.05	15.05	15.05	25.30	25.30	0.00
	75.58	392.53	0.00	392.53	328.03	0.00	21.08	21.08	21.07	14.06	2813	2600	0.624	306.95	11.71	11.71	24.31	2702	2702	0.648		32.79	359.74	74.55	75.06	14.06	14.06	24.31	24.31	0.00
	74.55	359.74	0.00	359.75	295.25	4.11	19.08	23.19	23.18	13.00	2600	2600	0.686	272.06	12.88	12.88	23.25	2583	2583	0.682		36.07	323.68	73.45	74.00	13.00	13.00	23.25	23.25	0.00
Jan	73.45	323.68	0.00	323.68	259.18	0.00	21.08	21.08	21.07	11.92	2384	2384	0.572	238.10	11.71	11.71	22.17	2464	2464	0.591		32.79	290.89	72.39	72.92	11.92	11.92	22.17	22.17	0.00
	72.39	290.89	0.00	290.89	226.39	4.74	16.34	21.08	21.07	10.82	2165	2165	0.520	205.31	11.71	11.71	21.07	2341	2341	0.562		32.79	258.10	71.25	71.82	10.82	10.82	21.07	21.07	0.00
	71.25	258.10	0.00	258.10	193.60	0.67	22.52	23.19	23.18	9.64	1929	1929	0.509	170.41	5.00	5.00	19.89	858	858	0.227		28.19	229.91	70.03	70.64	9.64	9.64	19.89	19.89	0.00
Feb.	70.03	229.91	0.00	229.91	165.41	3.48	17.60	21.08	21.07	8.46	1691	1691	0.406	144.33	7.00	7.00	18.71	1243	1243	0.298		28.08	201.83	68.88	69.46	8.46	8.46	18.71	18.71	0.00
	68.88	201.83	0.00	201.83	137.33	2.19		2.19	0.00	0.00	0	0	0.000	135.14	11.71	11.71	17.82	1980	1980	0.475		13.90	187.93	68.25	68.57	7.57	0.00	17.82	17.82	0.00
	68.25	187.93	0.00	187.93	123.43	0.00		0.00	0.00	0.00	0	0	0.000	123.43		0.00	0.00	0	0	0.000		0.00	187.93	68.25	68.25	7.25	0.00	17.50	0.00	0.00
March	68.25	187.93	0.00	187.93	123.43	6.34		6.34	0.00	0.00	0	0	0.000	117.09		0.00	0.00	0	0	0.000		6.34	181.59	67.96	68.10	7.10	0.00	17.35	0.00	0.00
	67.96	181.59	0.00	181.59	117.09	0.00		0.00	0.00	0.00	0	0	0.000	117.09		0.00	0.00	0	0	0.000		0.00	181.59	67.96	67.96	6.96	0.00	17.21	0.00	0.00
	67.96	181.59	0.00	181.59	117.09	6.50		6.50	0.00	0.00	0	0	0.000	110.59		0.00	0.00	0	0	0.000		6.50	175.09	67.64	67.80	6.80	0.00	17.05	0.00	0.00
April	67.64	175.09	0.00	175.09	110.59	0.00		0.00	0.00	0.00	0	0	0.000	110.59		0.00	0.00	0	0	0.000		0.00	175.09	67.64	67.64	6.64	0.00	16.89	0.00	0.00
	67.64	175.09	0.00	175.09	110.59	4.41		4.41	0.00	0.00	0	0	0.000	106.18		0.00	0.00	0	0	0.000	20.000	24.41	150.68	66.43	67.04	6.04	0.00	16.29	0.00	0.00
	66.43	150.68	0.00	150.68	86.18	4.60		4.60	0.00	0.00	0	0	0.000	81.58		0.00	0.00	0	0	0.000	20.000	24.60	126.08	65.23	65.83	4.83	0.00	15.08	0.00	0.00
May	65.23	126.08	0.00	126.08	61.58	0.00		0.00	0.00	0.00	0	0	0.000	61.58		0.00	0.00	0	0	0.000	20.000	20.00	106.08	64.18	64.70	3.70	0.00	13.95	0.00	0.00
	64.18	106.08	0.00	106.08	41.58	10.95		10.95	10.95	0.00	0	0	0.000	30.63		0.00	0.00	0	0	0.000	25.000	35.95	70.13	62.06	63.12	2.12	0.00	12.37	0.00	0.00
	62.06	70.13	52.56	122.68	58.18	0.00		0.00	0.00	0.00	0	0	0.000	58.18		0.00	0.00	0	0	0.000	25.000	70.13	64.50	61.60	61.83	0.83	0.00	11.08	0.00	0.00
Carry Over	61.60	64.50																			58.180	58.18								
			2121.77			77.90	404.52	482.42	442.89	Generation in MU			12.240		239.09	239.09	Generation in MU			13.628	143.180										1267.07
										Generation at 95% PA			11.63				Generation at 95% PA			12.95										
										Plant Load Factor			53.74%				Plant Load Factor			51.86%										

CHAPTER -5

Civil Works

CHAPTER – 5

CIVIL WORKS

5.0 General

Dam Toe SHP-1 has been proposed on existing concrete outlets of Dam. Two units each of 1500 KW is proposed to be provided at SHP-1. Brief details of civil works are as given below:

5.1 Components of Dam Toe SHP-1

The main components of the SHP-1 are as given below:-

5.1.1 Intake

Two openings have already been provided at chainage 1013.469 m & 1018.955 m respectively in the body of the dam on the right bank. Trashracks, stoplogs & gates have been provided at the upstream face of the dam in each opening.

5.1.2 R.C.C Conduit /Penstock

Two number RCC penstocks each of size 1.524 x 1.524 m (square opening) and length of about 33m from intake opening to Bulk head have already been provided in the body of the masonry dam on the right bank. Steel lined penstock each of dia 1.5m, 12 mm thick and 9.5m long is proposed to be provided starting from existing end of bulk head, which will be further reduced to 1.2m dia near the upstream of the power house to feed two generating units.

5.1.3 Power House & Switchyard

Power House building is a simple structure housing two generating units, auxiliary equipment & control panels. The Power House is proposed on the right bank on the downstream side of existing dam. The average ground level in the vicinity of the Power House building is 42m. The main features of the Power House building are as follows.

(i) The main building of size 22.5m x10m in plan is provided to accommodate two generating units each of 1500 KW including auxiliary equipment etc.

(ii) The total height of the building is about 24m from deepest foundation level which is same as that of existing side walls of stone masonry. Due to high floods from river side RCC wall is proposed on the downstream side up to EL 61.26m so that water may not enter inside the Power House. Power House building will be compact one and it will be made water tight on all the four

sides. To facilitate handling of equipment one No. EOT crane of 20 tonnes capacity is proposed to be provided i.e. inside the Power House. This will be used during erection & maintenance.

Approach to the Power House will be from top at EL 61.26m. One hatch cover of size 4m x 4m is to be provided for handing of equipment from top. A movable crane of capacity 20 tonnes is proposed to be provided at top of the Power House for erection and maintenance of generating units. Thus entry will be possible only from top of the Power House *i.e* from existing generator room which is at El. 60.96m.

(iii) A separate control room of size 22.5m X 5m is proposed at EL 45.00 on the u/s of Power House where sufficient space is available between Power House & existing bulk head of R.C.C ducts.

(iv) Walls of the building will be made of R.C.C.

(v) Two vertical gates each of size 3.25m X 2m will be provided at the end of draft tube to facilitate dewatering of draft tube during maintenance and closure of generating units during maintenance.

(vi) A raft foundation is provided considering the vibration of machines and uplift pressures.

5.1.4 Tail race channel

Discharges from the generating units will be fed into single tail race channel of 9.25 width. The length of tail race channel will be about 15.6m with 4:1 (H: V) slope. The exit end of draft tube will be at EL 38.35m & weir crest will be at EL 42.25m. The minimum tail water level at EL 42.5m will be maintained by construction of weir at the end. Trail race channel has been designed for a discharge of about 15 cumecs.

5.1.5 Switchyard

Switchyard is proposed to be provided near the existing generator room of the dam at EL 60.96m where sufficient space is available.

CHAPTER -6

Electro-Mechanical Works

CHAPTER -6

ELECTRO-MECHANICAL WORKS

6.1 BROAD SCOPE OF WORKS:

Daman Ganga I H.E. Project envisages an installation of 2 units of 1.5MW in a surface power house. The scope of EM works includes Design, Engineering, Manufacture, Testing at Works, Supply, Transportation, Insurance, Handling, Storage at site, Erection, Testing and Commissioning of all Electro-Mechanical Equipments, Material and Services as broadly detailed below for commissioning of 2X1.5 MW generating units. The main equipment comprises of: -

- 2 (Two) Nos. of Vertical Shaft Kaplan Turbine & Main Inlet Valve of butterfly type complete with all unit auxiliaries like Governing System, Pressure oil System/Hydraulic Pack, High pressure and low pressure compressed air system, Grease Lubrication System, Drainage & dewatering system etc.
- 2(Two) Nos. of Hydro Generators complete with Brushless Excitation System with AVR panels, Brake System, cooling water system etc.
- 2 (Two) 3.3/34.5 kV, 2.0 MVA, 3 phase, ONAN cooled Generator Step-up Transformers
- 2 (Two) 33/0.433 kV, 150 KVA, 3 phase, ONAN (Oil natural, air natural) cooled Station Auxiliary Transformers.
- 3.3 kV LAVT Panel, Neutral Grounding panel & 3.3 kV Switchgear Panel.
- Unit control Boards, PLC panels, Metering, Protection, Annunciation Devices, Line & Transformer Control Panels and Station Aux. supply Panels
- 33 kV high voltage switchgear for outdoor switchyard
- Station D.C equipment comprising of 110 V DC battery, Battery charging equipment and DC Distribution board
- Power, Control & Instrumentation Cables, Cable Trays, cable supporting racks, Hardware & fittings etc.
- Common Station Auxiliary Equipment comprising of Illumination of Power House & Switchyard, Ventilation & Air conditioning, Fire Protection System and Drainage & Dewatering System
- Electric Overhead Traveling Cranes for power house
- Ground Mat & Earthing System for Power House & Switchyard

- Diesel Generating Set for emergency supply
- Power Evacuation Arrangement at 33kV switchyard

6.2 OPERATING CHARACTERISTICS

From the reservoir levels, tail water levels and losses in the water conductor system, operating parameters and heads are determined as a tabulated below

Turbine shall be suitable to operate satisfactorily under this extreme range of heads.

The heads are:

Maximum Net Head 33.75 m

Minimum Net Head 17.55 m

Rated Net head 27.0m

The design head i.e. the head at which turbine has best efficiency, is also proposed to be kept same as the rated head i.e. 13.0 m

6.3 BASIC TECHNICAL PARAMETERS OF MAIN EQUIPMENTS:

Sl. No	Equipment/Item	Brief Specifications
1	**Turbine**	
	Type	Vertical Shaft Kaplan with double regulation
	Output	To match the generator output of 1.5 MW at rated head conditions plus 10% continuous overload at rated head.
	Rated and design net Head	27.0 meters (Approx)
	Speed	600 rpm
	Runner Setting	-3.0 meters
	Minimum Tail Water Level	49.25 m
2	**Inlet Valve**	
	Type	Butterfly type
	Diameter	1.35 meters and/or to suit the discharge conditions

3	**Generator**	
	Out put	1.5 MW under rated conditions plus 10 % continuous overload
	Power factor	0.85 lagging
	Speed	600 rpm
	Voltage	3.3 kV
	Excitation System	Brushless Type
	Short Circuit Ratio	> 0.9
4	**Main Generator Transformers**	
	Capacity, three Phase	2.0MVA
	Voltage Ratio	3.3/34.5 kV
	Cooling Type	ONAN
5	**Switchyard Equipment**	
	33 kV Circuit Breakers	3 Nos. SF_6 / Vacuum Type, 25 kA, 630 A
	33 kV Isolators with/without earthing switch	6 Nos., 630 A, Short Time current rating 25 kA for 1 sec
	33 kV Current Transformers	9 Nos.
	33 kV/√110 V Potential Transformers	9 Nos.
	30 kV Lightning Arresters	9 Nos.
	Structural Steel	As Required
	Miscellaneous Items	Insulators, ACSR Conductor, Connectors, hard ware, GI wire
6	**DC Equipment**	
		Battery 110V , 200 AH , Tubular Type with HDP cells
		2 sets of Battery Chargers each comprising of Float cum Boost chargers
		DC distribution Board with adequate no. of feeders to meet DC normal and emergency load requirements
7	**Crane**	
		10 Tonnes or higher capacity EOT Crane suitable to lift heaviest equipment of the station
8	**Cables**	
		XLPE cables for Interconnection of Generator Terminals to Transformer LV side
		Power & Control Cables as required complete with cable terminations,

		cable Glands, Lugs and Cable Trays
9	DG Set	
		62.5 kVA DG set for emergency Power requirements of the station

6.4 BRIEF SPECIFICATION OF MAJOR EQUIPMENTS:

GENERAL

It is proposed to install two (2) nos. of 3.3 kV, 1.5 MW, 0.85 pf. synchronous generators. The generators will be connected to 3.3 kV switch board. The generator voltage will be stepped up to 33kV by means of 2 nos. of 2.0 MVA, 3.3/34.5 kV, 3 phase Step-up transformers and power will be evacuated to the nearest existing substation at xx/xx/xx by a single circuit 33kV transmission line. The electrical details of the proposed scheme are shown in single line diagram.

6.5 Turbine

One (1) double regulated vertical Kaplan turbine, with steel spiral casing, coupled rigid to the generator-shaft, consisting of the following components:

Kaplan Runner with 5 adjustable blades in stainless steel, finished grinded, with runner hub, with runner-blade-servomotor, with self-operating mechanism, a set of self-lubricated bearings, links and levers, and runner cone.

Discharge ring of the semi-spherical type, welded design, integral embedded in concrete, welded at site to the draft tube cone, with stainless steel in the range of runner.

Wicket gate assembly consisting of 20 moveable, stainless wicket gates supported by self-lubricated journal bushings, bearing housing including upper and lower bushings for the wicket gate upper stem bearings and bearing bushings for the wicket gate lower trunnions.

Gate operating ring, mounted to the head-cover, gate levers, friction coupiings for levers to gate stem, and double-acting servomotor

Wicket gate servomotor located in the turbine pit, wicket gate position transducer mounted on the servomotor.

Stay vane ring welded design

Head cover consisting of outer head cover of fabricated plate steel bolted to the stay vane ring and supporting the upper stems of the wicket gate,

Inner head cover of fabricated plate steel, supporting the turbine shaft seal and guide bearing.

Draft tube cone manufactured of steel-plate, embedded in concrete.

Draft tubes bend of steel-plate, embedded in concrete,

Hollow turbine shaft with flange connection to the turbine runner and generator shaft

Turbine guide-bearing designed as split roller-bearing (grease lubricated).

Shaft seal, designed as stuffing box sealing (PTFE coated seal rings) including sealing housing.

Runner servo motor, for adjustment of runner blades, with rotating oil supply head, mounted on top of generator, operating rod through the hollow turbine-generator shaft.

6.6 Control equipment:

Position control runner servo motor
Position control wicket gate servo motor
PT100 for turbine guide bearing
Speed sensor including tooth wheel

6.7 Hydraulic Power Pack (Pressure Oil Supply System)

Two (2) Hydraulic power packs suitable for control of the turbine units operation in parallel with the grid consisting of:

Hydraulic power pack with one ac-motor pump, hand pump and ball valve for manual operation mode, pressure accumulator designed for safe operation of all hydraulic cylinders in case of a fault in the pump power supply.

Maximum and minimum pressure monitoring, oil tank with oil level gauge and drainage system, control valve and quick shut off solenoid valves

All necessary fittings and piping from the power pack to the turbine and turbine inlet valve.

The hydraulic power pack unit shall be completely wired to a common terminal box.

The turbine shall be complete with necessary Control, Instruments, indicating and Safety devices.

6.8 Digital Turbine Controller

Two (2) Digital Turbine Controllers based on Programmable Logic controller shall be provided for control of turbine, generator & unit accessories. The following control modes shall be available. The controllers shall be suitable for window operating system and shall have TFT colour display panel. It shall be possible to retrieve actual values, modify target values and failure thresholds, and conduct failure analysis.
Basically, four different types of operation shall be selectable.

Automatic mode:
In automatic mode, the turbine will self-regulate according to the externally defined target value.

Semi-automatic mode:
In semi-automatic mode, the turbine will self-regulate according to the target value setting of the turbine controller.

Manual mode:
In manual mode, the turbine can be opened and closed by pressing the corresponding buttons on the user panel.

Emergency manual mode:
The controller shall be provided with an emergency control unit that allows bypassing of both the Programmable Logic Controller and the touch panel for opening and closing the turbine. For this purpose, the manual emergency plug-in shall be activated via the master switch. After this, the turbine can be opened and closed with a manual potentiometer and push-buttons.

6.9 GENERATOR

The synchronous generators will be 1.5 MW, 3.3 kV, 3 phase 0.85 PF (lag), 50 Hz with brushless excitation system, suitable for parallel operation with the grid. The generator with higher terminal voltage of is also acceptable if it leads to more economical alternative. The speed of the generator will be decided by the Vendor to provide the most economical and optimum design to match the turbine speed. The generator winding will be Class F insulation with temperature rise limited to Class B and will be star connected. The generator neutral will be earthed through neutral grounding transformer with secondary resistance. All six terminals of the generator will be brought out for external connection.

6.10 EXCITATION SYSTEM

The excitation system will be brushless system. The excitation system will include AVR, field suppression equipment, field circuit breaker, and exciter for brushless excitation system, field flashing unit etc. The ceiling voltage of the excitation system will be at least 200% of the normal field voltage and response ratio will be about 2.0. The excitation system shall have the following features:

(a) Maximum and minimum excitation limiter
(b) Over fluxing limiter
(c) Stator Over current limiter

Excitation system will have both auto mode and manual mode. Sufficient redundancy will be built in both rectifier and firing circuits so that failed cards can be identified and replaced on-line.

6.11 3.3 KV SWITCHGEAR

The power generated will be fed to an indoor, metal-enclosed, modularized 3.3 kV switchgear by means of two runs of 1Cx 300 sq.mm, aluminium conductor, XLPE insulated, armoured cable per phase. The connection between 3.3 kV switchgear and 3.3/34.5 kV generator transformer will be by two runs of 1Cx 300 Sq.mm, aluminium conductor, XLPE insulated, armoured cables per phase laid in trenches. Two outgoing feeders with switch and fuse will be provided for feeding the auxiliary transformers from 3.3 KV switchgear.

The main electrical parameters of the switchgear will be:

(a) Rated voltage – 3.3 kV
(b) Rated short circuit breaking current- 25 kA for 1 second
(c) Rated current - 630 A
(d) Type of breaker -SF6 /Vacuum

6.12 GENERATOR TRANSFORMERS

Power generated at 3.3 kV will be stepped up to 33 kV by means of 2 x 2.0 MVA, 3.3 kV / 34.5 kV step-up transformers. The 3.3 kV terminals will be suitable for cable connection. The 33 kV terminals will be brought out through bushings for connection to ACSR conductor.

The main electrical parameters of the transformers will be:

(a) Voltage ratio, 3.3 kV / 34.5 kV, 3 phase, 50 Hz
(b) Rating-2.0 MVA
(c) Cooling Method - ONAN
(d) 3.3 kV connection -delta
(e) 33 kV connection - Star with neutral solidly earthed.
(f) On Load Tap Changer (OLTC) in the range of -15% to +5% in steps of 1.25%, suitable for bi-directional power flow.

6.13 33 KV OUTDOOR SWITCHYARD

Conventional outdoor 33 kV switchgear with necessary equipment such as Circuit breaker; Lightning arrestor; Voltage transformer; current transformer and isolators will be provided for power evacuation by 33 kV outgoing single circuit line to existing/new substation. A 33 kV switchyard with 3 bays (2 transformer bays and 1 line bay) is provided.

6.14 POWER EVACUATION

It is proposed to evacuate the power generated at Daman Ganga I Hydel Scheme to the existing 33 kV substation by using two no. of step-up transformers and a single circuit 33 kV transmission line.

The transmission voltage of 33 kV single circuit with ACSR conductor is selected for power evacuation, considering the quantum of power to be exported and the distance of transmission (Approx. 4 km).

6.15 STATION AUXILIARY POWER SUPPLY ARRANGEMENT AND 415 V SWITCHGEAR

415 V station auxiliary power will be derived by providing 2 x 100%, 150 kVA 3.3 kV/433V auxiliary transformer. The transformer will be connected to the 3.3 kV switchgear by means of fuse and load break switch.

The auxiliary transformers will feed an indoor metal enclosed, modular, and fixed type 415V switchgear by means of suitably rated cables. The 415V switchgear will also include cubicles for feeding the unit auxiliary loads. The auxiliary load for the power plant includes governor oil pumps, cooling water pumps, de-watering pumps, drainage pumps, crane, ventilation, lighting load etc.

The main electrical parameters of the switchgear will be:

(a) Rated Voltage-415V
(b) Rated short circuit breaking current - 25 kA for 1 second
(c) Rated bus bar current - 630 A

The main bus bar will be equipped with the following.

(a) MCCB controlled incomer from auxiliary transformer.
(b) Outgoing feeders to battery chargers / lighting panels, with MCCB units
(c) Motor feeders fitted with air break contactor, high rupturing capacity fuses, thermal overload relays etc
(d) The switchgear will be fitted with the necessary current transformers indicating instruments, relays, lamps, pushbuttons, bus VT, etc.

During normal operation, power supply to 415 V board will be derived from the 3.3 kV switchboard fed by hydro generators. When the hydro generators are not in operation auxiliary power will be derived from the grid by means of generator transformers. To cater to the eventuality of failure of grid supply, an emergency 62.5 KVA DG set will be provided which will feed the lighting loads of the plant in addition to battery charger. The DG set will be started automatically through AMF panel or manually as required.

The various services in the power plant will be supplied at the following nominal voltages depending upon their ratings and function:

(a)	Motors	- 415V, 3 phase AC supply
(b)	Lighting and space heaters	- 240V, 1 phase AC supply
(c)	Power receptacles	- 415V, 3 phase AC supply
(d)	Control circuits	- 110V, 1 phase grounded AC supply for AC control circuits. - 110V ungrounded DC supply for control, indication and Instrumentation & Control system

6.16 DC SUPPLY SYSTEM

The DC system is the most reliable source of supply in the power station and will be used for the control and protection of power plant equipment.

The DC system will be used for the following:

(a) Electrical control of equipment and indications / annunciation on the control panel and protective schemes.

(b) Emergency D.C lighting, in case of AC power failure

The station battery will be sized to cater to the following type of loads:

(a) Momentary load for 1 minute.
(b) Emergency load for 2 hours.
(c) Continuous load for 4 hours.

One set of 110 V, 200AH battery bank with two nos. float cum boost chargers (both operating in parallel) and DC distribution board will meet the DC loads. The batteries will be of stationary lead acid tubular type, complete with racks, porcelain insulators, inter cell and inter-tier connectors.

The chargers will be of silicon rectifier type with automatic voltage control and load limiting features. Under normal conditions, the battery will be on float charge. The float charger is connected to a distribution board and meets the requirements of DC load. In case of additional demand of load or AC supply failure, the battery will meet the requirements of DC loads. The boost charger will be designed to charge the fully discharged battery in 10 hours before putting it back on float charge.

6.17 CONTROL & PROTECTION SYSTEM

GENERATOR

The following protections will be provided for the generators:

(i) Reverse power
(ii) Voltage Restrained Over current
(iii) Stator earth fault
(iv) Loss of excitation
(v) Over frequency and under frequency
(vi) Over Voltage
(vii) Under Voltage
(viii) Differential
(ix) Negative phase sequence

6.18 STEP-UP TRANSFORMER

The following protections will be provided for step-up transformer:

33kVside

(i) Over current
(ii) Earth fault
(iii) Differential
(iv) O/C and E/F relay for line
(v) Backup earth fault

3.3 KV side

(i) Over current
(ii) Differential
(iii) Winding temperature alarm /trip

33 KV LINE

The following protections will be provided as composite relay for the 33 kV line.

(i) Under voltage

(ii) Over current & Earth Fault

6.19 Relay & Control Panels

The relay and control panel for the generator, step-up transformers/lines will house all the protective relays, meters, switches, etc., as indicated in the single line diagram and the panels will be located in the control room .

6.20 LIGHTING SYSTEM

The power station lighting system will comprise the following:

Normal 240V AC Lighting

The lighting fittings, fans & receptacles will be fed from 415V, 3 phase, 4 wire, lighting panel which in turn will be fed from the 415V switchgear. The lighting will cover the entire power house areas like TG hall, control room / switchgear room, battery room, maintenance bay, stair case, entrance, transformer area, power house periphery, switchyard etc. The lighting system will be fed by DG to provide lighting to the plant during the grid failure condition.

D.C EMERGENCY LIGHTING

Emergency lamps through rechargeable units located at various areas, shall be used.

Earthing System:

The earth mat system shall comprise of closed current conductor grid of steel flats laid over the excavated surface of powerhouse and shall extend to the penstock/tailrace area, if required. The power house ground mat shall be interconnected with the switchyard mat to lower the earth resistance. The earth mat shall be connected to the following equipment/objects in the power house to switchyard.

i) The neutral point of each equipment through its own independent earth
ii) Equipment framework and other non-current carrying parts
iii) All extraneous metallic frame work not associated with equipment
iv) The earth point of lightning arrestors, capacitive voltage transformers, voltage transformers, coupling capacitors and lightning conductors through their permanent independent earth electrodes

v) Station Fence

The earthing conductor (steel flat) shall be of adequate cross-section to safely withstand the system fault current for time duration of fault clearance by the remotest/backup protective system. Sufficient allowances shall be provided for corrosion of the embedded conductor on account of chemical properties of soil and also due to galvanic action with other embedded systems.

The grounding system shall be designed with the following objectives:

i) To provide low impedance path to fault currents to ensure prompt and consistent operation of protective devices during ground faults.

ii) To keep the maximum voltage gradient along the surface inside and around the project complex within safe limits during ground faults.

iii) To protect the life and property from over voltage

iv) To stabilize current potentials with respect to ground and limit the overall protection rise.

CHAPTER -7

Environmental & Ecological Aspects

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CHAPTER -7

ENVIRONMENTAL AND ECOLOGICAL ASPECTS

7.1 ENVIRONMENTAL IMPACT ASSESSMENT

7.1.1 Daman Ganga SHP-1 envisages the power generation from existing releases of power outlets. Small hydel development project, while sharing all the benefits of hydro electric generation, harnesses a renewable source of energy in extremely environmentally benign manner. Social cost therefore are almost nil to even an environmental conscious state. Being small it does not involve any additional submergence or violation of the sanctity of forests.

7.1.2 The location of all the components of the project require minimum area of land which comes under Govt. of Gujarat, Irrigation Department. The location of power house is so taken that it requires minimum width and at a safe distance from the existing canal system from the safety point of view during excavation of power house foundation. It does not cause any environmental and ecological imbalance of the area.

7.1.3 The magnitude of construction activity will not induce migration of labour to this area, as sufficient local labour is available in the area, and thus local ecology will not be pressurized.

7.1.4 In addition, it is proposed to do plantation in the scheme area wherever possible.

7.1.5 The water will be passing through turbines for power generation and the surplus water will be discharged into the river in SHP-1 This project involves minimal acquisition of land which shall be taken on leäse from irrigation department and no rehabilitation & resettlement issues are involved. Further no cuttings of trees are involved in the project. Therefore no forest clearance is required for this project.

A standard questionnaire issued by Department of Environment for river valley project duly filled is given in Annex 7.1.

ANNEX: 7.1

QUESTIONNAIRE ISSUED BY THE DEPARTMENT OF ENVIRONMENT

FOR RIVER VALLEY PROJECTS

7.0. Detailed basic information affecting the environment

7.01	Predominant existing land use (agricultural land reserve and the forests etc.) in project area and upto 10 km upstream	:	For agricultural purpose pattern
7.02	Break up of submerged area total submerged area (hectares)	:	SHP-1 on downstream side of Damanganga Dam. No additional submergence is caused due to this small hydel scheme.
	Forest land	:	Nil
	Cultivated land	:	Nil
	Shrubs & fallow	:	Nil
	Rocky outcrop	:	Nil
	Wetland	:	Nil
	Open water	:	Nil
	Other use	:	Nil
7.03	(a) Forest type in Catchment and submerged areas.	:	Not Applicable
	(b) Extent and nature of forest to be cut for construction of roads, colony and other appurtenant works.	:	Nil
7.04	Duration of project's construction	:	Eighteen months

7.05	Estimated peak labour strength Skilled .....20 Unskilled..... 80 Labour to be recruited from affected population skilled ..... NIL unskilled.....NIL	:	No population would be affected by these project, however, labour required would be available from the area.
7.06	Population density in the area per sq. km.	:	Sparsly Populated.
7.07	Number of villages and population to be displaced of any village/No. of villages..Nil town Size of Village .... Nil Affected families in each Village ..... Nil ST ... SC .... Other ..... Nil Occupation of the affected people Agriculture ..... Nil Industrial Labour ..... Nil Forest based ..... Nil Owner cultivators by size of land holdings : Marginal (1.0 hect.) Nil Small (1.0 – 2.5 hect.) Nil Medium (2.5 – 5.0 hect.) Nil Large (over 5.0 hect.) Nil	:	No displacement There is no displacement of any population due to construction of the project. The information required is not relevant.
7.08	Resettlement Is a rehabilitation committee being Constituted ?	:	Resettlement is not required.
	Existing guidelines, if any for compensation.	:	Not required
	Level of compensation in cash and kind.	:	N.A.
	Number of oust families likely to be settled in new settlement.	:	N.A.

	Size of proposed new settlement.	:	N.A.
	Layout plans/masterplans for new settlement.	:	N.A.
	Distance of new settlements from the present habitant.	:	Not applicable
7.09	Number and type of facilities (e.g. School, post offices, bank, panchayat ghar, police station approach road, drainage and water supply etc.) proposed to be provided.	:	All these facilities are existing.
7.10	Is the affected area covered by development programmes like IED, SED, Drought prone area tribal development etc.	:	No
7.11	Any proposal to provide or create employment for outsees – nature and quantum of employment to be provided	:	There would be no outsees due to construction of the project.
7.12	What is the expected rate of siltation ?	:	Not applicable for this project.
	Is down stream area subject to flooding ?	:	Not applicable for this project.
7.13	Wind at Dam site (diagram giving statistical information concerning the direction and speed of the wind at the site.)	:	Not applicable for this project.
7.14	Hurricane, tonadoes, cyclones.	:	Nil
	Frequency of occurrence	:	Not applicable
	Wind velocity (Average)	:	Not available
7.15	Plan of area, on the reservoir periphery subject to erosion,	:	Not applicable

slides and slips.

7.16	The depth of round water Table – Maximum Minimum	: :	Not applicable Not applicable
	Quality of ground water potable / non-potable / fit for irrigation / industry.	:	Potable
7.17	Paresent ground water use pattern in the command area under irrigation.	:	Only surface water from canals and pumping sets are used in the command area.
7.18	Based on the experience of similar projects in the area, specify the inter action between the altered surface water patterns and underground acquifers and their recharge.	:	This being hydel project, hence not applicable
7.2	Environmental status		
7.2.1	(a) Indicate known pollution sources in the region (indicate the industrial like chemicals, textiles and other thermal power unit. Mining operations etc.)	:	Nil
7.2.2	Indicate the industrial and other development project likely to be taken up in the area during the next five to ten years.	:	The area has potential for further industrial development.
7.2.3	(a) Does the area support economically viable aquatic life, fish, crocodiles ?	:	No
	(b) Are there any fish / crocodile breeding ground in the river tributaries in the submergence ?	:	No

7.2.4	Does the site contain a wild life (including birds) habitat, breeding area, feeding area, migration route including the number of wild life available in the area.	:	No
7.2.5	Is the site a potential wild life sanctuary ?	:	No
7.2.6	Specify any rare or endangered species of flora and fauna found in the effected area alongwith their approximate number and measures to salvage / rehabilitate them.	:	No
7.2.7	Is the area a tourist resort ?	:	No
7.2.8	Are any monuments / sites of cultural, historical, religious, archeological or recreational importance including wild life sanctuaries, national parks etc. likely to be affected by the proposed project ? If so, details thereof.	:	No
7.2.9	Does the proposed area suffer from endemic health problems due to water / soil borne diseases ?	:	No
3.0	ENVIRONMENTAL IMPACTS		
7.3.1	What measures are planned to develop the site to enhance its aesthetic aspects (i.e. recreation and water sport facilities and picnic sites etc.	:	The project itself would develop aesthetic surroundings near the site.
7.3.2	Will the project help in flood control, reduction or even eradication of flood havoc down	:	N.A.

stream ?

7.3.3	Are any changes in water salinity expected ? If yes, give details of proposed measures to counter act this.	:	No
7.3.4	Are problems of water logging envisaged in the command area ? If so, give details of proposed steps to combat the problem.	:	The project is not expected to change any existing situation.
7.3.5	Will the reservoir be used for fisheries development, fish culture as well as fish breeding, Crocodile farming etc ? If yes, give details thereof.	:	Not applicable
7.3.6	Will fish ladders / lift and like arrangements be provided to allow movements of important migratory fish population ?	:	Not applicable
7.3.7	Measures proposed to prevent grazing the cultivation on reservoir slopes to avoid erosion and premature silting up the impoundment.	:	Not applicable
7.3.8	Will any important natural resources (mineral, coal, timber etc.) be lost or their use precluded because of the presence or operation of the project ? If yes, specify the resource estimate loss	:	No.
7.3.9	What is potential loss in aquatic production on site up and down stream ? Fish and other useful animals and plants	:	No
7.3.10	Will the formation and use of the water body result in the introduction or enhancement of water borne diseases ?	:	Not applicable

7.3.11	Will the impounded reservoir lead to : -	:	There is no additional reservoir due to this scheme.
	(i) Noxious aquatic weeds like salinia, water Hyacinth etc.	:	Nil
	(ii) Intermittent host (Vector) like snails, mosquitoes etc.	:	Nil
7.3.12	How will aquatic weeds be controlled in submerged areas so as to provide an improved habitat as for fishery exploitations.	:	No area would be submerged due to construction of the project.
7.3.13	Will the project induce adverse climatologically changes (regarding temperature. humidity, wind and precipitation including modifications to macro and micro climate	:	No
7.3.14	What impact is expected on geological factors (e.g. seismic impact or reservoir loading) ?	:	No impact
7.3.15	Indicate the magnitude of impact due to population pressure on :-	:	No impact
	(i) Felling of trees for firewood	:	Nil
	(ii) Forest fires	:	Nil
	(iii) Over grazing leading to depletion of the pastures	:	Nil
	(iv) Visual pollution and damage to scenic values.	:	Nil

7.3.16	What arrangements are being made (i) to meet fuel requirements of the labour force during construction period to prevent indiscriminate felling of trees for firewood ?	:	The question of indiscriminate feeling of trees for firewood does not rise. The arrangements of the fuel for labour would be made by the agencies constructing the project.
	(ii) For compensatory aforestation ?	:	N.A.
	(iii) To enforce anticipating Laws ?	:	Not applicable
	(iv) To control flow of sediments and pollutants due to fertilizer and pesticide run-off for cultivated area.	:	Not applicable
	(v) For restoration of land in construction areas (filling, grading and Reforesting etc. to Prevent erosion.	:	Not applicable
	(vi) For soil conservation in the catchment ?	:	Not applicable
7.4	Cost of Environmental studies and Project Management	:	Not applicable
7.4.1	Provision for environmental studies / surveys need for this project.	:	Not applicable
7.4.2	Cost of proposed remedial and mitigative measures, if any, to protect the environment.	:	Not required
7.4.3	Has the cost of environmental studies / protection measures been considered in the cost benefit analysis of the project.	:	Not required

CHAPTER -8

Construction Planning and Schedule

CHAPTER -8

CONSTRUCTION PLANNING AND SCHEDULE

8.0 CONSTRUCTION SCHEDULE

It is proposed to complete the project and commission SHP-1 in a period of 18 months from date of start of the project. The selection of the construction equipment has been made to achieve the objective of completion of Power House in least possible time. The method of construction based on the proposed equipment ensures that all the works are completed in a period of 18 months allowing a period of 2 months for tests on all the units to commission the same at suitable intervals. Detailed Construction Schedule is given as Annex 8.1.

8.1 MAGNITUDE OF WORKS

The various works required to be carried out for the completion of the project are classified under the following headings.

8.1.1 PRE-CONSTRUCTION ACTIVITIES

Pre-construction activities include the following:

i) Tendering process and Award of work.
ii) Preparation of Detailed Designs & Construction Drawings.
iii) Carrying out in-situ settlement test at power house site.

8.1.2 INFRASTRUCTURE FACILITIES

Infrastructure works include construction of buildings, roads workshops, job facilities comprising development of plant areas and arrangements for construction power and other preliminary works.

8.1.3 CIVIL WORKS

Civil works comprise the following:

i) Steel Penstocks
ii) Power house complex comprising Service Bay and Control Room etc
iii) Tail Race Channel
iv) Switchyard

8.1.4 ELECTRICAL WORKS

The electrical works involve installation of all generating units of power house, a switch yard and related auxiliaries and transmission system.

8.2 CONSTRUCTION PROGRAMME

8.2.1 INFRASTRUCTURE WORKS

Infrastructure works such as pre-construction surveys and investigations and the pre-construction facilities like establishing communication links, land acquisition, development of land for plant areas and quarries, construction of buildings, procurement of construction equipments/machinery and arrangements for construction power etc. will be carried out during the initial period of 6 months, where after the main works of the project will be taken up.

8.2.2 STEEL PENSTOCK/BY-PASS PIPE

The fabrication and erection of steel penstock by end of 10th month shall be completed.

8.2.3 POWER HOUSE AND APPURTENANT WORKS

The excavation of the surface power house shall be completed in 7th month; concreting works including the foundation for turbines shall be completed by 16th month from the start of the project.
Installation of hydro mechanical works and electro-mechanical equipment shall be completed by the 16th month from the start of the project.

8.2.4 TAIL RACE CHANNEL

The construction of outfall structure is also envisaged to be completed by the 16th month from the start of the project.

8.2.5 COMMISSIONING OF UNITS

Installation of generating units shall be started after the Ist stage concrete for a particular unit has been placed. The second stage concreting shall continue in co-ordination with the erection of generating plant and equipment. All the two units of SHP-1 are envisaged to be commissioned in 18 months from the date of start of project.

8.2.6 TRANSMISSION SYSTEM

The entire work will be so executed that the transmission lines are tested and commissioned in time to synchronize with the commissioning of the generating units.

CONSTRUCTION SCHEDULE

Sl. No.	Activity	Total Duration (Months)	Duration in months
			1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
1.1	Examination of DPR & Review		
1.2	Tendering Process & Award of work		
1.3	Detailed design & preparation of Construction Drawing		
1.4	Acquisition of Land		
1.5	Mobilisation of work Force		
2.1	Installation of Steel Penstocks & Anchor Blocks		
2.2	Power House		
2.3	Tail Race		
3.1	Tendering Process & Award of work		
3.2	Reciept of Machines at Site		
3.3	Erection of Machines (Turbine & Generator)		
3.4	Erection of Control Panels		
3.5	Installation of Station Auxillaries		
3.6	Switchyard		

CONSTRUCTION SCHEDULE

DAMJUNGANGA SHPP (3 MW)

Sl. No	Activity	Total Duration (Months)	Duration in months
			1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
1	Pre Construction Activities	6	
1.1	Examination of DPR & Review		
1.2	Tendering Process & Award of work		
1.3	Detailed design & preparation of Construction Drawing		
1.4	Acquisition of Land		
1.5	Mobilisation of work Force		
2	Construction of Civil Works	9	
2.1	Installation of Steel Penstocks & Anchor Blocks		
2.2	Power House		
2.3	Tail Race		
3	Electro-Mechanical Works	14	
3.1	Tendering Process & Award of work		
3.2	Reciept of Machines at Site		
3.3	Erection of Machines (Turbine & Generator)		
3.4	Erection of Control Panels		
3.5	Installation of Station Auxiliaries		
3.6	Switchyard		
4	Testing & Commissioning	2	

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CHAPTER -9

Cost Estimate

CHAPTER -9

COST ESTIMATE

9.1 GENERAL

Power generated from SHP-1 with installed capacity of 3 MW is proposed to be transmitted to the nearest of GEB's 66KV sub-station at Rakholi which is about 4 Km from the proposed power house site.

9.2 COMPONENTS

The cost estimate of the project include the cost of steel penstocks, power house, tail race channel, hydro-mechanical equipments viz., draft tubes gates and electro-mechanical equipments comprising turbines, generators, transformers, auxiliaries, etc.

Provision has also been made for permanent residential and non-residential buildings, approach roads, and also for preliminary works i.e. topographical surveys, detailed surveys and investigations, preparation of feasibility, and detailed project reports, etc.

9.3 BASIS FOR ESTIMATION OF COST

All the project components are located in Valsad district of Gujarat. The rates given in Standard Schedule of Rates for civil works of Public Works Department, Govt. of Gujarat have been considered with suitable escalation, for working out the cost of various items of works.

The rates for various items of works have been adopted after taking into account the current rates of materials, labour and equipments prevalent in project area keeping in view the rates of items for similar works on Damanganga area.

The quantities of various items have been worked out from the drawings prepared for the project report. Lumpsum provisions for some items which cannot be quantified at this stage of project preparation are based on the experience of similar projects in the area.

9.4 ESTIMATED COST

The total cost of SHP-1 has been worked out as given in Table 9.1. The break-up of the estimated cost for this project is as given below.

S. No.	Description	SHP-1 (Rs. In Lakhs)
1	Civil Works (including Hydro-Mechanical Works)	301
2	Electro-Mechanical Works	1351.00
3	Transmission works	40
	Total	**1692**

9.5 Civil Works

9.5.1 Direct Charges - I. Works

9.5.1.1 A - Preliminary

Provision under this sub-head has been made for expenditure on reconnaissance survey, topographical surveys, and geotechnical investigations. The provision also covers the cost of preparation of feasibility and detailed project reports, preparation of tender documents, and detailed engineering including construction drawings, etc. Detailed break up of total cost under this sub-head has been given at **Annex 9.1.1**

9.5.1.2 B - Land

The land for both the power houses will be made available to the private developer on lease for a period of 35 years by irrigation department. Therefore only lease charges have been considered and the detailed break-up of total cost under this sub-head is given at **Annex 9.1.2**

9.5.1.3 C - Works

Provision for all civil works, like water conductor system, power house, switchyard and tail race, building etc has been made on the basis of preliminary designs and drawings. Provision for hydro-mechanical works such as regulating gates and butterfly valves has also been made. Lump sum provision has been made wherever so warranted.

Detailed break-up of total cost is given in **Annex 9.1.3**

9.5.1.4 K - Buildings

Provision under this sub-head has been made to cover the cost of permanent residential buildings. The permanent buildings are proposed to be located near power house site for operation and maintenance staff. The plinth area of the permanent residential buildings is as per prevailing norms for different categories of staff. Detailed break-up of total cost is given in **Annex 9.1.4**

9.5.1.5 M - Plantation

A lumpsum provision has been made for plantation of trees in the project area as given at **Annex 9.1.5**

9.5.1.6 **O - Miscellaneous**

Provision under this sub-head has been made to cover expenditure on different amenities and facilities for staff, construction power, running and maintenance of inspection vehicles, ancillary camp facilities and other miscellaneous items. This also includes the capital cost as also the maintenance of electrification, water supply, sewage disposal and storm water devices. It has been worked out as 3% of cost of I-works less cost of A-Preliminary & B-Land. **(Refer Abstract of Cost) – Tables 9.1.**

9.5.1.7 **P - Maintenance**

Provision under this sub-head has been made to cover expenditure on maintenance of works during construction.

This has been worked out @ 1% of cost of I-Works less cost of A-Preliminary & B-Land. **(Refer Table 9.1.).**

9.5.1.8 **R - Communication**

The requirement of new approach roads to power house will be minimum as infrastructure is already available for both the power houses. However provision of Rs. 10 Lakhs has been considered as given at **Annex 9.1.7**

9.5.1.9 **Project Management**

Provision for project management charges has been made @ 5% of the cost of I-Works (less B-Land). **(Refer Abstract of Cost-Table 9.1).**

9.6 **Electro-Mechanical Works**

Provision under this has been made to cover the cost of generating units, switchgear and control panels, transformer, etc., overhead travelling crane and other items of equipment including taxes & duties, transportation, supervision of E&M charges etc. Budgetary prices have been obtained from the suppliers of the generating units. The prices of auxiliary equipment are based on the prevailing prices.

The total cost is given in **Table 9.1** for the **E & M Equipment** and annexure 9.1.8

9.7 **Transmission Line**

The total length of 11/33 KV transmission will be 4 Km up to existing GEB's 66 KV substation at Rakholi. Provision of about Rs.40 lakhs has been kept for the transmission line. Refer **table no 9.1**

TABLE 9.1

ABSTRACT OF PROJECT COST SHP-I

S. No.	Name of Item	Estimated Cost (Rs. In Lakhs)	Reference Annex
I. 1.	**Works** A - Preliminary	22.00	9.1.1
2	B - Land	5.00	9.1.2
3	**C - Works** Power House and Tail-race Channel	223.50	9.1.3
	Total C-Works (Including A & B)	**250.50**	
4	K - Buildings	4.20	9.1.4
5	M- Plantation	0.50	9.1.5
6	O - Miscellaneous @ 3% of I Works (Excluding items 1 and 2)	7.27	
7	P - Maintenance	5.00	9.1.6
8	R - Communication	2.00	9.1.7
	Total I-Works	**269.47**	
9	Contigencies @ 3% of C- Works	6.71	
10	Charges for Project Management during construction including charges for construction supervision @ 5% of I-Works less B- Land	13.23	
	Total (item 1 to 10)	**289.41**	
II. 11	**Indirect Charges** Consultancy charges, Hire charges, administrative expenses, foreign travel expenses, proffessional charges, subscription, bank charges, entertainment charges and other charges for obtaining liecense etc.	8.70	
12	Indirect Charges @ 1% of I- Works to cover audit and accounts charges	2.89	
	Total Cost of Civil Works	**301.00**	
	Total Cost of Electro - Mechanical Equipment	1351.00	9.1.8
	Cost of 33 KV Transmission Line (4 KM)	40.00	
	Total Project Cost	**1692.00**	

Annex 9.1.1

A- PRELIMINARY

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	(a) Reconnaissance survey including visit to site, identification of project area, topographical surveys, geological surveys etc. and preparation of feasibility report and observanation and detailed project report.	LS	7.00
2	Detailed Engineering Design and Construction Drawings for Civil works and checking of vendor Drawings for Hydro-Mechanical and Electro-Mechanical works.	LS	15.00
	TOTAL		22.00

B- LAND Annex 9.1.2

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	Acquisition of Government Land from Irrigation Deptt. Including leagal charges	LS	5.00
	TOTAL		5.00

ANNEXURE 9.1.3

POWER HOUSE AND TAILRACE

NO.	ITEM	UNIT	QUANTITY	RATE	AMOUNT (Lakh Rs.)
1	Excavation in all type of rock requiring controlled blasting for all leads and lifts including dewatering and disposal of excaviled metarial to earmarked dumping sites.	Cum	1700	250	4.25
2	Compacted backfill with selected earth including all leads an lifts in all respects.	Cum	300	80	0.24
3	Providing and placing in position vivrated cement concrete at specify temperature for plain/reinforced concrete including cost of cement and agreegate, cost of form works, vibration, finishing, curing, and cleaning but excluding cost of reinforcement steel.				0.00
	I) M-10	Cum	65	2000	1.30
	II) M-20	Cum	1850	4000	74.00
	III) M-25	Cum	100	5000	5.00
4	Providing, fabricating and placing in position Tor Steel reinforcement for RCC works including cleaning, stratining, cutting, bending, lapping, welding wherever required, binding with 1.25 mm dia anneled steel wire includiong cost of all metarials, machinery, labours etc. as directed and complete with all leads and lifts.	MT	195	35000	68.25
5	Anchor Bars 25 dia, 3,000 long at 2,000 c/c bothways	MT	0.5	35000	0.18
6	Providing and fixing in position Steel Penstock of dia 1.5 m, 12 mm thick, 24 m long confirming to IS:2002 grade III including fabrication stiffeners complete in all respects.	MT	10	75000	7.50
7	Providing and fixing railing in position complete in all respects.	RM	100	40	0.04
8	Providing and fixing gates (2 Nos. of 3.25 m X 2.0 m) in position including supply of all metarials, fabrication, erection, hoisting arrangement and complete in all respects.	LS	2	400000	8.00
9	Providing and fixing of raw water drainage pipes (150 mm dia) including cost of Bends, Collars and jointing metarials and complete in all respects.	RM	80	2000	1.60
10	Providing and fixing/installations in position Alluminium glazed doors/windows with frames including cost of all fittings, metarials, finishing and completing all respects.	SQM	50	2200	1.10
11	Providing and placing of 250 x 250 mm size terrazzo tiles over 30 mm thick Cement Concrete base flooring including cost of all materials, finishing and complete in all respects.	SQM	120	500	0.60
12	Providing and placing of 50 mm thick acid-proof/chemical resistant tiles in floors and walls of Battery room including the cost of all materials, finishing and concrete in all respects.	SQM	40	1600	0.64
13	Sanatery and water supply arrangement for power house.	LS	1	200000	2.00
14	Civil works of switchyard.	LS	1	200000	2.00
15	Roof and Storm water drainage.	LS	1	200000	2.00
16	Providing and placing white glazed tiles in toilet.	SQM	20	1500	0.30
17	Provision of movable crane of capacity 20 tonnes.	Nos.	1	1500000	15.00
18	Providing and fixing movable steel hatch-cover in position (4.0 m x 4.0 m)	MT	1	50000	0.50
19	Butter Fly valve	Nos.	2	1000000	20.00
20	Roof Truss	LS	1	400000	4.00
21	Miscellanous	LS	1	500000	5.00
	TOTAL				223.50

K- BUILDINGS

Annex 9.1.4

PERMANENT RESIDENTIAL BUILDINGS

Provision under this sub-head has been made to cover the cost of permanent residential buildings, which shall be located near power house site for operational and maintenance staff.

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	Residential Buildings for station incharge, switch board attendent/turbine operator, helpers and watch-men.	LS	4.20
	TOTAL		**4.20**

M- PLANTATION

Annex 9.1.5

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	A Lumpsum provision has been made for plantation of trees in the project area.	LS	0.50
	TOTAL		**0.50**

P- MAINTENANCE

Annex 9.1.6

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	Maintenance of work during construction	LS	5.00
	TOTAL		**5.00**

R- COMMUNICATION

Annex 9.1.7

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	Construction of Approch Road to power house.	LS	2.00
	TOTAL		**2.00**

Annexure 9.1.8

COST ESTIMATE OF DAMAN GANGA H.E.PROJECT

ELECTRO-MECHANICAL WORKS- (2x1.5 MW)

Generator , Turbine & Accessories

SL. No.	Item Particulars	Qty.	Rate (Rs.Lakhs)	Amount (Rs. Lakhs)	E D 16.48%	CD 10%	Total (Rs. Lakhs)
1	2	3	4	5	6		7
1	(a) Supply of 2 X 1.5 MW, 600 rpm, 27.0 m head, vertical shaft Kaplan turbine with matching 3.3 kV, 1.5 MW 0.85 pf, 50 Hz, generating sets including MIV, excitation system, AVR, centralised lubrication system, HP/LP compressed air system, unit control boards, instrumentation, drainage and dewatering system, cooling water system etc. including spares. (b) 3.3 kV, 500 amps,S/C XLPE cables along with terminal equipment comprising of NG cubicles, 3.3 kV LAVT cubicle etc. (c) Lube oil & turbine oil for first filling	3 MW meters	per meter	1158.64		115.86	1274.50
2	3.3/33kva, 3 phase, 50 Hz, 2.0 MVA, Generator transformer along with all accessories & first filling of oil.	2	7.45 Rs 350 per kVA	14.90	2.38		17.28
3	Station Auxiliary transformer 3.3/.433 kV, 150 kVA, 3 phase, 50 Hz	2	1 Rs.	2.00	0.32		2.32
4	LTAC switchgear for aux.supply to power house and outdoor switchyard	1 set	6.00	6.00	0.96		6.96

5	110 V, 200 Ah battery with boost and float chargers, DCDB and emergency lighting	1 Set	4.00	4.00	0.64		4.64
6	Power & control cables for PH and switchyard	LS	6.00	6.00	0.96		6.96
7	Illumination of power house & switchyard	LS	1.00	1.00	0.16		1.16
8	Ventilation & air conitioning power house and control room	LS	2	2	0.33		2.33
9	Transformer oil filteration & oil storage plants, piping and turbine oil purification plant	LS	2	2	0.33		2.33
10	Filtered water for power house	LS	1	1	0.16		1.16
11	33 kV, SF6 circuit, 630 Amps 12.5 kA breaking current capacity	3	4.00	12.00	1.98		13.98
12	33 kV, isolators with/without earthing blade,630 A, 12.5 kA	6	0.40	2.40	0.40		2.80
13	33 kV Current transformers	6	0.60	3.60	0.59		4.19
14	33 kV potential transformers	6	0.60	3.60	0.59		4.19
15	30 kV, gapless type Lightning arrestors	6	0.60	3.60	0.59		4.19
16	Cost of civil works			2.00			2.00
	Total						1351.00

CHAPTER -10

Financial Analysis

10. FINANCIAL ANALYSIS

10.1 Introduction to financial analysis

The financial analysis for Daman Ganga SHP-1 has been carried out to ascertain the financial viability of the scheme.

The financial analysis consists of a cash flow during the project life. The financial evaluation suggests the Internal Rate of Return (IRR) of the project, and debt service cover ratio (DSCR), payback period, return on equity and return on investment.

10.2 Major Assumptions

Assumptions and inputs for financial analysis are presented in TABLE 10-1. Major assumptions made for the financial evaluation are as follows:

10.2.1 Project Cost

Base Cost

Cost of the project is taken as discussed in the previous chapter. The cost is estimated in the base year of July 2007.

Escalation in cost

As the implementation period is less, escalation has not been accounted.

IDC

Interest during construction is worked out based on the disbursement of cash flow. The interest rate is taken as 13.00% p.a.

Phasing

Capital cost for the project will be disbursed during the project construction period of 18 months. A linear disbursement of funds has been considered from 0% to 100% during the construction period of 18 months.

10.2.2 Financing

It is assumed that the project shall be financed at an interest of 13.0% p.a. 70% of capital cost is considered for debt, which shall be paid back in 8 years after 18 months of construction period.

10.2.3 Energy Benefits

The financial analysis is based on the energy output on 75% dependable year flows as per current practice and guidelines for small hydropower projects.

0.5% auxiliary consumption, 0.5% transformation and 1% transmission losses has been considered.

The rate of energy per KWH is taken as Rs. 2.90 for Damanganga SHP-1 without escalation.

Water royalty of Rs. 0.23 per unit (KWh) has been considered for financial evaluation of the project.

10.2.4 Annual Costs

Annual operation and maintenance expenses and insurance costs have been taken as 1.5% of the capital cost, which shall be escalated by 4% annually.

10.2.5 Depreciation

Straight line method depreciation is calculated to 2.57 % p.a. for the project life of 35 years with 10% salvage value. No depreciation is taken in the value of land.

10.2.6 Tax

To promote the hydro power development, the Govt has declared the tax holiday for first 10 years. After 10 years of generation 35 % tax is taken in financial analysis.

10.2.7 Tariff

Tariff per unit of energy has been worked out with 14% return on equity.

10.2.8 Others

Economic life of the project is 35 years.

Discount rate is taken as 12%.

10.3 Major Financial Results

The financial analysis is presented as per following:

A: Daman Ganga Dam Toe Small Hydropower Project-1

10.4 Financial Indicators

Based on the base case parameters, the financial parameters of the project over the project life of 35 years are as below:

PARAMETERS	SHP-1
FIRR ON NET CASH-FLOW (TOTAL CAPITAL)	17.36%
FIRR ON NET CASH-FLOW (EQUITY CAPITAL)	20.08%

10.5 Cost of Generation

Cost of generation with 14% return on equity is worked out as per TABLE 10.7 The results are as given below:

PARAMETERS	SHP-1
Cost of Generation in First year Without Return on Equity	Rs.2.10
Cost of Generation in First year With Return on Equity	Rs.2.69
Levellised Cost of Generation (With Return on Equity) @ 12% Discounting rate	Rs.2.18

10.6 Conclusions and Recommendations

The above financial analysis have been carried out based on assumptions for funds and financing available in India, and the construction cost, as well as the energy purchase rate of Rs.2.90 per unit for Damanganga SHP-1 without escalation.

The levellised tariff (with 14% return on equity) for 35 years of project life @ 12% discounting rate works out to Rs. 2.18 per KWh. The FIRR and DSCR show that the project is commercially viable @ sale price of Rs. 2.90 KWh.

NOTE: ALL FIGURES IN LACS

INPUT DATA SHEET

TABLE 10-1

Name of the Project				DAMAN GANGA DAM TOE SHP-1
Installed Capacity of Project in KW				3000
Costs				
Cost of Land				5.00
Estimated Cost of Civil Works				296.00
Estimated Cost of E&M Works i/c Transmission Works				1391.00
Others				0.00
Total Cost				1692.00
Inflation in Cost per Year				4.00%
Financing & Other Expenses (% 0f Projected Cost)				1.00%
Working Capital				
Period in Months of O&M Expenses				1
Period in Months of receivable revenue				2
Cost for Maintenance Spares for Working Capital L.S per Year				2.00
Escalation in Maintenance Spares for Working Capital per Year				4.00%
Margin Money as % of Working Capital				30.00%
Implementation Period Proposed in Years				2
First Year of Implementation				2007
Phasing of Expenditure (% of Capital Cost)				
First Year				2%
Second Year				30%
Third Year				68%
Expenses				
O&M Expenses including Insurance % of Projected Capital Cost				1.50%
Escalation in O&M every Year				4.00%
Energy				
Generated Units in Millions in	75% Dependable Year			12.95
Auxiliary Consumption				0.50%
Loss due to Transformation				0.50%
Loss due to Transmission				1.00%
Water Royalty		@ Rs.	0.23	per KWh
Energy Unit Price				
Basic Selling Price in First Generation Year in Rupees				2.90
Escalation in Selling Price per year				0.00%
Interest Rate				
Interest Rate on Term Loan				13.00%
Interest rate on Working Capital				13.50%
Period for Repayment of Term Loan (in years)				7
Debt Equity Ratio				
Without Interest During Construction (IDC)				
Equity				31.45%
Loan				68.55%
With IDC				
Equity				29.8%
Loan				70.2%

NOTE: ALL FIGURES IN LACS

INPUT DATA SHEET

TABLE 10-1

Name of the Project		DAMAN GANGA DAM TOE SHP-1
Depreciation		
Salvage Value (% of the Cost)		10.00%
For Civil Works & Others		2.57%
For E&M Works		2.57%
For Calculation As per I. T. Act		
For Civil Works		15.00%
For E&M Works		15.00%
Tax		
MAT including Serice Tax & Cess for Fist 10 years of generation (Tax Free Ye		11.24%
Tax rate including Serice Tax & Cess on Taxable Income after 10 years		33.71%
Tariff Calculation		
Life of the Project		35
Discounting Factor		12.00%
Return on Equity		14.00%
Subsidy Consideration	Yes/ NO	Yes
Source of Subsidy		
As per MNES policy, the capital subsidy may be available after commissioning of the project at the end of generation year		1
Amount of Subsidy shall be	(Rs. Lacs)	264.4
Carbon Credit Consideration	Yes/ NO	NO
Amount of carbon credit shall be per annum	(Rs. Lacs)	0.00

SUBSIDYAS PER DEC 2006 (NEW)

KW	Amount in Lacs =1.5*P^0.646	Increament
1000	130.0	
1500	169.0	38.9
2000	203.5	34.5
2500	235.1	31.6
3000	264.4	29.4
3500	292.1	27.7
4000	318.4	26.3
4500	343.6	25.2

DAMAN GANGA DAM TOE SHP-1

TABLE 10-2

CAPITALIZED COST & ENERGY CALCULATIONS

Inflation Rate = 4.00% (ALL COST FIGURES IN LACS)

Phasing of Expenditures

Year		Phasing	Cost	Civil Works & Others	E & M Works & Land	No of Months	Escalation in Civil works only	Projected Cost
1	2007	2%	33.84	5.92	27.92	6.00	0.06	33.90
2	2008	30%	507.60	88.80	418.80	12.00	3.55	511.15
3	2009	68%	1150.56	201.28	949.28	6.00	14.09	1164.65
TOTAL		**100.00%**	**1692.00**	**296.00**	**1396.00**	**24.00**	**17.70**	**1709.70**

Calculation of Interest During Construction

Interest Rate = **13.00%**

Year		Phasing of Loan (% of Projected Cost)		Opening Balance	Loan During The Year	No of Months	Interest During Const	Closing Balance
1	2007	2.00%	23.24	0.00	23.24	6.00	0.76	23.99
2	2008	30.00%	350.39	23.99	350.39	12.00	25.89	400.28
3	2009	68.00%	798.37	400.28	798.37	6.00	51.97	1250.62
			1172.00		**1172.00**	24.00	**78.62**	**1250.62**

Debt with IDC and Equity

Year		Projected Cost	Financial & Other Expenses	Intt. During Const.	Equity	Loan	Total Cost
1	2007	33.90	0.34	0.76	10.66	24.33	34.99
2	2008	511.15	5.11	25.89	160.76	381.40	542.16
3	2009	1164.65	11.65	51.97	366.28	861.98	1228.26
TOTAL		1709.70	17.10	78.62	**537.70**	**1267.71**	**1805.41**

Debt Equity Ratio

	Without IDC	% of Total Cost	With IDC	% of Total Cost
Total Cost	1709.70		1805.41	
Equity =	537.70	**31.45%**	537.70	**29.8%**
Loan =	1172.00	**68.55%**	1267.71	**70.2%**

Energy Generated and Saleable (Million Units)

Generated Units in Millions in	**75%**	**Dependable Year**		**12.950**
Auxiliary Consumption		@	0.50%	0.065
Loss due to Transformation		@	0.50%	0.065
Loss due to Transmission		@	1.00%	0.130
Net Energy at Bus Bar				**12.691**

DAMAN GANGA DAM TOE SHP-I
FINANCIAL EVALUATION
PROFITABILITY STATEMENT

TABLE 10-3

Details	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Energy (MU) for Sale in 75%	Dependable Year		12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691
Energy Unit Price in Rs.			2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900
Revenue from sale of energy in Lacs in Rs.			368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039
Carbon Credit			0.000	0.000	0.000	0.000	0 000	0.000	0.000	0.000	0.000
Total Revenue in Lacs in Rs.			368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04
Expenses											
Capital Cost I/c IDC= *1805.4* Lacs											
O&M including Insurance @ *1.50%*	0.00	0.00	27.08	28.16	29.29	30.46	31.68	32.95	34.27	35.64	37.06
PBIDT	*0.00*	*0.00*	*340.96*	*339.87*	*338.75*	*337.58*	*336.36*	*335.09*	*333.77*	*332.40*	*330.98*
Depreciation			46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Interest on Term Loan @ *13.00%*			163.85	113.53	97.14	80.75	64.37	47.98	31.60	15.21	6.35
& Working Capital @ *13.50%*											
Water Royalty @ 0.23	Rs. per KWh		29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19
Total Expenses			266.38	217.14	201.88	186.67	171.50	156.38	141.31	126.30	118.86
Operational Profit Before Tax			101.66	150.90	166.16	181.37	196.54	211.66	226.73	241.74	249.18
Taxation			0.00	0.00	0.00	0.00	2.98	15.52	19.23	22.63	24.93
Profit after Tax			101.66	150.90	166.16	181.37	193.56	196.14	207.49	219.11	224.25
Add Depreciation			46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Cash Accruals before Loan Installment			147.92	197.16	212.42	227.63	239.82	242.40	253.76	265.37	270.51
Installment for Loan repayment			120.00	126.19	126.19	126.19	126.19	126.19	126.19	126.19	0.00
Cash Accruals after Loan Installment			27.92	70.97	86.23	101.45	113.63	116.21	127.57	139.18	270.51
Cumulative Cash Accruals			27.9	98.9	185.1	286.6	400.2	516.4	644.0	783.2	1053.7
Return on Equity (Without Depreciation)			27.51%	36.67%	39.51%	42.33%	44.60%	45.08%	47.19%	49.35%	50.31%
Return on Equity (on PAT)			18.91%	28.06%	30.90%	33.73%	36.00%	36.48%	38.59%	40.75%	41.71%

FIRR on Net Cash-Flow (Total Capital) 17.36%
FIRR on Net Cash Flow (Equity Capital) After tax 20.08%

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DAMAN GANGA DAM TOE SHP-1
FINANCIAL EVALUATION
PROFITABILITY STATEMENT

TABLE 10-3

Details	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24
OPERATION YEAR	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Energy (MU) for Sale in 75%	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691
Energy Unit Price in Rs.	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900
Revenue from sale of energy in Lacs in Rs.	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039
Carbon Credit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Revenue in Lacs in Rs.	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04
Expenses													
Capital Cost i/c IDC= *1805.4* Lacs													
O&M including Insurance @ *1.50%*	38.54	40.09	41.69	43.36	45.09	46.90	48.77	50.72	52.75	54.86	57.06	59.34	61.71
PBIDT	*329.49*	*327.95*	*326.35*	*324.68*	*322.95*	*321.14*	*319.27*	*317.32*	*315.29*	*313.18*	*310.98*	*308.70*	*306.33*
Depreciation	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Interest on Term Loan @ *13.00%*	6.37	6.39	6.42	6.44	6.47	6.49	6.52	6.55	6.58	6.61	6.64	6.68	6.71
& Working Capital @ *13.50%*													
Water Royalty @ 0.23	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19
Total Expenses	120.37	121.93	123.56	125.25	127.01	128.84	130.74	132.72	134.78	136.92	139.15	141.47	143.88
Operational Profit Before Tax	247.67	246.11	244.48	242.79	241.03	239.20	237.29	235.32	233.26	231.11	228.89	226.57	224.16
Taxation	26.00	80.63	82.77	84.49	85.84	86.87	87.63	88.16	88.48	88.62	88.60	88.44	88.16
Profit after Tax	221.67	165.48	161.71	158.30	155.19	152.33	149.66	147.16	144.78	142.50	140.29	138.13	136.01
Add Depreciation	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Cash Accruals before Loan Installmen:	267.94	211.74	207.97	204.56	201.46	198.59	195.93	193.42	191.04	188.76	186.55	184.39	182.27
Installment for Loan repayment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Accruals after Loan Installment	267.94	211.74	207.97	204.56	201.46	198.59	195.93	193.42	191.04	188.76	186.55	184.39	182.27
Cumulative Cash Accruals	1321.6	1533.3	1741.3	1945.9	2147.3	2345.9	2541.9	2735.3	2926.3	3115.1	3301.6	3486.0	3668.3
Return on Equity (Without Depreciation)	49.83%	39.38%	38.68%	38.04%	37.47%	36.93%	36.44%	35.97%	35.53%	35.11%	34.69%	34.29%	33.90%
Return on Equity (on PAT)	41.23%	30.77%	30.07%	29.44%	28.86%	28.33%	27.83%	27.37%	26.93%	26.50%	26.09%	25.69%	25.29%

FIRR on Net Cash-Flow (Total Capital) 17.36%
FIRR on Net Cash Flow (Equity Capital) After tax 20.08%

000325

DAMAN GANGA DAM TOE SHP-1
FINANCIAL EVALUATION
PROFITABILITY STATEMENT

TABLE 10-3

Details	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
Energy (MU) for Sale in 75%	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691	12.691
Energy Unit Price in Rs.	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900
Revenue from sale of energy in Lacs in Rs.	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039	368.039
Carbon Credit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Revenue in Lacs in Rs.	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04	368.04
Expenses													
Capital Cost i/c IDC= *1805.4* Lacs													
O&M including Insurance @ *1.50%*	64.18	66.75	69.42	72.19	75.08	78.09	81.21	84.46	87.84	91.35	95.00	98.80	102.75
PBIDT	*303.86*	*301.29*	*298.62*	*295.84*	*292.96*	*289.95*	*286.83*	*283.58*	*280.20*	*276.69*	*273.04*	*269.24*	*265.28*
Depreciation	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Interest on Term Loan @ *13.00%*	6.75	6.79	6.83	6.87	6.91	6.96	7.00	7.05	7.10	7.15	7.21	7.26	7.32
& Working Capital @ *13.50%*													
Water Royalty @ 0.23	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19
Total Expenses	146.38	148.99	151.70	154.51	157.44	160.49	163.66	166.96	170.39	173.95	177.66	181.52	185.53
Operational Profit Before Tax	221.66	219.05	216.34	213.52	210.59	207.55	204.38	201.08	197.65	194.09	190.38	186.52	182.51
Taxation	87.76	87.27	86.68	86.00	85.25	84.42	83.52	82.56	81.52	80.43	79.26	78.04	76.75
Profit after Tax	133.90	131.79	129.67	127.52	125.34	123.12	120.85	118.52	116.13	113.66	111.11	108.48	105.76
Add Depreciation	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Cash Accruals before Loan Installment	180.16	178.05	175.93	173.78	171.61	169.39	167.11	164.78	162.39	159.92	157.37	154.74	152.02
Installment for Loan repayment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Accruals after Loan Installment	180.16	178.05	175.93	173.78	171.61	169.39	167.11	164.78	162.39	159.92	157.37	154.74	152.02
Cumulative Cash Accruals	3848.5	4026.5	4202.4	4376.2	4547.8	4717.2	4884.3	5049.1	5211.5	5371.4	5528.8	5683.5	5835.5
Return on Equity (Without Depreciation)	33.51%	33.11%	32.72%	32.32%	31.91%	31.50%	31.08%	30.65%	30.20%	29.74%	29.27%	28.78%	28.27%
Return on Equity (on PAT)	24.90%	24.51%	24.11%	23.72%	23.31%	22.90%	22.48%	22.04%	21.60%	21.14%	20.66%	20.17%	19.67%

FIRR on Net Cash-Flow (Total Capital) 17.36%
FIRR on Net Cash Flow (Equity Capital) After tax 20.08%

000326

DAMAN GANGA DAM TOE SHP-1

CALCULATION OF DEPRECIATION

TABLE 10-4

Cost with IDC	Land	5.34
	Civil Works	315.84
	E & M Work	1484.24
	Others	0.00
	Total Cost	1805.41 Lacs

Year				Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
OPERATION YEAR				*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
I. AS PER I. E. ACT (SLM)														
Salvage Value	10.00%													
Depreciation @														
on Land	5.34	@	0.00%			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
on Civil Works & Others	315.84	@	2.57%			**8.12**	**8.12**	**8.12**	**8.12**	**8.12**	**8.12**	**8.12**	**8.12**	**8.12**
on E&M Works	1484.24	@	2.57%			**38.14**	**38.14**	**38.14**	**38.14**	**38.14**	**38.14**	**38.14**	**38.14**	**38.14**
Total Depreciation						**46.26**	**46.26**	**46.26**	**46.26**	**46.26**	**46.26**	**46.26**	**46.26**	**46.26**
II. AS PER INCOME TAX														
Civil Works & Others		@	15.00%											
	Opening Cost					315.84	268.46	228.19	193.97	164.87	140.14	119.12	101.25	86.06
	Depreciation					47.38	40.27	34.23	29.09	24.73	21.02	17.87	15.19	12.91
	Written Down Value					268.46	228.19	193.97	164.87	140.14	119.12	101.25	86.06	73.15
E & M Works		@	15.00%											
	Opening Cost					1484.24	1261.60	1072.36	911.51	774.78	658.56	559.78	475.81	404.44
	Depreciation					222.64	189.24	160.85	136.73	116.22	98.78	83.97	71.37	60.67
	Written Down Value					1261.60	1072.36	911.51	774.78	658.56	559.78	475.81	404.44	343.77
Total Depreciation						**270.01**	**229.51**	**195.08**	**165.82**	**140.95**	**119.81**	**101.83**	**86.56**	**73.58**

CALCULATION OF TAXATION

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Profit Before Tax			101.66	150.90	166.16	181.37	196.54	211.66	226.73	241.74	249.18
Add: Depreciation as per IE ACT (SLM)			46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Less: Depreciation as per I T Act			270.01	229.51	195.08	165.82	140.95	119.81	101.83	86.56	73.58
Taxable Profit			**-122.09**	**-32.35**	**17.34**	**61.81**	**101.85**	**138.12**	**171.15**	**201.44**	**221.86**
Loss B/F			0.00	-122.09	-154.45	-137.11	-75.30	0.00	0.00	0.00	0.00
Loss C/F			-122.09	-154.45	-137.11	-75.30	0.00	0.00	0.00	0.00	0.00
Taxable Income			**0.00**	**0.00**	**0.00**	**0.00**	**26.56**	**138.12**	**171.15**	**201.44**	**221.86**
Deduction u/s 80 IA			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Taxable Income			0.00	0.00	0.00	0.00	26.56	138.12	171.15	201.44	221.86
Tax Liability			**0.00**	**0.00**	**0.00**	**0.00**	**2.98**	**15.52**	**19.23**	**22.63**	**24.93**

NOTE: ALL FIGURES IN L

DAMAN GANGA DAM TOE SHP-1

CALCULATION OF DEPRECIATION

TABLE 10-4

Cost with IDC	Land	5.34
	Civil Works	315.84
	E & M Work	1484.24
	Others	0.00
	Total Cost	1805.41

Year			Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
OPERATION YEAR			*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
I. AS PER I. E. ACT. (SLM)																	
Salvage Value	10.00%																
Depreciation @																	
on Land	5.34	@ 0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
on Civil Works & Others	315.84	@ 2.57%	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12
on E&M Works	1484.24	@ 2.57%	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14
Total Depreciation			46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
II. AS PER INCOME TAX																	
Civil Works & Others		@ 15.00%															
	Opening Cost		73.15	62.18	52.85	44.93	38.19	32.46	27.59	23.45	19.93	16.94	14.40	12.24	10.41	8.84	7.52
	Depreciation		10.97	9.33	7.93	6.74	5.73	4.87	4.14	3.52	2.99	2.54	2.16	1.84	1.56	1.33	1.13
	Written Down Value		62.18	52.85	44.93	38.19	32.46	27.59	23.45	19.93	16.94	14.40	12.24	10.41	8.84	7.52	6.39
E & M Works		@ 15.00%															
	Opening Cost		343.77	292.21	248.38	211.12	179.45	152.53	129.65	110.21	93.68	79.62	67.68	57.53	48.90	41.56	35.33
	Depreciation		51.57	43.83	37.26	31.67	26.92	22.88	19.45	16.53	14.05	11.94	10.15	8.63	7.33	6.23	5.30
	Written Down Value		292.21	248.38	211.12	179.45	152.53	129.65	110.21	93.68	79.62	67.68	57.53	48.90	41.56	35.33	30.03
Total Depreciation			62.54	53.16	45.18	38.41	32.65	27.75	23.59	20.05	17.04	14.49	12.31	10.47	8.90	7.56	6.43

CALCULATION OF TAXATION

Year	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
OPERATION YEAR	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
Profit Before Tax	247.67	246.11	244.48	242.79	241.03	239.20	237.29	235.32	233.26	231.11	228.89	226.57	224.16	221.66	219.05
Add: Depreciation as per IE ACT (SLM)	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Less: Depreciation as per I T Act	62.54	53.16	45.18	38.41	32.65	27.75	23.59	20.05	17.04	14.49	12.31	10.47	8.90	7.56	6.43
Taxable Profit	**231.40**	**239.21**	**245.56**	**250.64**	**254.65**	**257.71**	**259.97**	**261.53**	**262.48**	**262.89**	**262.84**	**262.37**	**261.53**	**260.36**	**258.89**
Loss B/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loss C/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable Income	**231.40**	**239.21**	**245.56**	**250.64**	**254.65**	**257.71**	**259.97**	**261.53**	**262.48**	**262.89**	**262.84**	**262.37**	**261.53**	**260.36**	**258.89**
Deduction u/s 80 IA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Taxable Income	231.40	239.21	245.56	250.64	254.65	257.71	259.97	261.53	262.48	262.89	262.84	262.37	261.53	260.36	258.89
Tax Liability	26.00	80.63	82.77	84.49	85.84	86.87	87.63	88.16	88.48	88.62	88.60	88.44	88.16	87.76	87.27

00328

NOTE: ALL FIGURES IN L

DAMAN GANGA DAM TOE SHP-1

CALCULATION OF DEPRECIATION

TABLE 10-4

Cost with IDC	Land	5.34
	Civil Works	315.84
	E & M Works	1484.24
	Others	0.00
	Total Cost	1805.41

Year			Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR			*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
I. AS PER I. E. ACT (SLM)													
Salvage Value	10.00%												
Depreciation @													
on Land	5.34	@ 0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
on Civil Works & Others	315.84	@ 2.57%	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12	8.12
on E&M Works	1484.24	@ 2.57%	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14	38.14
Total Depreciation			46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
II. AS PER INCOME TAX													
Civil Works & Others		@ 15.00%											
	Opening Cost		6.39	5.43	4.62	3.92	3.34	2.84	2.41	2.05	1.74	1.48	1.26
	Depreciation		0.96	0.81	0.69	0.59	0.50	0.43	0.36	0.31	0.26	0.22	0.19
	Written Down Value		5.43	4.62	3.92	3.34	2.84	2.41	2.05	1.74	1.48	1.26	1.07
E & M Works		@ 15.00%											
	Opening Cost		30.03	25.53	21.70	18.44	15.68	13.32	11.33	9.63	8.18	6.96	5.91
	Depreciation		4.50	3.83	3.25	2.77	2.35	2.00	1.70	1.44	1.23	1.04	0.89
	Written Down Value		25.53	21.70	18.44	15.68	13.32	11.33	9.63	8.18	6.96	5.91	5.03
Total Depreciation			5.46	4.64	3.95	3.36	2.85	2.42	2.06	1.75	1.49	1.27	1.08

CALCULATION OF TAXATION

Year	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
Profit Before Tax	216.34	213.52	210.59	207.55	204.38	201.08	197.65	194.09	190.38	186.52	182.51
Add: Depreciation as per IE ACT (SLM)	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26
Less: Depreciation as per I T Act	5.46	4.64	3.95	3.36	2.85	2.42	2.06	1.75	1.49	1.27	1.08
Taxable Profit	**257.14**	**255.14**	**252.91**	**250.45**	**247.79**	**244.92**	**241.85**	**238.60**	**235.15**	**231.52**	**227.70**
Loss B/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loss C/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable Income	**257.14**	**255.14**	**252.91**	**250.45**	**247.79**	**244.92**	**241.85**	**238.60**	**235.15**	**231.52**	**227.70**
Deduction u/s 80 IA,	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Taxable Income	257.14	255.14	252.91	250.45	247.79	244.92	241.85	238.60	235.15	231.52	227.70
Tax Liability	86.68	86.00	85.25	84.42	83.52	82.56	81.52	80.43	79.26	78.04	76.75

000329

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-1
WORKING CAPITAL REQUIREMENT SCHEDULE

TABLE 10-5

Year	Period in Months	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
OPERATION YEAR		*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*
O & M Expenses	1			2.26	2.35	2.44	2.54	2.64	2.75	2.86	2.97	3.09	3.21	3.34	3.47	3.61	3.76	3.91	4.06	4.23	4.40
Revenue	2			61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34
Maintenance Spares				2.00	2.08	2.16	2.25	2.34	2.43	2.53	2.63	2.74	2.85	2.96	3.08	3.20	3.33	3.46	3.60	3.75	3.90
TOTAL WORKING CAPITAL				**65.60**	**65.77**	**65.94**	**66.13**	**66.32**	**66.52**	**66.73**	**66.94**	**67.17**	**67.40**	**67.64**	**67.89**	**68.16**	**68.43**	**68.71**	**69.01**	**69.31**	**69.63**
Margin Money @ 30% of WC				19.68	19.73	19.78	19.84	19.90	19.96	20.02	20.08	20.15	20.22	20.29	20.37	20.45	20.53	20.61	20.70	20.79	20.89
Bank Finance				45.92	46.04	46.16	46.29	46.42	46.56	46.71	46.86	47.02	47.18	47.35	47.53	47.71	47.90	48.10	48.30	48.52	48.74
Interest on WC @ 14%				6.20	6.21	6.23	6.25	6.27	6.29	6.31	6.33	6.35	6.37	6.39	6.42	6.44	6.47	6.49	6.52	6.55	6.58

Year	Period in Months	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR		*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
O & M Expenses	1	4.57	4.75	4.94	5.14	5.35	5.56	5.78	6.02	6.26	6.51	6.77	7.04	7.32	7.61	7.92	8.23	8.56
Revenue	2	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34
Maintenance Spares		4.05	4.21	4.38	4.56	4.74	4.93	5.13	5.33	5.54	5.77	6.00	6.24	6.49	6.75	7.02	7.30	7.59
TOTAL WORKING CAPITAL		**70.0**	**70.3**	**70.7**	**71.0**	**71.4**	**71.8**	**72.3**	**72.7**	**73.1**	**73.6**	**74.1**	**74.6**	**75.1**	**75.7**	**76.3**	**76.9**	**77.5**
Margin Money @ 30% of WC		20.99	21.09	21.20	21.31	21.43	21.55	21.68	21.81	21.94	22.08	22.23	22.38	22.54	22.71	22.88	23.06	23.25
Bank Finance		48.97	49.22	49.47	49.73	50.00	50.28	50.58	50.88	51.20	51.53	51.87	52.23	52.60	52.99	53.39	53.81	54.24
Interest on WC @ 14%		6.61	6.64	6.68	6.71	6.75	6.79	6.83	6.87	6.91	6.96	7.00	7.05	7.10	7.15	7.21	7.26	7.32

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-1

TABLE 10-6

TERM LOAN REPAYMENT SCHEDULE & CALCULATION OF INTEREST

Subsidy available in the end of year 1

Subsidy amount in Lacs Rs. 264.40

	Before Subsidy	After Subsidy
Loan Amount	1267.71	883.31
Rate of Interest	13.00%	13.0%
Period for repayment of Term Loan (Years)	8	7
Annual Installment of Loan	120.00	126.19
Monthly	10.00	10.52

Year		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
OPERATION YEAR		*CONSTRUCTION*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1st Month	Opening			1267.71	883.31	757.12	630.94	504.75	378.56	252.37	126.19
	Interest			13.73	9.57	8.20	6.84	5.47	4.10	2.73	1.37
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
2nd Month	Opening after instalment			1257.71	872.80	746.81	620.42	494.23	368.05	241.86	115.67
	Interest			13.63	9.46	8.09	6.72	5.35	3.99	2.62	1.25
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
3rd Month	Opening after instalment			1247.71	862.28	736.09	609.91	483.72	357.53	231.34	105.16
	Interest			13.52	9.34	7.97	6.61	5.24	3.87	2.51	1.14
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
4th Month	Opening after instalment			1237.71	851.77	725.58	599.39	473.20	347.02	220.83	94.64
	Interest			13.41	9.23	7.86	6.49	5.13	3.76	2.39	1.03
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
5th Month	Opening after instalment			1227.71	841.25	715.06	588.87	462.69	336.50	210.31	84.12
	Interest			13.30	9.11	7.75	6.38	5.01	3.65	2.28	0.91
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
6th Month	Opening after instalment			1217.71	830.73	704.55	578.36	452.17	325.98	199.80	73.61
	Interest			13.19	9.00	7.63	6.27	4.90	3.53	2.16	0.80
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
7th Month	Opening after instalment			1207.71	820.22	694.03	567.84	441.66	315.47	189.28	63.09
	Interest			13.08	8.89	7.52	6.15	4.78	3.42	2.05	0.68
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
8th Month	Opening after instalment			1197.71	809.70	683.52	557.33	431.14	304.95	178.77	52.58
	Interest			12.98	8.77	7.40	6.04	4.67	3.30	1.94	0.57
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
9th Month	Opening after instalment			1187.71	799.19	673.00	546.81	420.62	294.44	168.25	42.06
	Interest			12.87	8.66	7.29	5.92	4.56	3.19	1.82	0.46
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
10th Month	Opening after instalment			1177.71	788.67	662.48	536.30	410.11	283.92	157.73	31.55
	Interest			12.76	8.54	7.18	5.81	4.44	3.08	1.71	0.34
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
11th Month	Opening after instalment			1167.71	778.16	651.97	525.78	399.59	273.41	147.22	21.03
	Interest			12.65	8.43	7.06	5.70	4.33	2.96	1.59	0.23
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
12th Month	Opening after instalment			1157.71	767.64	641.45	515.27	389.08	262.89	136.70	10.52
	Interest			12.54	8.32	6.95	5.58	4.22	2.85	1.48	0.11
	Installment			10.00	10.52	10.52	10.52	10.52	10.52	10.52	10.52
Available Subsidy				264.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Closing Balance				883.31	757.12	630.94	504.75	378.56	252.37	126.19	0.00
Interest on Term Loan				157.65	107.31	90.91	74.60	58.10	41.89	25.29	8.89
Interest on Working capital				6.20	6.21	6.23	6.26	6.27	6.29	6.31	6.33
Total Interest				163.85	113.53	97.14	80.75	64.37	47.98	31.60	15.21
Installment of Debt				120.00	126.19	126.19	126.19	126.19	126.19	126.19	126.19

000331

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-1

DEBT SERVICE COVERAGE RATIO (DSCR)

TABLE 10-7

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Details	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
A - SERVICE											
Net Profit after Tax			101.66	150.90	166.16	181.37	193.56	196.14	207.49	219.11	
Depreciation			46.26	46.26	46.26	46.26	46.26	46.26	46.26	46.26	
Interest on term Loan			163.85	113.53	97.14	80.75	64.37	47.98	31.60	15.21	
TOTAL - A			**311.77**	**310.69**	**309.56**	**308.39**	**304.18**	**290.38**	**285.35**	**280.58**	**2400.90**
B - DEBT											
Installment on Term Loan			120.00	126.19	126.19	126.19	126.19	126.19	126.19	126.19	
Interest on Term Loan			163.85	113.53	97.14	80.75	64.37	47.98	31.60	15.21	
TOTAL - B			**283.85**	**239.71**	**223.33**	**206.94**	**190.55**	**174.17**	**157.78**	**141.40**	**1617.74**
DSCR			**1.10**	**1.30**	**1.39**	**1.49**	**1.60**	**1.67**	**1.81**	**1.98**	**1.48**

AVERAGE DSCR 1.54
MINIMUM DSCR 1.10
MAXIMUM DSCR 1.98

000332

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-1

TABLE 10-8

COMPUTATION OF GENERATION COST

Details	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
CAPACITY CHARGES											
1 Interest on Term Loan			*157.65*	*107.31*	*90.91*	*74.50*	*58.10*	*41.69*	*25.29*	*8.89*	*0.00*
2 Depreciation			*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*
TOTAL (1 +2)			*203.91*	*153.57*	*137.17*	*120.77*	*104.36*	*87.96*	*71.55*	*55.15*	*46.26*
ENERGY CHARGES											
1 O&M and Insurance @ 1.50%			27.08	28.16	29.29	30.46	31.68	32.95	34.27	35.64	37.06
2 Interst on Working Capital			6.20	6.21	6.23	6.25	6.27	6.29	6.31	6.33	6.35
3 Water Royalty @ 0.23	Rs per KWh		29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19
4 Tax			0.00	0.00	0.00	0.00	2.98	15.52	19.23	22.63	24.93
TOTAL			62.47	63.57	64.71	65.90	70.12	83.94	88.99	93.79	97.53
Total Capacity & Energy Charges in Lacs in Rupees			**266.38**	**217.14**	**201.88**	**186.67**	**174.48**	**171.90**	**160.54**	**148.93**	**143.79**
Net Energy in MU			**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**
GENERATION COST WITHOUT RETURN ON EQUITY in Rs			**2.10**	**1.71**	**1.59**	**1.47**	**1.37**	**1.35**	**1.27**	**1.17**	**1.13**
LEVELLISED COST OF GENERATION (W/O ROE) @ 12.0% Discount Factor = Rs **1.59**			1.000 2.099	0.880 1.506	0.774 1.232	0.681 1.002	0.600 0.824	0.528 0.715	0.464 0.587	0.409 0.480	0.360 0.407
WITH RETURN ON EQUITY											
5 Return on Equity @ 14.0%			75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28
Total Capacity & Energy Charges in Lacs in Rupees			**341.7**	**292.4**	**277.2**	**261.9**	**249.8**	**247.2**	**235.8**	**224.2**	**219.1**
Net Energy in MU			**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**
TARIFF WITH RETURN ON EQUITY in Rs			**2.69**	**2.30**	**2.18**	**2.06**	**1.97**	**1.95**	**1.86**	**1.77**	**1.73**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.18**											
WITH CARBON CREDIT											
carbon Credit			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Less Tariff against carbon Credit			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NET TARIFF in Rs			**2.69**	**2.30**	**2.18**	**2.06**	**1.97**	**1.95**	**1.86**	**1.77**	**1.73**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.18**											

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-1

TABLE 10-8

COMPUTATION OF GENERATION COST

Details	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24
OPERATION YEAR	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
CAPACITY CHARGES													
1 Interest on Term Loan	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
2 Depreciation	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*
TOTAL (1 +2)	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*
ENERGY CHARGES													
1 O&M and Insurance @ 1.50%	38.54	40.09	41.69	43.36	45.09	46.90	48.77	50.72	52.75	54.86	57.06	59.34	61.71
2 Interst on Working Capital	6.37	6.39	6.42	6.44	6.47	6.49	6.52	6.55	6.58	6.61	6.64	6.68	6.71
3 Water Royalty @ 0.23	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19
4 Tax	26.00	80.63	82.77	84.49	85.84	86.87	87.63	88.16	88.48	88.62	88.60	88.44	88.16
TOTAL	100.10	156.30	160.07	163.47	166.58	169.45	172.11	174.62	177.00	179.28	181.49	183.64	185.77
Total Capacity & Energy Charges in Lacs in Ru	**146.37**	**202.56**	**206.33**	**209.74**	**212.85**	**215.71**	**218.37**	**220.88**	**223.26**	**225.54**	**227.75**	**229.91**	**232.03**
Net Energy in MU	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**
GENERATION COST WITHOUT RETURN ON EQU	**1.15**	**1.60**	**1.63**	**1.65**	**1.68**	**1.70**	**1.72**	**1.74**	**1.76**	**1.78**	**1.79**	**1.81**	**1.83**
LEVELLISED COST OF GENERATION (W/O ROE) @ 12.0% Discount Factor = Rs . **1.59**	0.316	0.279	0.245	0.216	0.190	0.167	0.147	0.129	0.114	0.100	0.088	0.078	0.068
	0.365	0.445	0.398	0.356	0.318	0.284	0.253	0.225	0.200	0.178	0.158	0.141	0.125
WITH RETURN ON EQUITY													
5 Return on Equity @ 14.0%	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28
Total Capacity & Energy Charges in Lacs in Ru	**221.6**	**277.8**	**281.6**	**285.0**	**288.1**	**291.0**	**293.7**	**296.2**	**298.5**	**300.8**	**303.0**	**305.2**	**307.3**
Net Energy in MU	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**
TARIFF WITH RETURN ON EQUITY in Rs	**1.75**	**2.19**	**2.22**	**2.25**	**2.27**	**2.29**	**2.31**	**2.33**	**2.35**	**2.37**	**2.39**	**2.40**	**2.42**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.18**													
WITH CARBON CREDIT													
carbon Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Less Tariff against carbon Credit	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NET TARIFF in Rs	**1.75**	**2.19**	**2.22**	**2.25**	**2.27**	**2.29**	**2.31**	**2.33**	**2.35**	**2.37**	**2.39**	**2.40**	**2.42**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.18**													

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NOTE: ALL FIGURES IN LACS

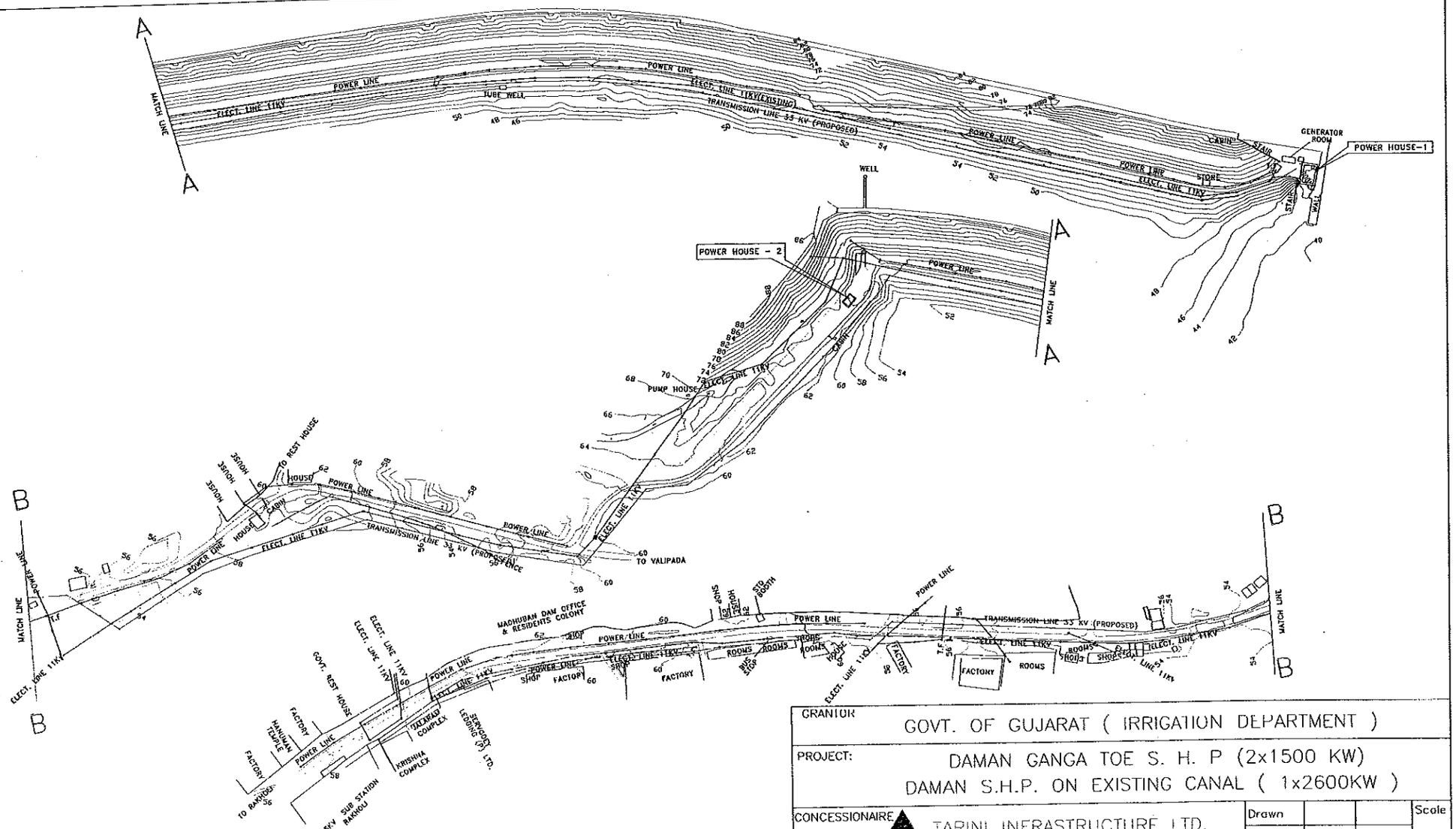
DAMAN GANGA DAM TOE SHP-1

TABLE 10-8

COMPUTATION OF GENERATION COST

Details	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
CAPACITY CHARGES													
1 Interest on Term Loan	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
2 Depreciation	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*
TOTAL (1 +2)	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*	*46.26*
ENERGY CHARGES													
1 O&M and Insurance @ 1.50%	64.18	66.75	69.42	72.19	75.08	78.09	81.21	84.46	87.84	91.35	95.00	98.80	102.75
2 Interst on Working Capital	6.75	6.79	6.83	6.87	6.91	6.96	7.00	7.05	7.10	7.15	7.21	7.26	7.32
3 Water Royalty @ 0.23	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19	29.19
4 Tax	87.76	87.27	86.68	86.00	85.25	84.42	83.52	82.56	81.52	80.43	79.26	78.04	76.75
TOTAL	187.88	189.99	192.11	194.26	196.43	198.65	200.92	203.25	205.65	208.12	210.66	213.30	216.02
Total Capacity & Energy Charges in Lacs in Ru	**234.14**	**236.25**	**238.37**	**240.52**	**242.70**	**244.92**	**247.19**	**249.5**	**251.9**	**254.4**	**256.9**	**259.6**	**262.3**
Net Energy in MU	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**
GENERATION COST WITHOUT RETURN ON EQU	**1.84**	**1.86**	**1.88**	**1.90**	**1.91**	**1.93**	**1.95**	**1.97**	**1.98**	**2.00**	**2.02**	**2.05**	**2.07**
LEVELLISED COST OF GENERATION (W/O ROE) @ 12.0% Discount Factor = Rs 1.59	0.060 0.111	0.053 0.098	0.047 0.087	0.041 0.078	0.036 0.069	0.032 0.061	0.028 0.054	0.025 0.048	0.022 0.043	0.019 0.038	0.017 0.034	0.015 0.030	0.013 0.027
WITH RETURN ON EQUITY													
5 Return on Equity @ 14.0%	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28	75.28
Total Capacity & Energy Charges in Lacs in Ru	**309.4**	**311.5**	**313.7**	**315.8**	**318.0**	**320.2**	**322.5**	**324.8**	**327.2**	**329.7**	**332.2**	**334.8**	**337.6**
Net Energy in MU	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**	**12.69**
TARIFF WITH RETURN ON EQUITY in Rs	**2.44**	**2.45**	**2.47**	**2.49**	**2.51**	**2.52**	**2.54**	**2.56**	**2.58**	**2.60**	**2.62**	**2.64**	**2.66**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs 2.18													
WITH CARBON CREDIT													
carbon Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Less Tariff against carbon Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NET TARIFF in Rs	**2.44**	**2.45**	**2.47**	**2.49**	**2.51**	**2.52**	**2.54**	**2.56**	**2.58**	**2.60**	**2.62**	**2.64**	**2.66**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs 2.18													

DRAWINGS



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GRANTOR: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN GANGA TOE S. H. P (2x1500 KW)
DAMAN S.H.P. ON EXISTING CANAL (1x2600KW)

CONCESSIONAIRE:
TARINI INFRASTRUCTURE LTD.
D-2, First Floor, Amar Colony,
Lajpat Nagar-IV, New Delhi-110 024
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TITLE: TRANSMISSION LINE

Drg. No. TIL/DAMAN-C/DPR/002

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Sheet 1 of 1

CAD Ref.

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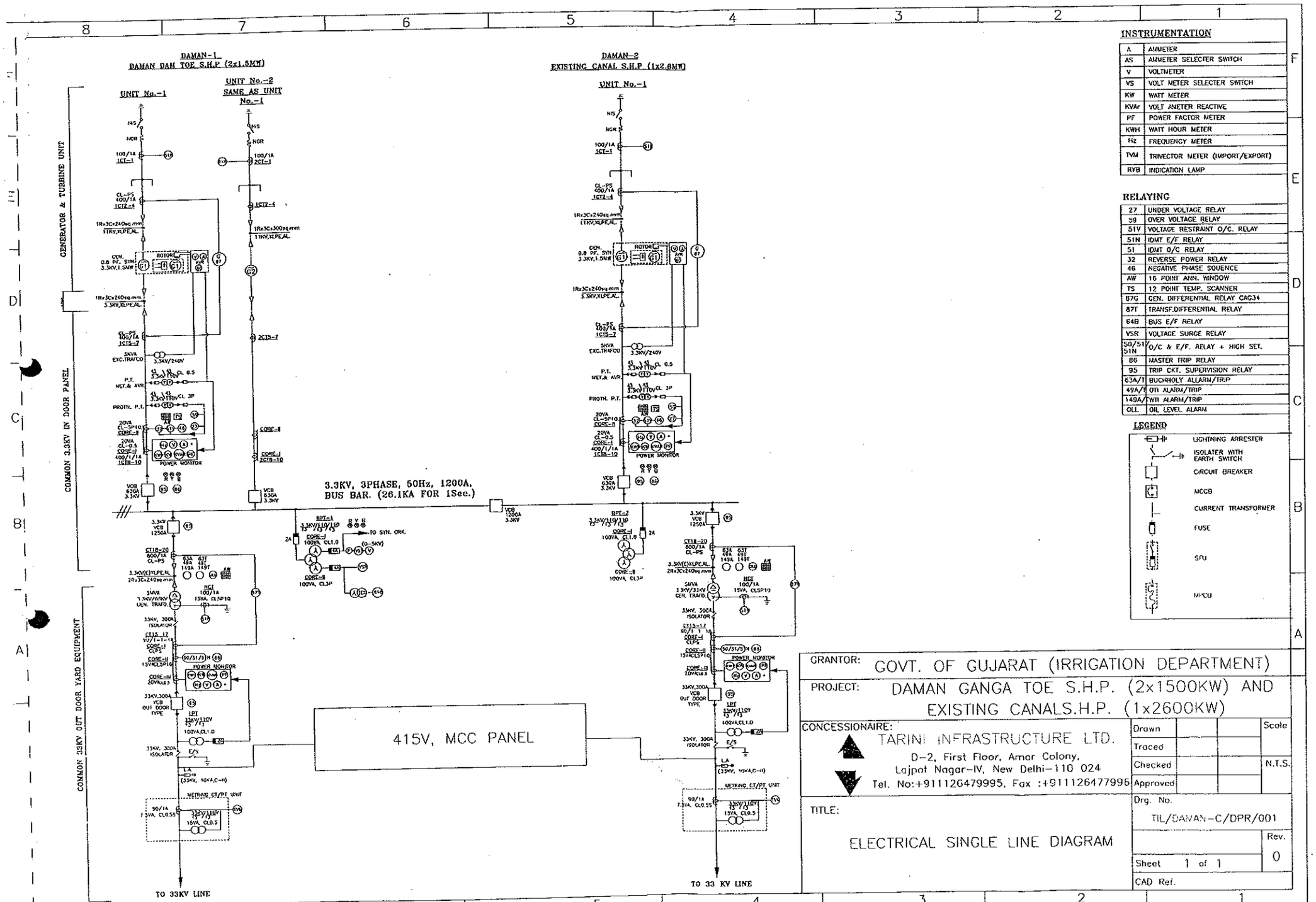
DAMAN-1
DAMAN DAM TOE S.H.P (2x1.5MW)
UNIT No.-1
UNIT No.-2
SAME AS UNIT No.-1
DAMAN-2
EXISTING CANAL S.H.P. (1x2.6MW)
UNIT No.-1
GENERATOR & TURBINE UNIT
COMMON 3.3KV IN DOOR PANEL
COMMON 33KV OUT DOOR YARD EQUIPMENT
3.3KV, 3PHASE, 50Hz, 1200A, BUS BAR. (26.1KA FOR 1Sec.)
415V, MCC PANEL
TO 33KV LINE
TO 33 KV LINE
INSTRUMENTATION
A AMMETER
AS AMMETER SELECTER SWITCH
V VOLTMETER
VS VOLT METER SELECTER SWITCH
KW WATT METER
KVAr VOLT AMETER REACTIVE
PF POWER FACTOR METER
KWH WATT HOUR METER
Hz FREQUENCY METER
TVM TRIVECTOR METER (IMPORT/EXPORT)
RYB INDICATION LAMP
RELAYING
27 UNDER VOLTAGE RELAY
59 OVER VOLTAGE RELAY
51V VOLTAGE RESTRAINT O/C. RELAY
51N IDMT E/F RELAY
51 IDMT O/C RELAY
32 REVERSE POWER RELAY
46 NEGATIVE PHASE SQUENCE
AW 16 POINT ANN. WINDOW
TS 12 POINT TEMP. SCANNER
87G GEN. DIFFERENTIAL RELAY CAG34
87T TRANSF.DIFFERENTIAL RELAY
64B BUS E/F RELAY
VSR VOLTAGE SURGE RELAY
50/51/51N O/C & E/F. RELAY + HIGH SET.
86 MASTER TRIP RELAY
95 TRIP CKT. SUPERVISION RELAY
63A/T BUCHHOLY ALLARM/TRIP
49A/T OTI ALARM/TRIP
149A/T WTI ALARM/TRIP
OLL OIL LEVEL ALARM
LEGEND
LIGHTNING ARRESTER
ISOLATER WITH EARTH SWITCH
CIRCUIT BREAKER
MCCB
CURRENT TRANSFORMER
FUSE
SFU
MIPCU
GRANTOR: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)
PROJECT: DAMAN GANGA TOE S.H.P. (2x1500KW) AND EXISTING CANALS.H.P. (1x2600KW)
CONCESSIONAIRE:
TARINI INFRASTRUCTURE LTD.
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TITLE:
ELECTRICAL SINGLE LINE DIAGRAM
Drg. No.
TIL/DAMAN-C/DPR/001
Rev.
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Sheet 1 of 1
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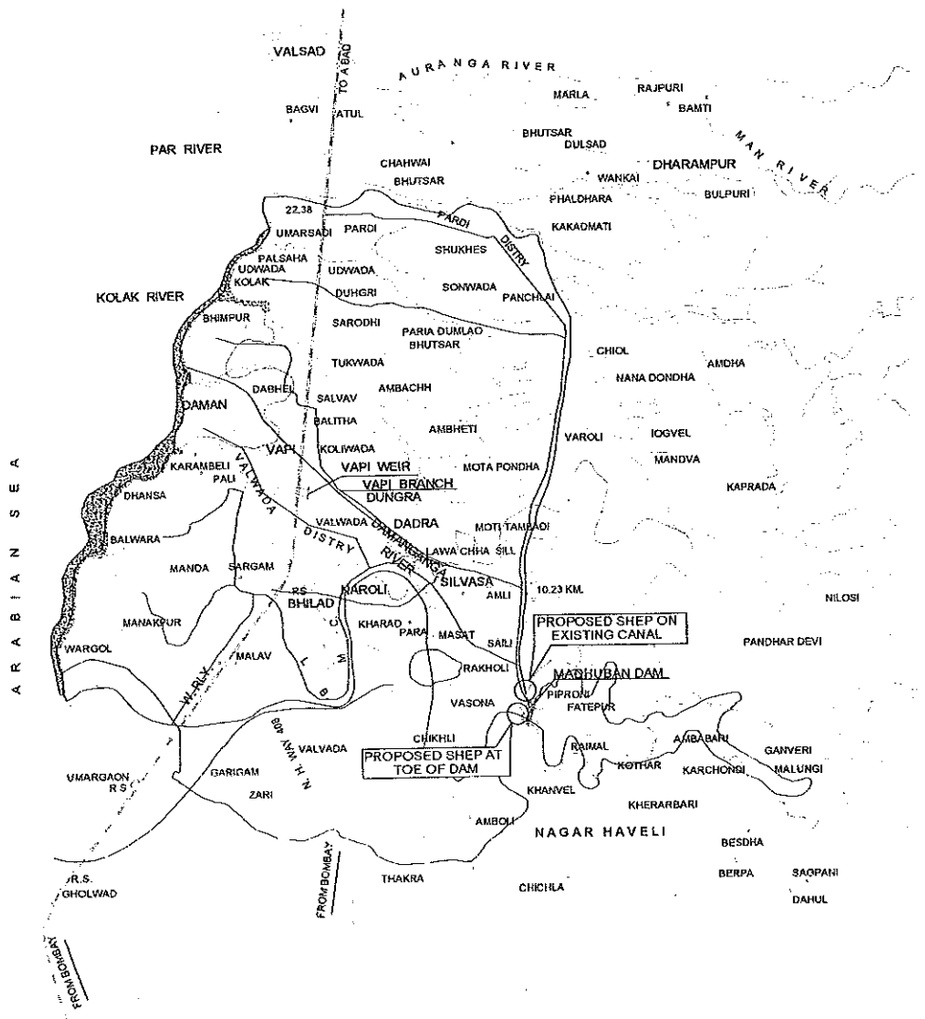
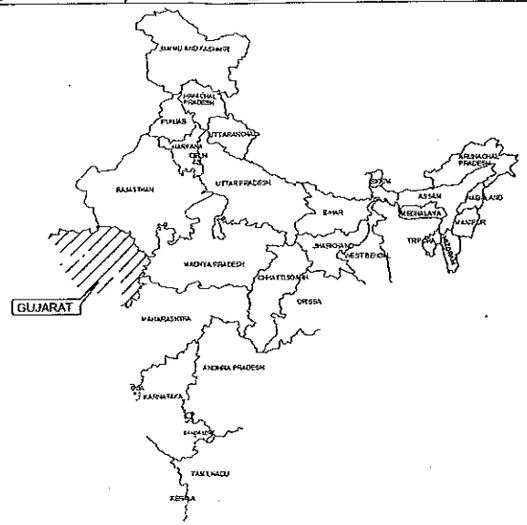


INDEX MAP OF
DAMANGAGA RESERVIOR PROJECT
SCALE: 1 INCH = 4 MILE



MAP OF INDIA

LEGEND:-

1. MADHUBAN DAM
2. VAPI PICKUP WEIR
3. COMMAND AREA OF DAMANGANGA PROJECT
4. CANLAS
5. AREA UNDER SUBMERGENCE
6. STATE BOUNDARY OF GUJRAT
7. BOUNDARY OF GUJARAT
8. NATIONAL HIGHWAY
9. STATE HIGHWAY
10. RIVER AND NALAS
11. RAILWAY (B.G)
12. RAIN GAUGE STATION
13. I.M.D STATION

CLIENT: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN DAM TOE S.H.P. (2x1500KW) & EXISTING CANAL S.H.P. (1x2600KW)

TARINI INFRASTRUCTURE LTD.
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TITLE: LOCATION AND VICINITY MAP

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Sheet 1 of 1

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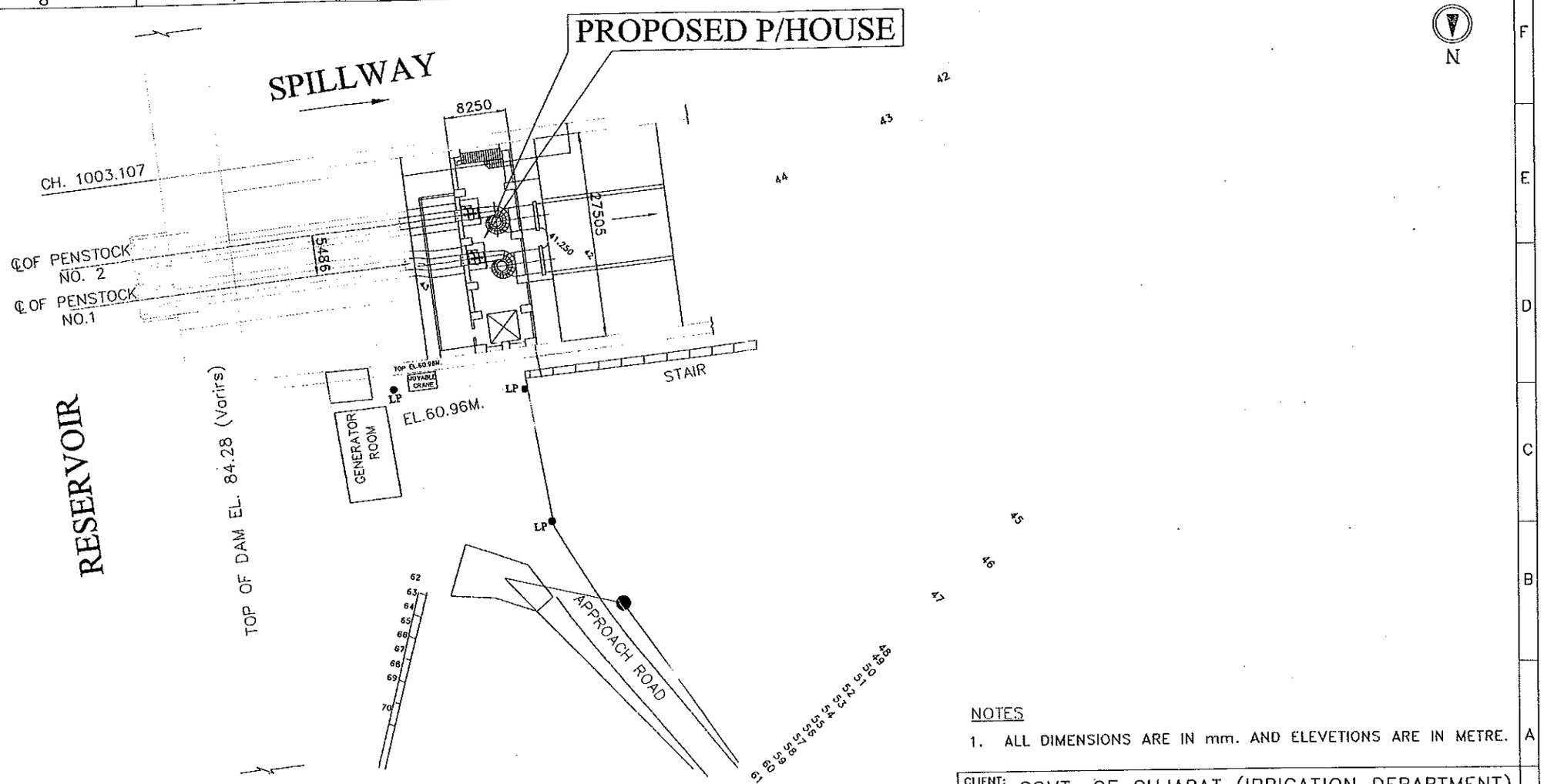

NOTES

1. ALL DIMENSIONS ARE IN mm. AND ELEVETIONS ARE IN METRE.

CLIENT: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN DAM TOE S.H.P. (2x1500KW)

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D-2, First Floor, Amar Colony,
Lajpat Nagar-IV, New Delhi- 110 024
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TITLE: GENERAL LAYOUT PLAN

Drg. No. TIL/DAMAN-1/DPR/002

Rev. 0

Sheet 1 of 1

CAD Ref.

Rev. No.	Modification	Date	Sign

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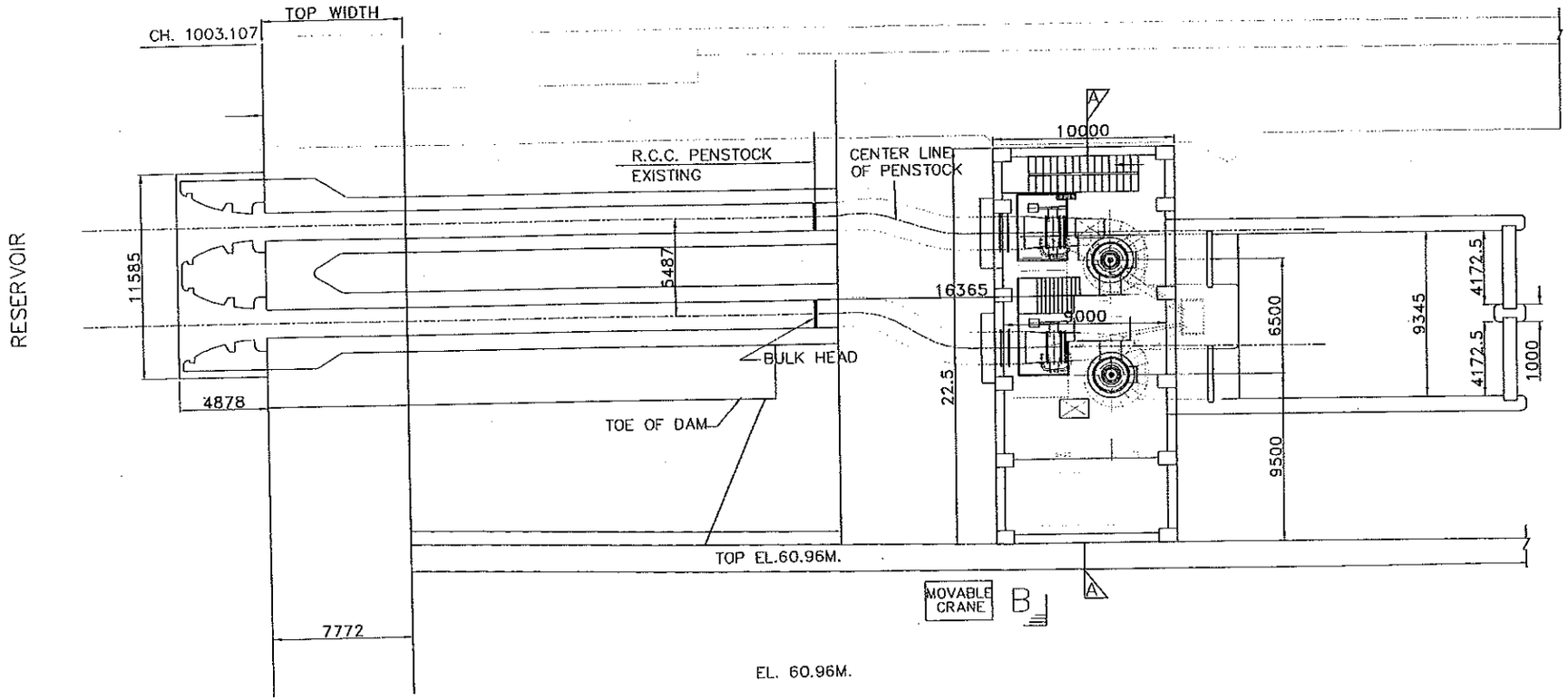
SPILLWAY



NOTES

2. DO NOT SCALE DIMENSIONS ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
3. REFER DRG NO TIL/DAMAN-1/ 003 SHEET 1 OF 3 FOR POWER HOUSE PLAN.
4. REFER DRG NO TIL/DAMAN-1/ 003 SHEET 3 OF 3 FOR CROSS SECTION OF POWER HOUSE.

Rev. No.	Modification	Date	Sign

CLIENT: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN DAM TOE S.H.P. (2x1500KW)

TARINI INFRASTRUCTURE LTD.
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Lajpat Nagar-IV, New Delhi-110 024
Tel. No:+911126479995, Fax :+911126477996

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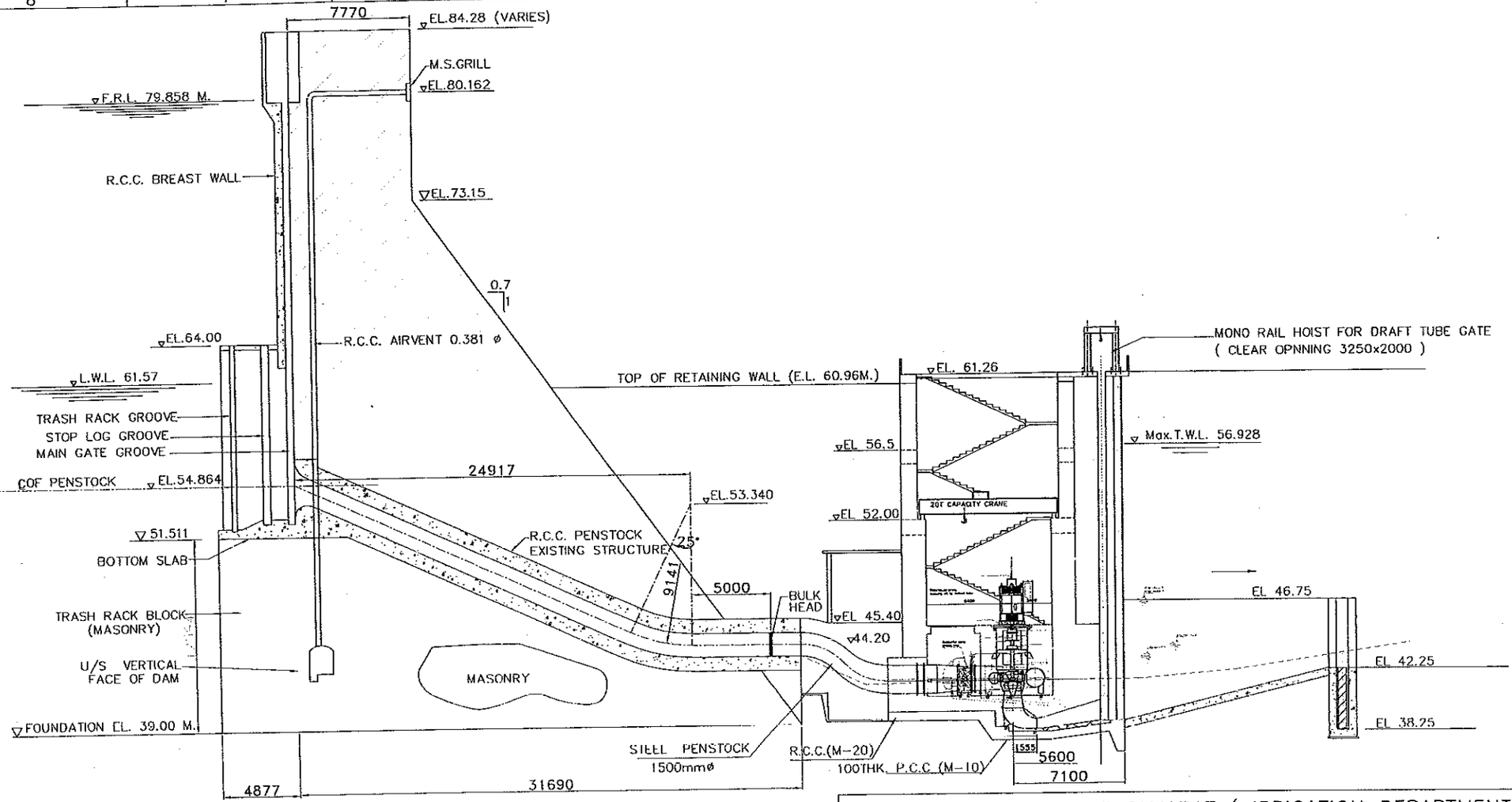
TITLE: POWER HOUSE PLAN

Drg. No. TIL/DAMAN-1/DPR/003

Rev. 0

Sheet 1 of 2

CAD Ref.



SECTION A-A

NOTES

1. ALL DIMENSIONS ARE IN mm. AND ELEVETIONS ARE IN METRE.
2. DO NOT SCALE DIMENSIONS ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
3. REFER DRG NO TIL/DAMAN-1/ 003 SHEET 1 OF 3 FOR POWER HOUSE PLAN.
4. REFER DRG NO TIL/DAMAN-1/ 003 SHEET 3 OF 3 FOR CROSS SECTION OF POWER HOUSE.

Rev. No.	Modification	Date	Sign

GRANTOR: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN GANGA TOE S.H.P. (2x1500KW)

CONCESSIONAIRE: TARINI INFRASTRUCTURE LTD.
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Lajpat Nagar-IV, New Delhi-110 024
Tel. No:+911126479995, Fax :+911126477996

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Approved			

TITLE

POWER HOUSE
L-SECTION ALONG THE ℄ OF UNIT

Drg. No. TIL/DAMAN-1/DPR/003

Rev. 0

Sheet 2 of 2

CAD Ref.

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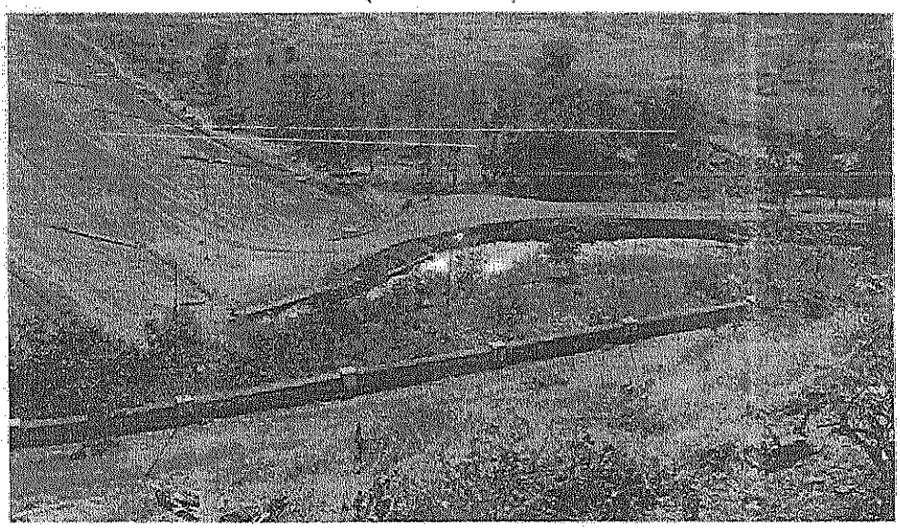
GOVERNMENT OF GUJARAT
(IRRIGATION DEPARTMENT)

DAMAN GANGA EXISTING CANAL S.H.P-2
(2.6MW)



M/s TARINI INFRASTRUCTURE LIMITED
NEW DELHI

DETAILED PROJECT REPORT

JULY, 2007

CONSULTANTS
TARINI INTERNATIONAL PVT. LTD.
D-2, FIRST FLOOR, AMAR COLONY, LAJPAT NAGAR - IV,
NEW DELHI -110024

List of Drawings

1.	Location & Vicinity Map	-	TIL /DAMAN-2 / DPR / 001
2.	General Layout Plan	-	TIL / DAMAN-2 / DPR / 002
3.	Power House Plan	-	TIL / DAMAN-2 /DPR / 003 (Sheet 1 of 2)
4.	L-Section Along with CL Unit	-	TIL / DAMAN-2 /DPR / 003 (Sheet 2 of 2)
5.	Electrical Single Line diagram	-	TIL / DAMAN-C / DPR / 001
6.	Transmission Line	-	TIL / DAMAN-C / DPR / 002

Check List

348

CHECK LIST

NAME OF THE PROJECT	:	DAMANGANGA DAM TOE SHP-2
LOCATION		
(A) State	:	Gujarat
(B) District	:	VALSAD
CATEGORY OF THE PROJECT	:	MINI HYDEL PROJECT

PLANNING:

Have the alternative proposal been studied and their merits and demerits discussed?	:	NA
Have the detailed topographical surveys been carried out for the following items and drawings prepared as per prescribed scales?		
(a) Stream surveys	:	NA
(b) Head work surveys (weir or diversion structure).	:	Yes
(c) Water Conductor system	:	Yes
(d) Power House, Switchyard, Tailrace	:	Yes
(e) Penstock	:	Yes

GEOLOGY:

Have the geological surveys for head works. Power house and tail race etc. been carried out and report on general geology of the area and on geology of the sites of principal structures Appended?	:	NA

HYDROLOGICAL & METEOROLOGICAL INVESTIGATIONS:

Have the hydrological and meteorological investigations been carried out and status of data discussed in report.

(i)	Rainfall in the catchment	:	Yes
(ii)	Gauge and discharge data of the stream	:	Yes

HYDROLOGY

Have hydrological studies been carried out to established the availability of water for the benefits envisaged and what is the dependability of the potential ?	:	Yes 75%

LAND ACQUISITION & RE-SETTLEMENT (wherever applicable):

Have the provisions for land acquisition been considered ?	:	NA
Have the socio-economic problems involved in re-settlement been investigated and discussed?	:	Re-settlement not involved

DESIGN:

Has the layout of the project components viz. diversion structures. Water conductor system. Power house and tail race been finalized ?	:	Yes, Project layout of Water Conductor System and Power House structure finalized

Have the preliminary designs been prepared for the following components ?

a.	Diversion weir	:	NA
b.	Penstock and water conductor system	:	Yes
c.	Power house and switchyard	:	Yes
d.	Power house equipment. LT switching equipment and control &protection equipment.	:	Yes

e.	Steel of various sizes and type of reinforcement	:	Yes
f.	Other materials-P.O.L. Electricity Explosives etc.	:	Yes

ESTIMATE:

a.	Is the estimate prepared?	:	Yes
b.	Have the analysis of rates for various major items and the components of the project been furnished with basis of analysis & the price index at which the estimate is based.	:	Yes.

ECOLOGICAL & ENVIRONMENTAL ASPECTS:

Is the area likely to have any environmental and ecological problems due to the alternate surface water pattern and preventive/ corrective measures discussed ? (wherever applicable).	:	No environmental and ecological degradation

CAMPS AND BUILDINGS:

Has the provision for camps building made ?	:	Yes

SOIL CONSERVATION:

Is the need for soil conservation Measures in the project discussed?	:	Not applicable

Salient Features

SALIENT FEATURES
DAMAN GANGA DAM

1. Location

i)	Name of Scheme	:	Damanganga Dam Toe Small Hydro Project
ii)	State	:	Gujarat
iii)	District	:	Valsad
iv)	River	:	Damanganga
v)	Roil Head	:	Vapi 30 Km from Dam site
vi)	Nearest Air port	:	Mumbai 180 Km from Dam site
vii)	Geographical Coordinates		
	Latitude	:	20° 10' N
	Logitude	:	73° 5' E

2. Discharge

a)	Daily incoming flow in cumec	:	80.40
b)	Daily overflow in cumec	:	69.182
c)	Daily discharge used for Irrigation in cumec	:	8.31

3. HYDROLOGY

a)	CA (Sq.Km.)		
	Maharashtra	:	1318
	Gujarat	:	376
	Union territories	:	119
	Total	:	1813
b)	Average rainfall (mm)	:	2232.17
c)	Maximum Rainfall	:	3379.3
d)	75% dependable runoff from entire catchment (Mcum)	:	3150.4
e)	entire catchment from Gujarat and UT only (Mcum)	:	639.7
f)	Maximum flood discharge (cumec)	:	22040.00 (Routed)
g)	Full Reservoir Level	:	79.858 m
h)	MDDL	:	61.57 m
i)	Maximum TWL	:	56.928m
j)	Minimum TWL	:	44.95 m
k)	Average	:	50.939 m

4. Water Levels for Power Generation

Full Reservoir Level	:	79.858m
Normal T.W.L (for SHP-II)	:	61:00m

Salient Features
Daman Ganga SHP II - (1 X 2600 KW)

1. Steel Penstock	
Dia	2.5m
No	1
Length of each	74m (Approx.)
2. Power House	
Length (m)	14.5
Width (m)	11.7
Height (m)	16
3. Design Discharge	24.39 cumec
4. Head (m)	
Maximum Net Head	16.25
Minimum Net Head	8.45
Rated Head	13
5. Installed Capacity	2600KW
6. Energy Generation	
75% Dependable year	11.63 Mus
7. Plant Load Factor	53.74%
8. Type of Turbine	Kaplan
9. Generator	
Type	1No. Vertical Shaft Synchronous machine
Rated Capacity	3050 KVA
No of Phases	3
Frequency	50
Power Factor	0.85
Rated Terminal Voltage	3.3 KV
Speed (rpm)	250
10. Generator Step-up transformer	
i) Location	Outdoor
ii) Nos.	1
iii) Rated Voltage	3.3/33KV
iv) Frequency	50Hz
v) Type of cooling	ONAN

11. Transmission Line (33KV)	Terminating Station existing GEB's 66KV substation at Rakholi, about 4Km from power house site
12. Estimated Cost (July 2007 Level)	
i) Civil Works	Rs. 417 Lakhs
ii) E&M Works	Rs. 1026 Lakhs
iii) Transmission Works	Included in SHP-1
iv) Total Project Cost	Rs.1443 Lakhs
v) Cost per MW installed	Rs. 555 Lakhs
13. Cost of Generation per Kwh	
First Year (With ROE)	Rs. 2.57
14. Levelised Tariff (35 Years)	Rs. 2.10
15. Sale Rate (Rs. per Kwh)	Rs. 2.90
16. Internal Rate of Return (IRR)	18.17%
17. DSCR	
Average	1.68
Minimum	1.02
Maximum	2.20

CHAPTER -1

Introduction

CHAPTER-1

INTRODUCTION

1.0 Introduction

Gujarat Irrigation Department has proposed Daman Ganga Dam Toe Small Hydro Power Project at Daman Ganga Dam/Madhuban reservoir located 30 Km away from Vapi in Valsad District, in Gujarat State. M/s Tarini Infrastructure Limited (TIL), New Delhi intends to take up one Small Hydro Project namely SHP -2 on existing right bank canal of the dam for development under private sector participation on Built-own-operate basis. 2600 KW installation is proposed for SHP-2.

M/s Tarini Infrastructure Ltd. Limited is applying to the relevant department under Government of Gujarat for taking up this proposed Small Hydro Power Project for implementation.

Accordingly, Detailed Project Report has been prepared by TIL for submission to Irrigation Department for taking up Small Hydro Power Project of 2600 kW installed capacity.

1.1 Project Description

Daman Ganga Dam is a major irrigation Project across river Damanganga in Gujarat State. The Damanganga Dam project is a massonry cum earthen dam. The total length of the Dam is 2728 m excluding spillway length of about 191 m. This project is irrigation cum Power Project and about 2.6 MW Hydro Power generation is proposed by Tarini Infrastructure Ltd.

1.2 Components of Dam Toe SHP-2

The main components of the SHP -2 is as given bellow:

1.2.1 Intake Structure / Right Bank Head Regulator

Existing Right bank Head Regulator in the reservoir of dam has been designed for about 28.32 cumec (1000 cusec) of discharge to meet downstream irrigation, industrial water supply and drinking requirements. Suitable provision for trash – rack, gate & stoplogs has been provided at the entry to R.C.C. duct.

R.C.C. duct of size 2.74m X 2.74m takes off from the intake structure which opens into stilling basin. Irrigation canal takes off from right bank canal head regulator at the exit end of RCC duct. Invert level of RCC duct at exit has been kept at EL 59.06m. After stilling basin, trapezoidal section of canal has been adopted with bottom width of 4.5m & side slope of canal as 1.5:1 (H:V). Design discharge of canal is about 28.32 cumecs.

1.2.2 Steel Penstock

A single steel penstock of dia 2.5m, 74m long & 12mm thick will take off from existing RCC duct of size 2.74m X 2.74m. Further, single penstock of dia 2.5m will be feed one vertical Kaplan Turbine. Butterfly valve of dia 2.5m is proposed to be provided at the beginning of the penstock.

1.2.3 Irrigation Outlet

The provision has been made to let the water for irrigation from below of Power House – 2, after completion of the project.

1.2.4 Power House

Power House is proposed to be constructed independent of the existing irrigation canal on the left bank as shown in the drawing. It is proposed to install one unit of 2600 KW capacity. The main features of the proposed Power House building are as follows.

1. The main building of size 14.5m X 11.7m in plan is provided to accommodate one unit of 2600KW
2. The height of the building will be about 16m from deepest foundation level at EL 51.5m.
3. Steel roof truss will be provided at the top.
4. Service bay has been provided separately.
5. Switchyard is proposed to be provided near the power house canal where sufficient space is available.
6. RCC columns with brick masonry walls will be provided for the Power House building.
7. One number stop log gate (3 of9m x 0.9m) has been provided to facilitate maintenance / repair of generating unit as and when required.

CHAPTER -2

Surveys and Investigations

CHAPTER 2

Surveys and Investigations

2.1 General

Detailed topographical survey of SHP-2 area covering both the banks on the downstream side of existing RBHR canal system for fixing the various components of power house and transmission line has been carried out as detailed below:

2.2 Topographical Surveys

Detailed topographical survey of SHP-2 area covering both the banks on the downstream side of existing RBHR canal system for fixing the various components of power house has been carried out on 1:500 scale with 0.25 m contour interval.

Detailed topographical surveys for the transmission line from proposed Power House to existing 66 KV Sub-station at Rakholi has been carried out on 1:7000 scale with contour interval of 0.25 m. The total length of transmission line will be about 4 Kms.

2.3 Hydrological Surveys

The proposed Power House will generate power by utilizing the hydro power potential available from the irrigation releases through existing RBHR . Table showing ten daily reservoir operation from 1987 to 2003 is presented in Table 3-1.

2.4 Geological Investigations

Rock is not available around the proposed location of the power house. The proposed power house shall be founded on permeable foundation.

2.5 Construction material

Coarse aggregate required for use as the construction material will be available within a radius of about 30 km (Near Vapi) while fine aggregate will be available at a distance of about 125 km from the project site and transported from Unai Anaval.

2.6 Power Evacuation

Daman Ganga Power project (SHP-2) shall generate 2600 kW of power which shall be stepped up to 11/33 KV level at the switchyard of the generating station for further evacuation of the same to the nearest GEB's 66 KV substation at Rakholi (About 4 Kms from the proposed power house site).

CHAPTER -3

HYDROLOGICAL STUDIES

CHAPTER 3
HYDROLOGICAL STUDIES

3.1 General

Daman Ganga dam (also called Madhuban dam) is a major irrigation project across river Daman Ganga, a tributary of Narmada River in Gujarat state. The dam has three nos. head regulators (Right Bank Head Regulator (RBHR), Left Bank Head Regulator (LBHR) and un-operated penstock outlets (BPO) for power generation) and about 191 m long spillway. Out of three, presently, RBHR is under operation to feed irrigation canal and excess water releases through spillway.

Two Dam Toe Small Hydro power Projects on Daman Ganga Dam are proposed as below:

1. Daman Ganga Dam Toe Small Hydropower Project- 1: through existing BPO (Penstock Outlets)

2. Daman Ganga Dam Toe Small Hydropower Project -2: **through RBHR (Right Bank Head Regulator)**

Both the projects are located on the right bank of the dam.

The Daman Ganga Dam Toe SHP-2 is proposed in this DPR. The chapter deals with the hydrological studies for power generation and optimization studies for plant capacity of Daman Ganga Dam Toe SHP-2.

3.2 Drainage Basin

River Daman Ganga is a major tributary of River Narmada. The catchment area up to Dam site is 1813 sq. km. The catchment area of 1318 sq. km., 376 sq. km. And 119 sq. km. lies in Maharastra, Gujrat and Union Territories of India respectively.

3.3 Precipitation Data

The maximum and average values of rainfall are 3780 mm and 2202 mm respectively.

3.4 Hydrological Data

Reservoir operation data is available for the period of 16 years from 1987 to 2003, which is presented in TABLE 3-1 (16 sheets). The reservoir operation table contains the 10 daily release of water through the RBHR (Right Bank Head Regulator), LBHR (Left Bank

Head Regulator) and BPO (Penstock Outlets). Presently LBHR is not working. The table also shows the various losses and net inflow and outflow from the reservoir.

Annual runoff from 1987 to 2003 period has been worked out for each year based on available ten daily inflows (in Mcum) and is presented in TABLE 3.2.

3.5 Availability of Water for SHP-2

Water availability for Daman SHP-2 has been worked out considering actual releases through Right Bank Head Regulator and additional available releases through the same, limiting to canal capacity (28.32 cumec) of the system.

3.6 Dependable Year

90% , 75% & 50% dependable years have been worked out on the basis of annual runoff and is presented in TABLE 3.3.

3.7 Power Potential Studies

Detailed power potential studies have been carried out as discussed in the next chapter on "Power Potential Studies". Based on these studies the power will not be generated if head is less than 65% of rated head and discharge is less than 30% of rated discharge of one unit. Based on these criteria, sometimes available discharge will be not be used for power generation. Hence based on the generation series, discharge used for power generation at SHP-2 is presented in TABLE 4.1 in next chapter.

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation on depth in mm.	Evaporation losses Mm³ Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1987	June	1-10	61.90	61.30	71.00	62.00	-9.00	8.60	0.00	0.00	0.00	8.60	61.60	11.30	35.00	0.40	0.00	9.00	0.00
		11-20	61.30	61.05	62.00	61.00	-1.00	1.00	0.00	0.00	0.00	1.00	61.18	11.00	37.00	0.41	0.00	1.41	0.41
		21-31	61.05	61.40	61.00	64.00	3.00	3.00	0.00	0.00	0.00	3.00	61.23	11.00	33.00	0.36	0.00	3.36	6.36
	July	1-10	61.40	66.40	64.00	150.00	86.00	0.65	0.00	0.00	333.60	334.25	63.90	14.75	12.00	0.18	0.00	334.43	420.43
		11-20	66.40	66.25	150.00	146.50	-3.50	0.49	0.00	0.00	116.72	117.21	66.33	19.03	11.00	0.21	0.00	117.42	113.94
		21-31	66.25	66.40	146.50	150.00	3.50	0.22	0.11	0.00	83.95	84.28	66.33	19.03	12.00	0.23	0.00	84.51	88.01
	Aug	1-10	66.40	66.40	150.00	150.00	0.00	1.11	0.10	0.00	78.57	79.78	66.40	19.20	22.00	0.42	0.00	80.20	80.20
		11-20	66.40	66.45	150.00	151.00	1.00	0.78	0.10	0.00	222.89	223.77	67.43	20.98	24.00	0.50	0.00	224.27	225.27
		21-30	66.45	71.95	150.00	279.00	129.00	0.00	0.03	0.00	228.46	228.49	70.20	24.40	20.00	0.49	0.00	228.98	357.98
	Sept.	1-10	71.95	72.95	279.00	302.50	23.50	0.00	0.00	0.00	53.41	53.41	72.45	31.08	37.00	1.15	0.00	54.56	76.06
		11-20	72.95	73.00	302.50	310.00	7.50	1.96	0.00	0.00	31.96	33.92	72.98	32.10	39.00	1.25	0.00	35.17	42.67
		21-31	73.00	73.00	310.00	310.00	0.00	1.89	0.00	0.00	22.11	24.00	73.00	32.40	35.00	1.13	0.00	25.13	25.21
	Oct.	1-10	73.00	72.95	310.00	308.50	-1.50	1.92	0.03	0.00	23.89	25.84	72.98	32.35	49.00	1.59	0.00	27.43	25.92
		11-20	72.95	72.95	308.50	308.50	0.00	1.93	0.08	0.00	53.20	55.21	72.95	32.28	47.00	1.52	0.00	56.73	56.73
		21-30	72.95	73.05	308.50	311.50	3.00	0.00	0.00	0.00	0.00	0.00	73.00	32.40	52.00	1.68	0.00	1.68	4.68
	Nov.	1-10	73.05	73.05	311.50	311.50	0.00	1.48	0.00	0.00	0.00	1.48	73.05	32.50	42.00	1.37	0.00	2.85	2.84
		11-20	73.05	73.10	311.50	313.00	1.50	2.80	0.15	0.00	0.00	2.95	73.08	32.56	44.00	1.43	0.00	4.38	5.88
		21-31	73.10	73.00	313.00	310.00	-3.00	0.00	0.00	0.00	10.76	10.76	73.05	32.50	40.00	1.30	0.00	12.06	9.06
	Dec.	1-10	73.00	72.30	310.00	290.00	-20.00	0.83	0.07	0.00	17.80	18.70	72.65	31.68	41.00	1.30	0.00	20.00	0.00
		11-20	72.30	71.50	290.00	267.00	-23.00	2.32	0.14	0.00	19.25	21.71	71.90	30.10	43.00	1.29	0.00	23.00	0.00
		21-31	71.50	71.40	267.00	263.00	-4.00	1.46	0.00	0.00	1.40	2.86	71.45	29.30	39.00	1.14	0.00	4.00	0.00
1988	Jan.	1-10	71.40	71.00	263.00	254.00	-9.00	1.37	0.10	0.00	6.41	7.88	71.20	28.80	39.00	1.12	0.00	9.00	0.00
		11-20	71.00	69.50	254.00	217.00	-37.00	2.93	0.13	0.00	32.96	36.02	70.25	26.60	37.00	0.98	0.00	37.00	0.00
		21-28	69.50	66.65	217.00	155.00	-62.00	0.00	0.00	0.00	61.09	61.09	68.08	22.20	41.00	0.91	0.00	62.00	0.00
	Feb.	1-10	66.65	65.80	155.00	138.00	-17.00	2.57	0.14	0.00	13.43	16.14	66.23	18.78	46.00	0.86	0.00	17.00	0.00
		11-20	65.80	65.60	138.00	134.00	-4.00	2.86	0.17	0.00	0.00	3.03	65.70	17.85	49.00	0.87	0.00	3.90	0.00
		21-31	65.60	65.55	134.00	133.00	-1.00	0.24	0.00	0.00	0.00	0.24	65.58	17.87	43.00	0.76	0.00	1.00	0.00
	March	1-10	65.55	64.20	133.00	108.00	-25.00	9.05	0.08	14.79	0.00	23.92	64.88	16.46	66.00	1.09	0.00	25.01	0.00
		11-20	64.20	62.25	108.00	76.00	-32.00	10.93	0.24	19.90	0.00	31.07	63.23	13.75	68.00	0.94	0.00	32.01	0.00
		21-30	62.25	61.65	76.00	70.00	-6.00	2.20	0.23	2.81	0.00	5.24	62.05	11.98	64.00	0.77	0.00	6.01	0.00
	April	1-10	61.65	61.60	70.00	65.00	-5.00	0.73	0.10	3.75	0.00	4.58	61.73	11.50	37.00	0.43	0.00	5.01	0.00
		11-20	61.60	59.70	65.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.65	0.00	0.00	0.00	0.00	0.00	0.00
		21-31	59.70		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.85	0.00	0.00	0.00	0.00	0.00	0.00
	May	1-10			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		11-20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		21-30			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation on depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1988	June	1-10			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		11-20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		21-31			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	July	1-10	58.50	60.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.68	0.00	0.00	0.00	0.00	0.00	0.00
		11-20	60.65	67.50	60.00	174.00	114.00	0.00	0.00	0.00	613.54	613.54	64.08	15.06	30.00	0.45	0.00	613.99	727.99
		21-31	67.50	67.25	174.00	168.50	-5.50	0.00	0.00	0.00	775.97	775.97	67.38	20.86	25.00	0.52	0.00	776.49	770.99
	Aug	1-10	67.25	66.65	168.50	155.00	-13.50	0.00	0.01	0.00	411.42	411.43	66.95	20.10	19.00	0.38	0.00	411.81	398.31
		11-20	66.65	68.10	155.00	187.00	32.00	0.00	0.05	0.00	114.50	114.55	67.38	20.86	23.00	0.48	0.00	115.03	147.03
		21-30	68.10	71.25	187.00	259.50	72.50	0.00	0.02	0.00	194.76	194.78	69.68	25.26	16.00	0.40	0.00	195.19	267.69
	Sept	1-10	71.25	73.40	259.50	322.00	62.50	0.00	0.00	0.00	132.84	132.84	72.33	31.03	24.00	0.74	0.00	133.58	196.08
		11-20	73.40	74.65	322.00	363.50	41.50	0.00	0.00	0.00	155.98	155.98	74.03	34.46	21.00	0.72	0.00	156.70	198.20
		21-31	74.65	74.75	363.50	365.50	2.00	0.00	0.00	0.00	240.22	240.22	74.70	35.75	27.00	0.97	0.00	241.19	243.19
	Oct.	1-10	74.75	75.00	365.50	374.00	8.50	0.00	0.00	0.00	139.24	139.24	74.88	36.16	37.00	1.34	0.00	140.58	149.08
		11-20	75.00	75.00	374.00	374.00	0.00	0.08	0.73	0.00	76.37	77.18	75.00	36.40	46.00	1.67	0.00	78.86	78.86
		21-30	75.00	75.05	374.00	375.50	1.50	0.94	0.12	0.00	43.37	44.44	75.03	36.48	45.00	1.64	0.00	46.08	47.58
	Nov.	1-10	75.05	75.00	375.50	374.00	-1.50	1.23	0.00	0.00	39.45	40.68	75.03	36.48	43.00	1.57	0.00	42.25	40.75
		11-20	75.00	74.95	374.00	372.50	-1.50	0.00	0.00	0.00	11.80	11.80	74.98	36.36	48.00	1.75	0.00	13.55	12.04
		21-31	74.95	74.90	372.50	371.00	-1.50	2.28	0.17	0.00	0.00	2.45	74.93	36.26	41.00	1.49	0.00	3.94	2.44
	Dec.	1-10	74.90	74.90	371.00	371.00	0.00	0.86	0.32	0.00	0.00	1.17	74.90	36.20	36.00	1.30	0.00	2.48	2.47
		11-20	74.90	74.75	371.00	365.50	-5.50	3.67	0.37	0.00	0.00	4.04	74.83	36.06	39.00	1.41	0.05	5.50	0.00
		21-31	74.75	74.70	365.50	364.00	-1.50	1.22	0.22	0.00	0.00	1.44	74.73	35.83	37.00	1.33	0.00	2.77	1.27
1989	Jan.	1-10	74.70	74.55	364.00	359.50	-4.50	2.71	0.18	0.00	0.00	2.89	74.63	35.58	35.00	1.25	0.37	4.51	0.00
		11-20	74.55	74.40	359.50	356.00	-3.50	2.72	0.18	0.00	0.00	2.90	74.48	35.32	40.00	1.41	0.00	4.31	0.81
		21-28	74.40	74.35	356.00	353.50	-2.50	0.99	0.06	0.00	0.00	1.06	74.38	35.16	38.00	1.34	0.12	2.51	0.00
	Feb.	1-10	74.35	74.10	353.50	345.00	-8.50	2.77	0.33	0.00	0.00	3.10	74.23	34.86	46.00	1.60	3.80	8.50	0.00
		11-20	74.10	74.05	345.00	343.50	-1.50	0.00	0.00	0.00	0.00	0.00	74.08	34.56	48.00	1.66	0.00	1.66	0.16
		21-31	74.05	73.90	343.50	338.00	-5.50	1.68	0.22	0.00	0.00	1.90	73.98	34.36	46.00	1.58	2.02	5.50	0.00
	March	1-10	73.90	73.70	338.00	331.00	-7.00	2.46	0.29	0.00	0.00	2.75	73.80	0.00	50.00	0.00	2.45	5.20	0.00
		11-20	73.70	73.65	331.00	329.00	-2.00	0.00	0.16	0.00	0.00	0.16	73.68	33.76	57.00	1.92	0.00	2.08	0.08
		21-30	73.65	73.40	329.00	322.00	-7.00	4.84	0.01	0.00	0.00	4.86	73.53	33.46	48.00	1.61	0.53	7.00	0.00
	April	1-10	73.40	73.30	322.00	319.00	-3.00	0.00	0.21	0.00	0.00	0.21	73.35	33.10	68.00	2.25	0.54	3.00	0.00
		11-20	73.30	73.05	319.00	311.50	-7.50	5.91	0.37	0.00	0.00	6.28	73.18	32.76	72.00	2.36	0.00	8.64	1.14
		21-31	73.05	72.85	311.50	305.50	-6.00	2.24	0.17	0.00	0.00	2.42	72.95	32.28	68.00	2.20	1.39	6.01	0.00
	May	1-10	72.85	72.70	305.50	301.00	-4.50	2.32	0.20	0.00	0.00	2.52	72.78	31.87	75.00	2.39	0.00	4.91	0.41
		11-20	72.70	72.45	301.00	294.50	-6.50	4.03	0.17	0.00	0.00	4.20	72.58	31.56	78.00	2.46	0.00	6.66	0.16
		21-30	72.45	70.90	294.50	252.00	-42.50	0.61	0.20	0.00	38.59	39.40	71.68	29.72	72.00	2.14	0.96	42.50	0.00

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm³ Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1989	June	1-10	70.90	65.45	262.00	131.00	-121.00	7.53	0.22	0.00	10.62	18.37	68.18	22.45	0.00	0.00	102.61	120.98	0.00
		11-20	65.45	68.55	131.00	153.00	22.00	4.20	0.00	0.00	0.00	4.20	66.00	18.40	0.00	0.00	0.00	4.20	26.20
		21-31	68.55	64.35	153.00	111.00	-42.00	6.56	0.00	35.42	0.00	41.98	65.45	17.48	0.00	0.00	0.00	41.98	0.00
	July	1-10	64.35	66.15	111.00	144.50	33.50	1.46	0.00	0.00	11.88	13.34	65.25	17.10	16.00	0.27	0.00	13.61	47.11
		11-20	66.15	66.50	144.50	152.00	7.50	3.06	0.00	0.00	96.13	99.19	66.33	19.02	19.00	0.36	0.00	99.55	107.05
		21-31	66.50	66.65	152.00	155.00	3.00	0.57	0.00	0.00	559.11	559.68	66.58	19.38	16.00	0.31	0.00	559.99	562.99
	Aug	1-10	66.65	66.50	155.00	195.00	40.00	3.36	0.44	0.00	71.72	75.52	67.58	21.35	15.00	0.32	0.00	75.84	115.84
		11-20	66.50	71.85	195.00	276.50	81.50	0.00	0.00	0.00	142.79	142.79	70.18	26.45	13.00	0.34	0.00	143.13	224.63
		21-30	71.85	74.10	276.50	345.00	68.50	0.00	0.00	0.00	451.78	451.78	72.98	32.35	13.00	0.42	0.00	452.20	520.70
	Sept.	1-10	74.10	75.10	345.00	377.00	32.00	0.00	0.00	0.00	90.46	90.46	74.60	35.50	26.00	0.92	0.00	91.38	123.38
		11-20	75.10	76.20	377.00	416.00	39.00	0.00	0.00	0.00	90.46	90.46	75.65	37.90	28.00	1.06	0.00	91.52	40.06
		21-31	76.20	77.90	416.00	484.00	68.00	0.88	0.00	0.00	133.11	133.99	77.05	31.12	31.00	0.96	0.00	134.95	160.61
	Oct.	1-10	77.90	77.45	484.00	464.50	-19.50	0.34	0.00	0.00	11.39	11.73	77.68	42.70	45.00	1.92	0.00	13.65	115.87
		11-20	77.45	77.45	464.50	464.50	0.00	2.24	0.00	0.00	12.97	15.21	77.45	42.12	43.00	1.81	0.00	17.02	15.44
		21-30	77.45	77.25	464.50	457.00	-7.50	0.37	0.00	0.00	0.00	0.37	77.35	41.88	47.00	1.97	0.00	2.34	7.81
	Nov.	1-10	77.25	77.00	457.00	447.00	-10.00	2.30	0.17	0.00	0.00	2.47	77.13	41.30	40.00	1.65	5.68	10.00	0.00
		11-20	77.00	76.95	447.00	445.00	-2.00	1.52	0.23	0.00	0.00	1.75	76.98	40.95	43.00	1.76	0.00	3.51	1.51
		21-31	76.95	76.80	445.00	438.00	-7.00	0.24	0.13	0.00	0.00	0.37	76.88	40.70	50.00	2.04	3.99	6.40	0.00
	Dec.	1-10	76.80	76.45	438.00	426.00	-12.00	2.81	0.21	0.00	0.00	3.02	76.63	40.05	47.00	1.88	7.10	12.00	0.00
		11-20	76.45	76.30	426.00	420.00	-6.00	0.00	0.00	0.00	0.00	0.00	76.38	39.45	46.00	1.81	4.19	6.00	0.00
		21-31	76.30	75.90	420.00	404.00	-16.00	4.11	0.27	0.00	0.00	4.38	76.10	38.80	48.00	1.86	9.76	16.00	0.00
1990	Jan.	1-10	75.90	75.75	404.00	398.50	-5.50	0.00	0.00	0.00	0.00	0.00	75.83	38.24	42.00	1.61	3.89	5.50	0.00
		11-20	75.75	75.45	398.50	389.00	-9.50	4.74	0.25	0.00	0.00	4.99	75.60	37.80	46.00	1.74	2.77	9.50	0.00
		21-28	75.45	75.00	389.00	374.00	-15.00	0.67	0.17	0.00	0.00	0.84	75.23	36.94	49.00	1.81	12.35	15.00	0.00
	Feb.	1-10	75.00	74.70	374.00	364.00	-10.00	3.48	0.31	0.00	0.00	3.79	74.85	36.10	44.00	1.59	4.62	10.00	0.00
		11-20	74.70	74.40	364.00	356.00	-8.00	2.19	0.25	0.00	0.00	2.44	74.55	35.42	45.00	1.59	3.99	8.02	0.00
		21-31	74.40	74.20	356.00	348.00	-8.00	0.00	0.00	0.00	0.00	0.00	74.30	35.00	43.00	1.51	6.49	8.00	0.00
	March	1-10	74.20	73.80	348.00	334.00	-14.00	6.34	0.38	0.00	0.00	6.72	74.00	34.40	58.00	2.00	5.29	14.01	0.00
		11-20	73.80	73.55	334.00	326.00	-8.00	0.00	0.00	0.00	0.00	0.00	73.68	33.76	62.00	2.09	5.91	8.00	0.00
		21-30	73.55	73.15	326.00	314.50	-11.50	6.50	0.36	0.00	0.00	6.86	73.35	33.10	68.00	2.25	2.89	12.00	0.00
	April	1-10	73.15	72.90	314.50	307.00	-7.50	0.00	0.00	0.00	0.00	0.00	73.03	32.44	69.00	2.24	5.26	7.50	0.00
		11-20	72.90	72.50	307.00	296.00	-11.00	4.41	0.25	0.00	0.00	4.66	72.70	31.75	71.00	2.25	4.09	11.00	0.00
		21-31	72.50	72.10	296.00	284.00	-12.00	4.60	0.13	0.00	0.00	4.73	72.30	30.95	71.00	2.20	5.07	12.00	0.00
	May	1-10	72.10	71.90	284.00	278.00	-6.00	0.00	0.00	0.00	0.00	0.00	72.00	30.30	57.00	1.73	4.27	6.00	0.00
		11-20	71.90	71.35	278.00	262.00	-16.00	10.95	0.44	0.00	0.00	11.39	71.63	29.63	62.00	1.84	2.77	16.00	0.00
		21-30	71.35	65.80	262.00	138.00	-124.00	0.00	0.00	175.00	0.00	175.00	68.58	23.26	67.00	1.56	0.00	176.56	52.56

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1990	June	1-10	65.60	64.90	136.00	120.00	-16.00	3.03	0.21	0.00	0.00	3.24	65.35	17.25	37.60	0.65	14.12	18.00	0.00
		11-20	64.90	64.95	120.00	121.00	1.00	2.52	0.21	12.35	0.00	15.08	64.93	16.55	38.00	0.63	0.00	15.71	16.71
		21-31	64.95	65.70	121.00	136.00	15.00	1.65	0.10	0.00	0.00	1.75	65.33	17.23	37.40	0.64	0.00	2.40	17.40
	July	1-10	65.70	66.25	136.00	146.50	10.50	1.82	0.00	0.00	253.59	255.41	65.98	18.34	22.60	0.41	0.00	255.82	266.32
		11-20	66.25	70.45	146.50	239.50	93.00	5.69	0.42	0.00	168.27	174.38	68.35	22.93	23.20	0.53	0.00	174.92	267.92
		21-31	70.45	72.40	239.50	293.00	53.50	3.95	0.10	0.00	240.83	244.88	71.43	29.11	22.20	0.65	0.00	245.52	299.02
	Aug	1-10	72.40	72.70	293.00	301.00	8.00	9.74	0.25	0.00	236.93	246.92	72.55	31.47	14.10	0.44	0.00	247.36	255.36
		11-20	72.70	71.80	301.00	304.00	3.00	0.79	0.00	0.00	773.71	774.50	72.25	30.82	14.30	0.44	0.00	774.94	777.94
		21-30	71.80	77.15	304.00	453.00	149.00	0.00	0.00	0.00	424.37	424.37	74.48	35.63	14.60	0.52	0.00	424.89	573.89
	Sept.	1-10	77.15	78.60	453.00	512.00	59.00	0.00	0.00	0.00	122.97	122.97	77.88	43.16	21.00	0.91	0.00	123.88	182.88
		11-20	78.60	78.90	512.00	524.00	12.00	0.00	0.00	0.00	93.48	93.48	78.75	45.37	20.00	0.91	0.00	94.39	106.39
		21-31	78.90	79.25	524.00	539.00	15.00	0.00	0.00	0.00	323.47	323.47	79.08	46.18	23.00	1.06	0.00	324.54	339.54
	Oct.	1-10	79.25	79.80	539.00	564.00	25.00	0.00	0.00	0.00	115.51	115.51	79.53	47.31	32.90	1.56	0.00	117.07	142.07
		11-20	79.80	79.90	564.00	568.00	4.00	0.00	0.00	0.00	62.12	62.12	79.85	48.18	41.50	2.00	0.00	64.11	68.11
		21-30	79.90	79.90	568.00	568.00	0.00	4.24	0.00	0.00	12.92	17.16	79.90	48.37	49.60	2.40	0.00	19.56	16.56
	Nov.	1-10	79.90	79.75	568.00	562.00	-6.00	0.41	0.05	0.00	0.00	0.47	79.83	48.12	43.90	2.11	3.42	6.00	0.00
		11-20	79.75	79.40	562.00	545.00	-17.00	5.17	0.31	0.00	0.00	5.48	79.58	47.43	39.60	1.88	9.65	17.00	0.00
		21-31	79.40	79.15	545.00	535.00	-10.00	0.00	0.00	0.00	0.00	0.00	79.28	46.69	37.80	1.76	8.24	10.00	0.00
	Dec.	1-10	79.15	78.75	535.00	518.00	-17.00	4.20	0.28	0.00	0.00	4.47	78.95	45.87	35.60	1.63	10.89	17.00	0.00
		11-20	78.75	78.35	518.00	502.00	-16.00	1.61	0.18	0.00	0.00	1.79	78.55	44.87	22.30	1.00	13.21	16.00	0.00
		21-31	78.35	77.85	502.00	482.00	-20.00	2.77	0.13	0.00	0.00	2.91	78.10	43.74	38.20	1.67	15.42	20.00	0.00
1991	Jan.	1-10	77.85	77.30	482.00	459.00	-23.00	6.59	0.18	0.00	0.00	6.77	77.58	42.43	29.70	1.26	14.10	22.13	0.00
		11-20	77.30	77.00	459.00	447.00	-12.00	0.00	0.04	0.00	0.00	0.04	77.15	41.37	34.70	1.44	10.05	11.52	0.00
		21-28	77.00	76.45	447.00	426.00	-21.00	7.61	0.31	0.00	0.00	7.91	76.73	40.31	47.20	1.90	11.18	21.00	0.00
	Feb.	1-10	76.45	76.20	426.00	416.00	-10.00	0.00	0.00	0.00	0.00	0.00	76.33	39.31	41.90	1.65	8.35	10.00	0.00
		11-20	76.20	75.95	416.00	405.50	-10.50	6.85	0.33	0.00	0.00	7.18	76.08	38.65	44.50	1.72	1.60	10.50	0.00
		21-31	75.95	75.80	405.50	400.00	-5.50	1.24	0.10	0.00	0.00	1.34	75.88	38.25	38.70	1.48	2.69	5.50	0.00
	March	1-10	75.80	75.65	400.00	395.50	-4.50	3.69	0.18	0.00	0.00	3.87	75.73	35.39	50.90	1.80	0.00	5.67	1.32
		11-20	75.65	75.50	395.50	391.00	-4.50	5.94	0.28	0.00	0.00	6.22	75.58	37.87	60.70	2.30	0.00	8.51	4.01
		21-30	75.50	75.40	391.00	387.00	-4.00	0.00	0.00	0.00	0.00	0.00	75.45	37.43	73.10	2.74	1.26	4.00	0.00
	April	1-10	75.40	74.95	387.00	372.50	-14.50	2.22	0.46	0.00	0.00	2.68	75.18	36.84	59.30	2.18	0.00	4.87	0.36
		11-20	74.95	74.70	372.50	364.00	-8.50	1.95	0.00	0.00	0.00	1.95	74.83	36.24	66.00	2.39	4.16	8.50	0.00
		21-31	74.70	74.55	364.00	359.50	-4.50	5.87	0.14	0.00	0.00	6.01	74.63	35.78	60.90	2.18	0.00	8.19	3.69
	May	1-10	74.55	74.05	359.50	343.50	-16.00	11.04	0.17	0.00	2.09	13.30	74.30	34.96	58.60	2.05	0.85	16.00	0.00
		11-20	74.05	66.90	343.50	160.00	-183.50	3.28	0.00	0.00	176.59	181.87	70.48	27.25	59.80	1.63	0.00	183.50	0.00
		21-30	66.90	64.95	160.00	121.00	-39.00	10.68	0.19	7.48	19.82	38.17	65.93	18.30	68.60	1.26	0.00	39.42	0.42

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1991	June	1-10	65.00	66.95	122.00	161.00	39.00	6.94	0.00	0.00	67.60	74.54	65.98	18.40	17.80	0.33	0.00	74.87	113.87
		11-20	66.95	65.25	161.00	128.00	-33.00	7.34	0.00	1.17	8.00	16.51	66.10	18.60	14.10	0.26	16.23	33.00	0.00
		21-31	65.25	65.84	128.00	138.80	10.80	11.14	0.00	0.00	0.00	11.14	65.55	17.59	19.70	0.35	0.00	11.49	22.29
	July	1-10	65.84	66.39	138.80	149.80	13.00	4.50	0.00	0.00	59.42	63.92	66.12	18.62	28.50	0.53	0.00	64.45	75.45
		11-20	66.39	67.21	149.80	167.15	17.35	1.87	0.00	0.00	511.48	513.35	66.80	19.84	6.70	0.13	0.00	513.48	530.83
		21-31	67.21	67.62	167.15	176.60	9.45	0.00	0.00	0.00	1048.91	1048.91	67.42	20.97	4.20	0.09	0.00	1049.00	1058.45
	Aug	1-10	67.62	67.04	176.60	162.00	-14.60	0.00	0.00	0.00	280.07	280.07	67.33	20.80	12.50	0.26	0.00	280.33	265.73
		11-20	67.04	67.09	162.00	164.70	2.70	0.00	0.00	0.00	269.99	269.99	67.07	20.26	10.20	0.21	0.00	270.20	272.90
		21-30	67.09	68.82	164.70	202.40	37.70	0.00	0.00	0.00	421.27	421.27	67.96	21.99	7.20	0.16	0.00	421.43	459.13
	Sept.	1-10	68.82	73.06	202.40	311.80	109.40	0.00	0.00	0.00	0.00	0.00	70.94	26.30	17.10	0.48	0.00	0.48	109.88
		11-20	73.06	74.38	311.80	355.00	43.20	0.14	0.00	0.00	0.00	0.14	73.72	34.06	33.90	1.15	0.00	1.29	44.49
		21-31	74.38	74.92	355.00	371.60	16.60	6.31	0.02	0.00	0.00	6.33	74.65	35.70	38.10	1.36	0.00	7.69	24.29
	Oct.	1-10	74.92	75.03	371.60	374.90	3.30	0.64	0.21	0.00	0.00	0.85	74.98	36.35	37.54	1.36	0.00	2.22	5.52
		11-20	75.03	74.90	374.90	371.00	-3.90	7.26	0.20	0.00	0.00	7.47	74.97	36.33	40.60	1.47	0.00	8.94	5.04
		21-30	74.90	74.80	371.00	367.00	-4.00	6.84	0.29	0.00	0.00	7.13	74.85	36.10	59.40	2.14	0.00	9.27	5.27
	Nov.	1-10	74.80	74.80	367.00	367.00	0.00	0.00	0.06	0.00	0.00	0.06	74.80	36.00	53.40	1.92	0.00	1.98	1.97
		11-20	74.80	74.59	367.00	360.70	-6.30	8.91	0.31	0.00	0.00	9.22	74.70	35.74	41.80	1.49	0.00	10.71	4.41
		21-31	74.59	74.46	360.70	357.20	-3.50	5.63	0.06	0.00	0.00	5.69	74.53	35.39	36.80	1.30	0.00	6.99	3.49
	Dec.	1-10	74.40	74.16	357.20	346.80	-10.40	6.67	0.24	0.00	0.00	6.91	74.28	35.00	37.70	1.32	0.17	10.40	0.00
		11-20	74.16	74.03	346.80	342.90	-3.90	3.30	0.10	0.00	0.00	3.39	74.10	34.59	46.90	1.62	0.00	5.02	1.12
		21-31	74.03	73.99	342.90	341.80	-1.10	0.31	0.17	0.64	0.00	1.11	74.01	34.42	32.50	1.12	0.00	2.23	1.12
1992	Jan.	1-10	73.99	73.64	341.80	328.60	-13.20	9.58	0.11	1.81	0.00	11.50	73.82	34.03	36.70	1.25	0.48	13.20	0.00
		11-20	73.64	73.55	328.60	326.00	-2.60	1.28	0.11	1.47	0.00	2.87	73.60	34.08	45.00	1.53	0.00	4.40	1.80
		21-28	73.55	73.15	326.00	314.50	-11.50	9.77	0.07	1.62	0.00	11.45	73.35	33.09	47.10	1.56	0.00	13.01	1.51
	Feb.	1-10	73.15	73.08	314.50	312.40	-2.10	0.82	0.13	1.47	0.00	2.43	73.12	32.63	41.60	1.36	0.00	3.78	1.68
		11-20	73.08	72.07	312.40	306.10	-6.30	3.38	0.04	1.47	0.00	4.89	72.58	32.32	42.20	1.36	0.05	6.30	0.00
		21-31	72.87	72.56	306.10	297.20	-8.90	6.70	0.18	1.32	0.00	8.20	72.72	31.80	46.80	1.49	0.00	9.69	0.79
	March	1-10	72.56	72.47	297.20	295.10	-2.10	0.00	0.04	1.47	0.00	1.51	72.52	31.43	55.00	1.73	0.00	3.24	1.14
		11-20	72.47	72.10	295.10	284.00	-11.10	8.62	0.09	1.47	0.00	10.18	72.29	30.92	61.00	1.89	0.00	12.07	0.97
		21-30	72.10	71.85	284.00	276.50	-7.50	4.24	0.16	1.62	0.00	6.01	71.98	30.25	71.90	2.17	0.00	8.19	0.69
	April	1-10	71.85	71.54	276.50	268.20	-8.30	5.12	0.04	1.47	0.00	6.64	71.70	29.74	58.00	1.72	0.00	8.36	0.06
		11-20	71.54	71.05	268.20	255.00	-13.20	11.18	0.09	1.47	0.00	12.74	71.30	28.99	64.70	1.88	0.00	14.62	1.42
		21-31	71.05	70.84	255.00	250.20	-4.80	3.43	0.12	1.47	0.00	5.01	70.95	28.25	60.20	1.70	0.00	6.71	1.91
	May	1-10	70.84	70.24	250.20	234.80	-15.40	11.78	0.12	1.47	0.00	13.37	70.54	27.29	70.30	1.92	0.12	15.40	0.00
		11-20	70.24	69.94	234.80	226.80	-8.00	3.89	0.18	1.47	0.00	5.35	70.09	28.21	69.10	1.81	0.57	7.73	0.00
		21-30	69.94	69.32	226.80	213.40	-13.40	12.09	0.04	1.62	0.00	13.75	69.83	25.21	73.20	1.85	0.00	15.60	2.49

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Avg. level	Evaporation depth in mm.	Evaporation losses Mm³ Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1992	June	1-10	69.32	68.98	213.40	205.60	-7.80	4.10	0.21	1.47	0.00	5.78	69.15	24.27	64.60	1.57	0.00	7.34	0.41
		11-20	68.98	68.77	205.60	201.40	-4.20	8.09	0.02	1.47	0.43	10.01	68.88	23.74	51.50	1.22	0.00	11.23	7.03
		21-31	68.77	66.05	201.40	143.00	-58.40	0.00	0.00	0.26	119.33	119.58	67.41	21.00	21.20	0.45	0.00	120.03	61.63
	July	1-10	66.05	65.76	143.00	137.20	-5.80	3.48	0.23	0.00	16.41	20.11	65.91	18.21	31.90	0.58	0.00	20.69	14.89
		11-20	65.76	66.85	137.20	158.50	21.30	8.12	0.18	0.00	4.07	12.37	66.31	18.92	14.50	0.27	0.00	12.64	33.94
		21-31	66.85	70.85	158.50	250.50	92.00	0.00	0.00	0.00	115.33	115.33	68.85	23.95	10.70	0.26	0.00	115.59	207.59
	Aug	1-10	70.85	72.54	250.50	296.80	46.30	0.00	0.00	0.00	155.71	155.71	71.70	29.75	13.80	0.41	0.00	156.12	202.42
		11-20	72.54	72.69	296.80	300.40	3.60	0.00	0.00	0.00	969.41	969.41	72.62	31.60	2.30	0.07	0.00	969.48	973.08
		21-30	72.69	74.76	300.40	365.80	65.40	0.00	0.00	0.00	108.15	108.15	73.73	33.81	13.30	0.45	0.00	108.60	174.10
	Sept.	1-10	74.76	77.13	365.80	452.20	86.40	0.00	0.00	0.00	603.38	603.38	75.95	38.61	12.90	0.50	0.00	603.88	690.28
		11-20	77.13	79.02	452.20	529.00	76.80	0.00	0.00	0.00	0.00	0.00	78.08	43.69	39.00	1.70	0.00	1.70	124.90
		21-31	79.02	79.49	529.00	549.50	20.50	3.07	0.06	0.00	0.00	3.13	79.26	46.64	49.90	2.33	0.00	5.46	25.96
	Oct.	1-10	79.49	79.71	549.50	560.40	10.90	4.26	0.15	0.00	0.00	4.40	79.60	47.51	42.80	2.03	0.00	6.44	17.34
		11-20	79.71	79.76	560.40	562.40	2.00	2.39	1.22	0.00	0.00	3.61	79.74	47.85	38.80	1.86	0.00	5.47	7.47
		21-30	79.76	79.76	562.40	562.40	0.00	2.84	0.12	0.00	0.00	2.95	79.76	47.90	44.40	2.13	0.00	5.08	5.08
	Nov.	1-10	79.76	79.68	562.40	559.00	-3.40	0.62	0.15	0.00	0.00	0.76	79.72	47.80	44.80	2.14	0.50	3.40	0.00
		11-20	79.68	79.29	559.00	540.60	-18.40	12.72	0.29	0.00	0.00	13.01	79.49	47.21	41.80	1.97	3.41	16.40	0.00
		21-31	79.29	79.20	540.60	537.00	-3.60	4.16	0.09	0.00	0.00	4.25	79.25	46.61	45.50	2.12	0.00	6.37	0.93
	Dec.	1-10	79.20	78.98	537.00	527.20	-9.80	8.92	0.17	0.00	0.00	9.10	79.09	46.22	44.50	2.06	0.00	11.15	1.35
		11-20	78.98	78.84	527.20	521.60	-5.60	5.90	0.20	0.00	0.00	6.10	78.91	45.77	38.70	1.77	0.00	7.87	2.27
		21-31	78.84	78.88	521.60	515.20	-6.40	4.04	0.06	0.00	0.00	4.09	78.76	45.40	39.00	1.77	0.54	6.40	0.00
1993	Jan.	1-10	78.88	78.40	515.20	504.50	-10.70	11.11	0.29	0.00	0.00	11.40	78.54	44.65	43.10	1.93	0.00	13.33	2.15
		11-20	78.40	78.36	504.50	502.40	-2.10	0.39	0.03	0.00	0.00	0.42	78.38	44.45	36.90	1.64	0.00	2.06	0.46
		21-28	78.36	78.04	502.40	489.60	-12.80	11.03	0.25	0.00	0.00	11.28	78.20	43.95	40.90	1.80	0.00	13.08	0.55
	Feb.	1-10	78.04	77.67	489.60	482.80	-6.80	3.96	0.14	0.00	0.00	4.10	77.96	43.34	52.40	2.27	0.43	6.80	0.00
		11-20	77.67	77.68	482.80	473.00	-9.80	4.78	0.18	0.00	0.00	4.95	77.77	42.91	59.30	2.54	2.30	9.80	0.00
		21-31	77.66	77.38	473.00	462.20	-10.80	9.43	0.34	0.00	0.00	9.77	77.52	42.30	38.60	1.63	0.00	11.40	0.60
	March	1-10	77.38	77.27	462.20	457.80	-4.40	1.89	0.05	0.00	0.00	1.94	77.33	41.81	54.90	2.30	0.16	4.40	0.00
		11-20	77.27	77.89	457.80	442.50	-15.30	12.73	0.29	0.00	0.00	13.02	77.58	41.20	58.60	2.41	0.00	15.43	0.13
		21-30	77.89	76.69	442.50	434.70	-7.80	3.97	0.08	0.00	0.00	4.05	77.29	40.47	66.60	2.70	1.06	7.80	0.00
	April	1-10	76.69	76.33	434.70	421.20	-13.50	10.72	0.21	0.00	0.00	10.93	76.51	39.77	62.50	2.49	0.09	13.50	0.00
		11-20	76.33	76.13	421.20	413.20	-8.00	4.09	0.76	0.00	0.00	4.85	76.23	39.09	66.00	2.58	1.26	9.68	0.00
		21-31	76.13	66.52	413.20	152.40	-260.80	13.32	0.29	0.00	273.23	286.84	71.33	29.09	69.10	2.01	0.00	288.85	28.05
	May	1-10	66.52	65.57	152.40	133.40	-19.00	5.00	0.07	9.68	0.00	14.74	66.05	18.49	67.70	1.25	3.01	19.00	0.00
		11-20	65.57	64.66	133.40	116.20	-17.20	12.82	0.28	0.00	0.00	13.10	65.12	16.87	64.60	1.09	3.01	17.20	0.00
		21-30	64.66	64.24	116.20	108.80	-7.40	4.94	0.11	0.00	0.00	5.04	64.45	15.82	72.10	1.14	1.22	7.40	0.00

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1993	June	1-10	64.24	63.88	108.80	99.60	-9.20	8.32	0.17	0.00	0.00	8.49	63.96	14.90	62.20	0.93	0.00	9.41	0.21
		11-20	63.88	68.35	99.60	149.00	49.40	0.00	0.00	0.74	43.05	43.79	65.62	16.75	22.00	0.37	0.00	44.16	93.56
		21-31	68.35	68.22	149.00	145.60	-3.40	0.00	0.00	0.00	87.09	87.09	66.29	18.91	36.50	0.69	0.00	87.78	84.38
	July	1-10	66.22	67.91	145.60	182.20	36.60	0.12	0.00	0.00	166.41	166.53	67.07	20.31	16.30	0.33	0.00	166.86	203.46
		11-20	67.91	67.32	182.20	176.40	-5.80		0.00	0.00	1206.01	1206.01	67.62	21.65	6.00	0.13	0.00	1206.14	1200.34
		21-31	67.32	70 65	176.40	245.50	69.10	0.70	0.00	0.00	187.49	188.19	68.99	24.48	16.20	0.40	0.00	188.59	257.69
	Aug	1-10	70.65	72.68	245.50	300.40	54.90	0.00	0.00	0.00	109.65	109.65	71.67	29.62	12.40	0.37	0.00	110.02	164.92
		11-20	72.68	76.16	300.40	414.40	114.00	0.00	0.02	0.00	91.51	91.53	74.42	35.32	10.90	0.38	0.00	91.91	103.30
		21-30	76.16	76.35	414.40	422.00	7.60	0.00	0.01	0.00	203.95	203.96	76.26	39.15	17.60	0.69	0.00	204.65	212.25
	Sept.	1-10	76.35	79.51	422.00	550.50	128.50	0.00	0.00	0.00	97.71	97.71	77.93	43.32	9.40	0.41	0.00	98.12	226.62
		11-20	79.51	79.68	550.50	559.00	8.50	0.00	0.00	0.00	166.15	166.15	79.60	47.48	18.00	0.85	0.00	167.00	175.50
		21-31	79.68	79.51	559.00	550.50	-8.50	0.00	0.00	0.00	718.99	718.99	79.60	47.48	8.70	0.41	0.00	719.40	710.90
	Oct.	1-10	79.51	79.74	550.50	561.60	11.10	0.00	0.00	0.00	163.44	163.44	79.63	47.56	41.20	1.96	0.00	165.40	176.50
		11-20	79.74	79.81	561.60	564.40	2.80	0.00	0.00	0.00	105.26	105.26	79.78	47.94	26.20	1.26	0.00	106.52	109.32
		21-30	79.81	79.84	564.40	565.60	1.20	0.00	0.00	0.00	120.76	120.76	79.83	48.09	39.10	1.88	0.00	122.64	123.84
	Nov.	1-10	79.84	79.75	565.60	562.00	-3.60	0.86	0.00	0.00	58.20	59.06	79.80	48.01	40.60	1.95	0.00	61.01	57.41
		11-20	79.75	79.75	562.00	561.20	-0.80	0.50	0.00	0.00	25.35	25.85	79.75	47.85	42.80	2.05	0.00	27.90	27.10
		21-31	79.75	79.62	561.20	556.00	-5.20	6.64	0.13	0.00	0.00	6.77	79.69	47.68	33.90	1.62	0.00	8.39	3.19
	Dec.	1-10	79.62	79.56	556.00	553.00	-3.00	1.99	0.19	0.00	0.00	2.17	79.59	47.47	39.80	1.89	0.00	4.06	1.06
		11-20	79.56	79.39	553.00	544.60	-8.40	6.44	0.24	0.00	0.00	6.68	79.48	47.19	38.50	1.82	0.00	8.49	0.14
		21-31	79.39	79.22	544.60	537.80	-6.80	6.38	0.09	0.00	0.00	6.45	79.31	46.76	48.20	2.25	0.00	8.71	1.91
1994	Jan.	1-10	79.22	78.99	537.80	527.60	-10.20	8.58	0.03	0.00	0.00	8.61	79.11	46.26	42.00	1.94	0.00	10.55	0.60
		11-20	78.99	78.90	527.60	524.00	-3.60	3.09	0.07	0.00	0.00	3.17	78.95	45.86	26.40	1.21	0.00	4.38	0.78
		21-28	78.90	78.57	524.00	510.80	-13.20	10.40	0.33	0.00	0.00	10.73	78.74	45.34	43.70	1.98	0.49	13.20	0.00
	Feb.	1-10	78.57	78.44	510.80	505.60	-5.20	3.80	0.04	0.00	0.00	3.83	78.51	44.76	38.30	1.71	0.00	5.55	0.35
		11-20	78.44	78.24	505.60	495.40	-10.20	4.65	0.15	0.00	0.00	4.80	78.34	44.35	42.30	1.88	3.53	10.20	0.00
		21-31	78.24	77.95	495.40	486.00	-9.40	9.67	0.30	0.00	0.00	9.96	78.10	43.74	37.50	1.64	0.00	11.60	2.20
	March	1-10	77.95	77.71	486.00	475.40	-10.60	4.28	0.07	0.00	0.00	4.36	77.83	43.08	53.40	2.30	3.94	10.60	0.00
		11-20	77.71	77.34	475.40	460.60	-14.80	12.12	0.36	0.00	0.00	12.47	77.53	42.31	57.90	2.45	0.00	14.92	0.12
		21-30	77.34	77.08	460.60	450.20	-10.40	5.94	0.14	0.00	0.00	6.07	77.21	41.52	69.00	2.86	1.46	10.40	0.00
	April	1-10	77.08	76.66	450.20	433.80	-16.40	12.48	0.41	0.00	0.00	12.89	76.87	40.67	65.40	2.66	0.85	16.40	0.00
		11-20	76.66	76.42	433.80	424.80	-9.00	4.90	0.16	0.00	0.00	5.05	76.54	39.85	66.40	2.65	1.30	9.00	0.00
		21-31	76.42	75.91	424.80	404.30	-20.50	14.01	0.27	0.00	0.00	14.28	76.17	38.98	66.00	2.57	3.65	20.50	0.00
	May	1-10	75.91	75.55	404.30	392.50	-11.80	10.76	0.12	0.00	0.00	10.88	75.73	38.05	66.60	2.54	0.00	13.43	1.63
		11-20	75.55	70.29	392.50	235.80	-156.70	13.95	0.36	0.00	124.97	139.28	72.92	32.18	66.30	2.13	15.29	156.70	0.00
		21-30	70.29	65.65	235.80	135.00	-100.80	11.99	0.40	0.00	106.14	118.53	67.97	22.23	66.10	1.47	0.00	119.99	19.42

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1994	June	1-10	65.65	64.83	135.00	118.60	-16.40	13.09	0.36	0.00	0.00	13.45	65.24	17.07	59.70	1.02	1.93	16.40	0.00
		11-20	64.83	65.57	118.60	113.40	-5.20	1.47	0.07	0.00	198.30	199.84	65.20	16.99	15.20	0.26	0.00	200.10	194.90
		21-31	65.57	68.30	113.40	191.00	77.60	0.00	0.00	0.00	451.52	451.52	66.94	20.16	3.90	0.08	0.00	451.60	529.20
	July	1-10	68.30	67.28	191.00	196.40	5.40	0.00	0.00	0.00	369.81	369.81	67.79	21.68	8.20	0.18	0.00	369.99	348.39
		11-20	67.28	72.77	196.40	303.10	106.70	0.00	0.00	0.00	1284.73	1284.73	70.03	26.27	3.30	0.09	0.00	1284.82	1418.52
		21-31	72.77	73.16	303.10	314.80	11.70	0.00	0.00	0.00	639.80	639.80	72.97	32.30	5.70	0.18	0.00	639.98	651.68
	Aug	1-10	73.16	74.10	314.80	345.00	30.20	0.00	0.00	0.00	138.50	138.50	73.63	33.66	6.60	0.22	0.00	138.72	168.92
		11-20	74.10	74.03	345.00	342.90	-2.10	0.00	0.00	0.00	339.48	339.48	74.07	34.53	6.60	0.23	0.00	339.71	337.61
		21-30	74.03	74.54	342.90	359.20	16.30	0.00	0.00	0.00	801.92	801.92	74.29	34.93	3.30	0.12	0.00	802.04	818.34
	Sept.	1-10	74.54	76.94	359.20	444.60	85.40	0.00	0.00	0.00	593.28	593.28	75.74	38.13	4.50	0.17	0.00	593.45	678.85
		11-20	76.94	78.78	444.60	523.20	78.60	0.00	0.00	0.00	130.02	130.02	77.86	43.27	18.40	0.80	0.00	130.82	209.42
		21-31	78.78	79.46	523.20	548.00	24.80	0.00	0.00	0.00	27.27	27.27	79.12	46.42	30.30	1.78	0.00	29.05	53.85
	Oct.	1-10	79.46	79.69	548.00	559.50	11.50	1.13	0.16	0.00	0.00	1.29	79.58	47.44	46.20	2.19	0.00	3.48	14.98
		11-20	79.69	79.74	559.50	561.60	2.10	4.71	0.07	0.00	0.00	4.78	79.72	47.79	16.10	0.77	0.00	5.55	9.08
		21-30	79.74	79.60	561.60	559.50	-2.10	8.69	0.22	0.00	0.00	8.90	79.67	47.79	52.00	2.49	0.00	11.39	9.29
	Nov.	1-10	79.60	79.59	559.50	554.50	-5.00	4.90	0.12	0.00	0.00	5.01	79.60	47.80	54.10	2.58	0.00	7.59	2.59
		11-20	79.59	79.41	554.50	545.50	-9.00	11.87	0.20	0.00	0.00	12.08	79.50	47.25	53.70	2.54	0.00	14.61	5.61
		21-31	79.41	79.24	545.50	538.60	-6.90	8.20	0.29	0.00	0.00	8.49	79.33	46.81	43.90	2.05	0.00	10.55	3.65
	Dec.	1-10	79.24	79.06	538.60	531.00	-7.60	7.47	0.15	0.00	0.00	7.61	79.15	46.37	47.60	2.21	0.00	9.82	2.22
		11-20	79.06	78.91	531.00	524.40	-6.60	5.77	0.17	0.00	0.00	5.95	79.49	45.96	45.00	2.07	0.00	8.01	0.00
		21-31	78.91	79.74	524.40	517.60	-6.80	5.75	0.17	0.00	0.00	5.93	79.83	45.56	55.30	2.52	0.00	8.45	1.64
1995	Jan.	1-10	79.74	78.47	517.60	506.80	-10.80	9.73	0.29	0.00	0.00	10.02	79.11	45.01	36.60	1.65	0.00	11.67	0.87
		11-20	78.47	78.35	506.80	502.00	-4.80	4.77	0.06	0.00	0.00	4.83	78.41	44.53	44.00	1.96	0.00	6.79	1.99
		21-28	78.35	79.06	502.00	409.00	-93.00	9.18	0.26	0.00	0.00	9.44	78.71	44.00	49.40	2.17	0.00	11.61	0.00
	Feb.	1-10	79.06	77.94	409.00	485.60	76.60	4.20	0.06	0.00	0.00	4.26	78.50	43.49	53.70	2.34	0.00	6.59	2.19
		11-20	77.94	77.78	485.60	478.80	-6.80	4.59	0.12	0.00	0.00	4.71	77.86	43.15	52.20	2.25	0.00	6.96	0.16
		21-31	77.78	77.44	478.80	464.20	-14.60	9.79	0.20	0.00	0.00	9.99	77.61	42.52	43.20	1.84	0.00	11.83	0.00
	March	1-10	77.44	77.25	464.20	457.00	-7.20	6.06	0.09	0.00	0.00	6.14	77.35	41.86	49.60	2.08	0.00	8.22	1.02
		11-20	77.25	76.87	457.00	441.50	-15.50	12.73	0.23	0.00	0.00	12.96	77.06	41.15	56.00	2.30	0.00	15.26	0.00
		21-30	76.87	76.74	441.50	436.20	-5.30	2.75	0.00	0.00	0.00	2.75	76.81	40.51	60.90	2.47	0.00	5.22	0.00
	April	1-10	76.74	76.37	436.20	422.60	-13.60	10.01	0.23	0.00	0.00	10.24	76.56	39.82	59.80	2.38	0.00	12.62	0.00
		11-20	76.37	75.94	422.60	405.20	-17.60	13.71	0.20	0.37	0.00	14.27	76.16	39.06	55.00	2.14	0.00	16.41	0.00
		21-31	75.94	75.47	405.20	389.80	-15.40	12.58	0.09	0.61	0.00	13.28	75.71	37.98	58.00	2.13	0.00	15.41	0.01
	May	1-10	75.47	74.99	389.80	373.70	-16.10	13.29	0.29	0.61	0.00	14.19	75.23	36.93	60.20	2.22	0.00	16.41	0.08
		11-20	74.99	66.44	373.70	150.80	-222.90	14.19	0.23	0.22	213.75	228.39	70.72	27.61	53.80	1.50	0.00	229.89	6.99
		21-30	66.44	65.13	150.80	125.60	-25.20	16.33	0.00	1.73	5.87	23.93	65.79	18.07	61.50	1.11	0.00	25.04	0.00

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation on depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1995	June	1-10	65.13	64.07	125.60	106.40	-19.20	13.12	0.00	0.00	0.00	13.12	64.60	15.97	62.40	1.00	0.00	14.12	0.00
		11-20	64.07	63.59	106.40	97.80	-8.60	8.40	0.00	0.00	0.00	8.40	63.83	14.67	50.20	0.74	0.00	9.13	0.53
		21-31	63.59	62.72	97.80	83.20	-14.60	9.72	0.05	0.00	0.00	9.77	63.16	13.72	46.50	0.64	0.00	10.40	0.00
	July	1-10	62.72	62.05	83.20	72.50	-10.70	10.16	0.17	0.00	0.00	10.32	62.39	12.57	35.90	0.45	0.00	10.78	0.08
		11-20	62.05	68.65	72.50	198.50	126.00	2.39	0.00	0.00	133.69	136.08	65.35	17.68	6.30	0.11	0.00	136.19	262.19
		21-31	68.65	72.60	198.50	298.00	99.50	0.00	0.00	0.00	437.35	437.35	70.63	27.19	7.40	0.20	0.00	437.55	537.05
	Aug	1-10	72.60	73.00	298.00	310.00	12.00	0.00	0.00	0.00	227.82	227.82	72.80	32.00	11.90	0.38	0.00	228.20	240.20
		11-20	73.00	74.30	310.00	351.00	41.00	0.00	0.00	0.00	14.85	14.85	73.65	33.70	26.80	0.90	0.00	15.75	56.75
		21-30	74.30	76.80	351.00	438.00	87.00	2.20	0.00	0.00	0.00	2.20	75.55	37.75	22.00	0.83	0.00	3.03	90.03
	Sept.	1-10	76.80	77.25	438.00	457.00	19.00	0.00	0.00	0.00	311.57	311.57	77.03	41.07	40.80	1.68	0.00	313.25	332.24
		11-20	77.25	78.50	457.00	508.00	51.00	2.20	0.03	0.00	52.79	55.02	77.88	43.19	35.20	1.52	0.00	56.54	107.54
		21-31	78.50	78.75	508.00	518.00	10.00	11.50	0.17	0.00	6.15	17.82	78.63	45.07	23.40	1.05	0.00	18.88	28.88
	Oct.	1-10	78.75	79.15	518.00	535.00	17.00	3.42	0.00	0.00	0.00	3.42	78.95	45.88	39.90	1.83	0.00	5.25	22.37
		11-20	79.15	79.35	535.00	543.00	8.00	13.24	0.24	0.00	0.00	13.48	79.25	46.63	36.50	1.70	0.00	15.18	23.18
		21-30	79.35	79.55	543.00	552.50	9.50	0.00	0.29	0.00	0.00	0.29	79.45	47.09	50.70	2.39	0.00	2.68	11.89
	Nov.	1-10	79.55	79.10	552.50	533.00	-19.50	15.64	0.15	0.00	0.00	15.98	79.33	46.82	35.70	1.67	1.67	19.32	0.00
		11-20	79.10	78.95	533.00	526.00	-7.00	9.42	0.22	0.00	0.00	9.64	79.03	46.07	39.10	1.80	0.00	11.45	4.37
		21-31	78.95	78.75	526.00	518.00	-8.00	8.82	0.33	0.00	0.00	9.16	78.85	45.63	35.90	1.64	0.00	10.79	2.68
	Dec.	1-10	78.75	78.45	518.00	506.00	-12.00	14.32	0.03	0.00	0.00	14.35	78.60	45.01	36.20	1.63	0.00	15.98	4.28
		11-20	78.45	78.45	506.00	506.00	0.00	0.56	0.32	0.00	0.00	0.88	78.45	44.63	39.30	1.75	0.00	2.64	2.35
		21-31	78.45	79.95	506.00	486.00	-20.00	15.07	0.09	0.00	0.00	15.16	79.20	44.01	41.20	1.81	2.79	19.77	0.00
1996	Jan.	1-10	79.95	77.80	486.00	480.00	-6.00	6.24	0.15	0.00	0.00	6.39	78.88	43.19	37.60	1.62	0.00	8.01	1.95
		11-20	77.80	77.60	480.00	470.00	-10.00	6.36	0.32	0.00	0.00	6.68	77.70	42.75	37.50	1.60	1.89	10.17	0.00
		21-28	77.60	77.15	470.00	453.00	-17.00	17.13	0.00	0.00	0.00	17.13	77.38	41.94	43.20	1.81	0.00	18.94	2.26
	Feb.	1-10	77.15	77.05	453.00	449.00	-4.00	3.18	0.46	0.00	0.00	3.64	77.10	41.26	41.30	1.70	0.00	5.34	0.88
		11-20	77.05	76.85	449.00	440.50	-8.50	6.00	0.26	0.00	0.00	6.26	76.95	40.88	45.70	1.87	0.49	8.62	0.00
		21-31	76.85	76.35	440.50	422.00	-18.50	15.76	0.12	0.00	0.00	15.88	76.60	40.01	40.80	1.63	0.85	18.36	0.00
	March	1-10	76.35	76.20	422.00	416.00	-6.00	7.24	0.00	0.00	0.00	7.24	76.28	39.19	54.80	2.15	0.00	9.39	3.51
		11-20	76.20	75.95	416.00	405.00	-11.00	7.34	0.29	0.00	0.00	7.63	76.08	38.75	52.30	2.03	1.13	10.79	0.00
		21-30	75.95	75.25	405.00	382.00	-23.00	20.32	0.23	0.00	0.00	20.55	75.60	37.75	66.20	2.50	0.40	23.45	0.00
	April	1-10	75.25	74.85	382.00	369.00	-13.00	14.81	0.00	0.00	0.00	14.81	75.05	36.55	84.60	2.36	0.00	17.17	4.40
		11-20	74.85	74.55	369.00	359.50	-9.50	5.14	0.17	0.00	0.00	5.31	74.70	35.77	57.80	2.07	2.30	9.67	0.00
		21-31	74.55	73.90	359.50	338.00	-21.50	18.35	0.20	0.00	0.00	18.55	74.23	34.82	61.90	2.16	0.82	21.53	0.00
	May	1-10	73.90	73.50	338.00	325.00	-13.00	11.75	0.00	0.00	0.00	11.75	73.70	33.80	64.10	2.17	0.00	13.91	1.11
		11-20	73.50	73.30	325.00	319.00	-6.00	5.38	0.00	0.00	0.00	5.38	73.40	33.20	61.30	2.04	0.00	7.42	1.42
		21-30	73.30	72.65	319.00	299.50	-19.50	19.32	0.32	0.00	0.00	19.64	72.98	32.34	67.20	2.17	0.00	21.82	2.33

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation on depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1996	June	1-10	72.65	72.15	289.50	285.50	-14.00	17.99	0.61	0.00	0.00	18.60	72.40	31.20	62.20	1.94	2.35	22.89	8.85
		11-20	72.15	69.75	285.50	222.00	-63.50	10.65	0.37	0.00	107.81	118.82	70.95	28.27	24.70	0.70	0.03	119.55	56.05
		21-31	69.75	68.15	222.00	144.50	-77.50	7.83	0.00	0.00	127.25	135.08	67.95	21.77	26.20	0.57	0.02	135.67	58.17
	July	1-10	68.15	65.90	144.50	140.00	-4.50	9.79	0.31	0.00	32.60	42.70	66.03	18.40	26.00	0.48	0.01	43.18	38.68
		11-20	65.90	68.80	140.00	157.00	17.00	9.10	0.61	0.00	0.00	9.71	67.35	19.00	14.10	0.27	0.01	9.99	26.99
		21-31	68.80	73.40	157.00	322.00	165.00	0.00	0.00	0.00	383.24	383.24	71.10	7.00	3.00	0.02	0.01	383.27	548.33
	Aug	1-10	73.40	74.55	322.00	359.50	37.50	0.00	0.00	0.00	417.69	417.69	73.98	26.25	5.90	0.15	0.02	417.87	455.41
		11-20	74.55	74.50	359.50	358.00	-1.50	0.00	0.00	0.00	267.62	267.62	74.53	34.30	8.00	0.27	0.01	267.90	266.40
		21-30	74.50	76.70	358.00	435.00	77.00	0.00	0.00	0.00	367.56	367.56	75.60	35.38	11.10	0.39	0.01	367.96	444.99
	Sept.	1-10	76.70	78.35	435.00	502.00	67.00	0.00	0.00	0.00	383.84	383.84	77.53	37.80	14.50	0.55	0.02	384.41	451.47
		11-20	78.35	78.65	502.00	514.00	12.00	0.00	0.00	0.00	188.67	188.67	78.50	42.31	21.70	0.92	0.02	189.61	201.66
		21-31	78.65	79.70	514.00	560.00	46.00	0.00	0.00	0.00	0.00	0.00	79.18	44.75	34.00	1.52	0.02	1.54	47.60
	Oct.	1-10	79.70	79.50	560.00	550.00	-10.00	0.29	0.49	0.00	74.00	74.78	79.60	46.44	27.30	1.27	0.02	76.07	66.09
		11-20	79.50	79.70	550.00	560.00	10.00	0.88	0.12	0.00	0.00	1.00	79.60	47.50	43.90	2.09	0.02	3.11	13.11
		21-30	79.70	79.55	560.00	552.00	-8.00	0.00	0.00	0.00	142.60	142.60	79.63	47.50	49.50	2.35	0.02	144.97	137.48
	Nov.	1-10	79.55	79.55	552.00	552.00	0.00	4.65	0.00	0.00	0.00	4.65	79.55	47.56	38.40	1.83	1.90	8.38	8.37
		11-20	79.55	79.35	552.00	543.00	-9.00	8.57	0.06	0.00	0.00	8.63	79.45	47.38	37.70	1.79	3.87	14.28	4.77
		21-31	79.35	79.10	543.00	533.00	-10.00	7.47	0.61	0.00	0.00	8.08	79.23	14.13	38.20	0.54	4.45	13.07	4.31
	Dec.	1-10	79.10	78.45	533.00	522.00	-11.00	13.03	0.61	0.00	0.00	13.64	78.78	46.56	32.70	1.52	3.34	18.51	7.49
		11-20	78.45	78.60	522.00	512.00	-10.00	9.54	0.43	0.00	0.00	9.97	78.53	45.94	37.70	1.73	2.52	14.22	4.20
		21-31	78.60	78.60	512.00	512.00	0.00	0.00	0.00	0.00	0.00	0.00	78.60	45.31	47.50	2.15	0.02	2.17	2.16
1997	Jan.	1-10	78.60	78.30	512.00	500.00	-12.00	12.42	0.25	0.00	0.00	12.66	78.45	45.00	35.20	1.58	2.06	16.30	4.30
		11-20	78.30	78.00	500.00	488.00	-12.00	12.31	0.49	0.00	0.00	12.80	78.15	44.62	40.30	1.80	4.14	18.74	6.71
		21-28	78.00	77.75	488.00	477.00	-11.00	6.63	0.54	0.00	0.00	7.17	77.88	43.87	48.30	2.12	6.60	15.89	4.86
	Feb.	1-10	77.75	77.60	477.00	470.00	-7.00	4.11	0.00	0.00	0.00	4.11	77.68	43.19	40.20	1.74	4.38	10.23	3.21
		11-20	77.60	77.45	470.00	464.50	-5.50	7.27	0.10	0.00	0.00	7.36	77.53	42.69	47.00	2.01	2.28	11.65	6.67
		21-31	77.45	77.20	464.50	455.00	-9.50	9.83	0.19	0.00	0.00	10.02	77.33	42.31	43.00	1.82	2.22	14.06	4.54
	March	1-10	77.20	76.75	455.00	436.50	-18.50	15.59	0.24	0.00	0.00	15.83	76.98	41.81	52.00	2.17	4.75	22.75	4.21
		11-20	76.75	77.65	436.50	433.50	-3.00	2.20	0.24	0.00	0.00	2.44	77.20	40.94	50.00	2.05	1.10	5.59	2.55
		21-30	77.65	76.30	433.50	420.00	-13.50	13.10	0.12	0.00	0.00	13.22	76.98	40.25	52.00	2.09	1.18	16.48	2.95
	April	1-10	76.30	75.75	420.00	398.50	-21.50	18.36	0.49	0.00	0.00	18.85	76.03	39.69	50.70	2.01	2.90	23.76	2.21
		11-20	75.75	75.35	398.50	385.50	-13.00	8.45	0.20	0.00	0.00	8.64	75.55	38.67	60.00	2.32	4.25	15.21	2.15
		21-31	75.35	74.95	385.50	372.50	-13.00	15.74	0.44	0.00	0.00	16.18	75.15	37.65	55.70	2.10	0.02	18.30	5.25
	May	1-10	74.95	74.20	372.50	384.00	11.50	18.35	0.49	0.00	0.00	18.84	74.58	35.55	57.90	2.06	4.13	25.03	0.53
		11-20	74.20	65.95	384.00	141.00	-243.00	12.60	0.49	0.00	245.70	258.79	70.08	26.55	54.70	1.45	0.94	261.19	54.19
		21-30	65.95	65.83	141.00	138.60	-2.40	1.84	0.54	0.00	2.73	5.10	65.89	18.18	69.50	1.26	0.02	6.39	3.92

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporati on depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beg nning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1997	June	1-10	65.83	65.25	138.60	126.00	-10.60	10.40	0.49	0.00	0.00	10.89	65.54	17.58	40.90	0.72	0.03	11.64	2.02
		11-20	65.25	64.80	126.00	118.00	-10.00	11.92	0.39	0.00	0.00	12.31	65.03	16.70	28.00	0.47	0.01	12.79	5.16
		21-30	64.8	66.15	118.00	144.50	26.50	0.86	0.00	0.00	25.56	26.42	65.46	17.46	13.10	0.23	0.00	26.65	53.15
	July	1-10	66.15	66.40	144.50	150.00	5.50	6.00	0.42	0.00	82.28	88.70	66.26	18.91	17.10	0.32	0.01	89.03	94.75
		11-20	66.4	65.95	150.00	141.00	-9.00	6.76	0.27	0.00	51.93	58.96	66.18	18.75	16.90	0.32	0.01	59.28	50.28
		21-31	65.95	73.10	141.00	313.00	172.00	8.32	0.31	0.00	512.83	521.46	69.53	25.45	12.40	0.32	0.00	521.78	693.78
	Aug	1-10	73.1	73.10	313.00	293.00	-20.00	0.00	0.00	0.00	578.61	578.61	73.10	31.90	11.20	0.36	0.00	578.97	558.98
		11-20	73.1	75.95	293.00	395.00	102.00	1.70	0.37	0.00	68.16	70.23	74.53	34.85	15.10	0.53	0.01	70.77	173.28
		21-30	75.95	75.85	395.00	402.00	7.00	1.42	0.27	0.00	767.52	769.21	75.90	38.40	12.60	0.48	0.01	769.70	776.22
	Sept.	1-10	75.85	74.90	402.00	371.00	-31.00	0.73	0.00	0.00	121.43	122.16	75.38	37.25	24.70	0.92	0.02	123.10	92.08
		11-20	74.9	75.75	371.00	398.50	27.50	1.18	0.41	0.00	0.00	1.59	75.33	37.15	24.10	0.90	0.02	2.50	30.00
		21-30	75.75	77.75	398.50	477.00	78.50	0.41	0.28	0.00	0.00	0.68	76.75	40.48	22.20	0.90	0.02	1.60	80.10
	Oct.	1-10	77.75	78.45	477.00	506.00	29.00	1.29	0.00	0.00	0.00	1.29	78.10	43.74	38.70	1.69	0.07	3.05	32.00
		11-20	78.45	78.70	506.00	516.00	10.00	2.17	0.22	0.00	0.00	2.39	78.58	44.93	34.30	1.64	0.05	3.98	12.49
		21-31	78.7	78.70	516.00	516.00	0.00	8.94	0.37	0.00	0.00	9.31	78.70	45.25	46.60	2.11	0.10	11.52	9.42
	Nov.	1-10	78.7	78.78	516.00	518.00	2.00	3.83	0.13	0.00	0.00	3.96	78.74	45.31	41.60	1.88	0.06	5.93	8.49
		11-20	78.78	78.50	518.00	508.00	-10.00	15.71	0.49	0.00	0.00	16.20	78.64	45.06	33.80	1.52	0.05	17.77	9.53
		21-30	78.5	78.50	508.00	508.00	0.00	3.41	0.08	0.00	0.00	3.50	78.50	44.75	29.10	1.30	0.04	4.84	7.45
	Dec.	1-10	78.5	78.30	508.00	500.00	-8.00	11.54	0.00	0.00	0.00	11.54	78.40	44.50	28.40	1.26	0.04	12.84	6.37
		11-20	78.3	78.00	500.00	488.00	-12.00	12.76	0.00	0.00	0.00	12.76	78.15	43.87	28.30	1.24	0.04	14.03	4.17
		21-30	78	77.90	488.00	484.00	-4.00	2.76	0.00	0.00	0.00	2.76	77.95	73.87	30.30	2.24	0.07	5.07	1.86
1998	Jan.	1-10	77.9	77.45	484.00	464.50	-19.50	15.79	0.17	0.00	0.00	15.96	77.68	42.68	36.80	1.57	0.06	17.59	1.76
		11-20	77.454	77.40	464.50	463.00	-1.50	3.86	0.10	0.00	0.00	3.95	77.43	42.06	34.50	1.45	0.05	5.45	3.29
		21-31	77.4	76.90	463.00	443.00	-20.00	16:29	0.00	0.00	0.00	16.29	77.15	41.37	41.10	1.70	0.07	18.06	3.20
	Feb.	1-10	76.9	76.65	443.00	433.50	-9.50	7.78	0.27	0.00	0.00	8.04	76.78	40.43	51.20	2.07	0.11	10.22	5.09
		11-20	76.65	76.45	433.50	426.00	-7.50	6.21	0.34	0.00	0.00	6.55	76.55	39.87	47.60	1.90	0.09	8.54	1.54
		21-30	76.45	76.10	426.00	412.00	-14.00	9.75	0.00	0.00	0.00	9.75	76.28	39.21	38.20	1.50	0.06	11.30	0.92
	March	1-10	76.1	75.70	412.00	397.00	-15.00	11.83	0.21	0.00	0.00	12.04	75.90	38.40	58.70	2.25	0.13	14.43	3.91
		11-20	75.7	75.25	397.00	382.00	-15.00	15.96	0.12	0.00	0.00	16.07	75.48	37.50	60.90	2.28	0.14	18.50	4.88
		21-30	75.25	74.80	382.00	367.00	-15.00	11.15	0.38	0.00	0.00	11.52	75.03	36.50	81.50	2.97	0.24	14.74	3.60
	April	1-10	74.8	74.45	367.00	357.00	-10.00	9.63	0.00	0.00	0.00	9.63	74.63	35.63	76.90	2.74	0.21	12.58	4.65
		11-20	74.45	73.75	357.00	332.00	-25.00	18.21	0.12	0.00	0.00	18.34	74.10	34.58	65.90	2.28	0.15	20.76	3.81
		21-31	73.75	73.25	332.00	317.50	-14.50	15.26	0.49	0.00	0.00	15.75	73.50	33.40	64.60	2.16	0.14	18.04	4.36
	May	1-10	73.25	72.90	317.50	307.00	-10.50	9.54	0.10	0.00	0.00	9.64	73.08	32.52	69.90	2.27	0.16	12.07	3.21
		11-20	72.90	72.20	307.00	287.00	-20.00	18.35	0.37	0.00	0.00	18.72	72.55	31.42	69.80	2.19	0.15	21.07	4.55
		21-30	72.20	71.45	287.00	265.00	-22.00	17.76	0.54	0.00	0.00	18.30	71.83	30.00	78.50	2.36	0.18	20.84	3.70

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level at beginning of period	Reservoir level at end of period	Reservoir capacity at beginning	Reservoir capacity at end	Reservoir capacity Difference Col. 7 - Col. 6	Water Released through RBHR	LBHR	BPO	Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1986	June	1-10	71.45	71.05	265.00	255.00	-10.00	11.89	0.49	0.00	0.00	12.38	71.25	28,920	54.50	1.58	0.09	14.05	5.60
		11-20	71.05	67.40	255.00	172.00	-83.00	7.83	0.39	0.00	117.67	125.89	69.23	24,720	40.00	0.99	0.04	126.92	43.89
		21-30	67.4	65.95	172.00	141.00	-31.00	7.37	0.49	0.00	61.12	68.98	66.68	19,600	38.10	0.75	0.03	69.75	38.73
	July	1-10	65.95	66.75	141.00	156.50	15.50	0.69	0.10	0.00	261.13	261.91	66.35	19,000	11.10	0.21	0.00	262.13	277.64
		11-20	66.75	66.50	156.50	152.00	-4.50	2.20	0.49	0.00	164.64	167.33	66.63	19,500	20.50	0.40	0.01	167.74	163.15
		21-31	66.5	68.80	152.00	202.00	50.00	13.22	0.54	0.00	4.18	17.94	67.65	21,450	14.00	0.30	0.00	18.24	68.25
	Aug	1-10	68.8	74.50	202.00	358.00	156.00	0.00	0.47	0.00	56.30	56.77	71.65	29,470	11.90	0.35	0.00	57.12	213.14
		11-20	74.5	75.85	358.00	402.00	44.00	1.59	0.00	0.00	161.18	162.77	75.18	36,820	20.70	0.76	0.02	163.55	207.55
		21-30	75.85	78.10	402.00	492.00	90.00	9.47	0.00	0.00	77.60	87.07	76.98	41,020	25.80	1.06	0.03	88.16	177.61
	Sept.	1-10	78.1	78.30	492.00	500.00	8.00	0.00	0.00	0.00	305.35	305.35	78.20	44,000	19.10	0.84	0.02	306.21	314.21
		11-20	78.3	78.40	500.00	504.00	4.00	0.00	0.00	0.00	889.58	889.58	78.35	44,370	17.10	0.76	0.01	890.35	894.36
		21-30	78.4	79.30	504.00	541.00	37.00	0.00	0.00	0.00	108.25	108.25	78.85	45,620	30.90	1.41	0.04	109.70	146.68
	Oct.	1-10	79.3	79.85	541.00	566.00	25.00	0.00	0.00	0.00	87.14	87.14	79.58	47,460	37.20	1.77	0.07	88.97	113.92
		11-20	79.85	79.55	566.00	552.50	-13.50	0.00	0.00	0.00	104.04	104.04	79.70	47,770	38.90	1.86	0.07	105.97	92.42
		21-31	79.55	79.90	552.50	568.00	15.50	0.00	0.00	0.00	0.00	0.00	79.73	47,870	36.10	1.73	0.06	1.79	17.25
	Nov.	1-10	79.9	79.85	568.00	566.00	-2.00	0.00	0.00	0.00	28.11	28.11	79.88	48,270	34.10	1.65	0.06	29.81	27.76
		11-20	79.85	79.70	566.00	560.00	-6.00	2.94	0.00	0.00	13.22	16.16	79.78	47,960	37.00	1.77	0.07	18.00	13.68
		21-30	79.7	79.60	560.00	555.00	-5.00	6.71	0.32	0.00	0.00	7.04	79.65	47,620	46.00	2.19	0.10	9.33	7.09
	Dec.	1-10	79.6	79.53	555.00	552.50	-2.50	2.75	0.49	0.00	0.00	3.24	79.57	47,430	44.10	2.09	0.09	5.43	2.86
		11-20	79.53	79.10	552.50	533.00	-19.50	14.97	0.20	0.00	0.00	15.16	79.32	46,810	61.30	2.87	0.18	18.21	5.43
		21-30	79.1	78.85	533.00	522.00	-11.00	8.14	0.51	0.00	0.00	8.64	78.98	45,930	39.80	1.83	0.07	10.54	3.98
1999	Jan.	1-10	78.85	78.60	522.00	512.00	-10.00	6.34	0.49	0.00	0.00	6.83	78.73	45,310	40.30	1.83	0.07	8.73	1.98
		11-20	78.6	78.20	512.00	496.00	-16.00	16.15	0.49	0.00	0.00	16.64	78.40	44,500	45.90	2.04	0.09	18.78	3.71
		21-31	78.2	78.10	496.00	492.00	-4.00	1.14	0.70	0.00	0.00	1.84	78.15	43,870	52.00	2.28	0.12	4.24	2.47
	Feb.	1-10	78.1	77.65	492.00	472.50	-19.50	15.35	0.49	0.00	0.00	15.84	77.88	43,180	52.00	2.25	0.12	18.20	5.03
		11-20	77.65	77.20	472.50	455.00	-17.50	17.27	0.23	0.00	0.00	17.51	77.43	42,060	57.50	2.42	0.14	20.07	2.92
		21-30	77.2	77.10	455.00	451.00	-4.00	0.92	0.00	0.00	0.00	0.92	77.15	41,370	59.00	2.44	0.14	3.50	2.67
	March	1-10	77.1	76.85	451.00	440.00	-11.00	6.31	0.03	0.00	0.00	6.34	76.98	40,930	77.00	3.15	0.24	9.74	2.73
		11-20	76.85	76.25	440.00	418.00	-22.00	18.84	0.49	0.00	0.00	19.33	76.55	39,870	75.70	3.02	0.23	22.58	3.91
		21-30	76.25	75.95	418.00	405.50	-12.50	6.91	0.44	0.00	0.00	7.35	76.10	38,810	0.70	0.03	0.00	7.38	2.66
	April	1-10	75.95	75.60	405.50	394.00	-11.50	7.34	0.08	0.00	0.00	7.42	75.78	38,150	79.60	3.04	0.24	10.70	2.02
		11-20	75.6	74.85	394.00	369.00	-25.00	19.42	0.49	0.00	0.00	19.91	75.23	36,950	93.60	3.46	0.32	23.69	4.22
		21-31	74.85	74.40	369.00	356.00	-13.00	14.26	0.49	0.00	0.00	14.77	74.63	35,650	79.60	2.84	0.23	17.83	5.60
	May	1-10	74.4	74.00	356.00	342.00	-14.00	8.58	0.49	0.00	0.00	9.07	74.20	34,800	87.30	3.04	0.27	12.37	2.17
		11-20	74.00	70.75	342.00	248.00	-94.00	19.58	0.49	0.00	95.11	115.18	72.38	31,08	85.00	2.64	0.22	118.05	28.14
		21-30	70.75	65.70	248.00	136.00	-112.00	14.80	0.54	0.00	123.92	139.25	68.23	22.61	79.60	1.82	0.14	141.21	32.47

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm³ Col. 15x16 /1000	Other losse	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1999	June	1-10	65.7	65.25	136.00	128.00	-8.00	5.55	0.29	0.00	0.00	5.84	65.48	17.470	78.63	1.37	0.11	7.32	0.96
		11-20	65.25	64.90	128.00	120.00	-8.00	11.74	0.39	0.00	0.00	12.14	65.08	16.770	30.80	0.52	0.02	12.67	6.96
		21-30	64.9	66.10	120.00	144.00	24.00	0.21	0.00	0.00	145.75	145.96	65.50	17.500	29.70	0.52	0.02	146.50	170.50
	July	1-10	66.1	66.50	144.00	152.00	8.00	7.71	0.22	0.00	21.76	29.69	66.30	18.920	43.70	0.83	0.04	30.55	38.53
		11-20	66.5	67.85	152.00	177.00	25.00	2.89	0.17	0.00	898.00	901.06	67.08	20.380	8.90	0.18	0.00	901.24	926.26
		21-31	67.85	72.40	177.00	293.00	116.00	0.36	0.05	0.00	286.18	286.59	70.03	26.330	19.10	0.50	0.01	289.10	405.11
	Aug	1-10	72.4	74.10	293.00	345.00	52.00	1.32	0.26	0.00	235.12	236.70	73.25	32.900	12.90	0.42	0.01	237.13	289.13
		11-20	74.1	72.90	345.00	307.00	-38.00	0.00	0.00	0.00	221.04	221.04	73.50	33.370	26.70	0.89	0.02	221.95	183.95
		21-30	72.9	74.25	307.00	349.00	42.00	0.00	0.00	0.00	0.00	0.00	73.58	33.520	31.65	1.06	0.03	1.09	43.58
	Sept.	1-10	74.25	75.20	349.00	380.00	31.00	1.80	0.00	0.00	0.00	1.80	74.73	35.900	23.80	0.85	0.02	2.68	33.18
		11-20	75.2	77.65	380.00	472.50	92.50	0.00	0.00	0.00	0.00	0.00	76.43	39.760	26.10	1.04	0.03	1.06	93.60
		21-30	77.65	79.10	472.50	533.00	60.50	0.00	0.00	0.00	0.00	0.00	78.38	44.430	30.20	1.34	0.04	1.38	61.66
	Oct.	1-10	79.1	79.75	533.00	562.00	29.00	0.00	0.00	0.00	185.24	185.24	79.43	47.060	30.80	1.45	0.04	186.73	215.71
		11-20	79.75	79.55	562.00	552.00	-10.00	0.00	0.00	0.00	122.13	122.13	79.65	47.680	36.90	1.76	0.06	123.95	114.41
		21-31	79.55	79.90	552.00	568.00	16.00	3.43	0.00	0.00	10.30	13.73	79.73	47.930	52.30	2.51	0.13	16.37	31.76
	Nov.	1-10	79.9	79.60	568.00	555.00	-13.00	2.26	0.00	0.00	21.79	24.05	79.75	47.930	49.20	2.36	0.12	26.53	13.43
		11-20	79.6	79.70	555.00	560.00	5.00	1.33	0.42	0.00	0.00	1.75	79.65	47.620	50.30	2.40	0.12	4.27	9.17
		21-30	79.7	79.60	560.00	555.00	-5.00	7.33	0.28	0.00	0.00	7.61	79.65	47.620	49.40	2.35	0.12	10.06	7.29
	Dec.	1-10	79.6	79.15	555.00	535.00	-20.00	11.13	0.00	0.00	0.00	11.13	79.38	46.93	48.20	2.17	0.10	13.40	2.22
		11-20	79.15	78.90	535.00	524.00	-11.00	7.28	0.00	0.00	0.00	7.28	79.03	46.06	48.10	2.22	0.11	9.60	9.64
		21-30	78.9	78.75	524.00	518.00	-6.00	8.26	0.00	0.00	0.00	8.26	78.83	45.56	51.00	2.32	0.12	10.70	6.29
2000	Jan.	1-10	78.75	78.50	518.00	508.00	-10.00	13.94	0.00	0.00	0.00	13.94	78.63	45.06	48.20	2.17	0.10	16.22	8.13
		11-20	78.5	78.05	508.00	490.00	-18.00	14.09	0.00	0.00	0.00	14.09	78.28	44.18	46.40	2.05	0.10	16.24	1.46
		21-31	78.05	77.70	490.00	475.00	-15.00	13.88	0.01	0.00	0.00	13.69	77.88	43.18	56.30	2.43	0.14	16.25	6.07
	Feb.	1-10	77.7	78.25	475.00	457.00	-18.00	16.66	0.17	0.00	0.00	16.83	77.98	42.18	48.80	2.06	0.10	18.99	2.39
		11-20	78.25	77.20	457.00	455.00	-2.00	3.06	0.24	0.00	0.00	3.30	77.73	41.56	54.40	2.26	0.12	5.68	5.06
		21-30	77.2	76.80	455.00	438.00	-17.00	13.49	0.22	0.00	0.00	13.71	77.00	41.06	58.00	2.38	0.14	16.23	1.41
	March	1-10	76.8	76.25	438.00	418.00	-20.00	18.95	0.27	0.00	0.00	19.22	76.53	39.67	75.20	3.00	0.23	22.44	2.98
		11-20	76.25	75.60	418.00	404.00	-14.00	8.95	0.28	0.00	0.00	9.23	76.08	38.76	71.20	2.76	0.20	12.19	10.00
		21-30	75.9	75.55	404.00	392.50	-11.50	7.75	0.28	0.00	0.00	8.02	75.73	38.03	197.20	7.50	1.48	17.00	5.18
	April	1-10	75.55	75.00	392.50	374.00	-18.50	18.11	0.37	0.00	0.00	18.48	75.28	37.03	81.80	3.03	0.25	21.76	4.24
		11-20	75	74.25	374.00	349.00	-25.00	20.80	0.02	0.00	0.00	20.82	74.63	35.65	84.60	3.02	0.26	24.10	4.39
		21-31	74.25	73.60	349.00	327.00	-22.00	18.91	0.08	0.00	0.00	18.99	73.93	34.25	78.70	2.70	0.21	21.90	3.69
	May	1-10	73.6	73.25	327.00	317.00	-10.00	10.59	0.49	0.00	0.00	11.08	73.43	33.250	86.80	2.89	0.25	14.21	6.97
		11-20	73.25	73.00	317.00	310.00	-7.00	6.86	0.49	0.00	0.00	7.35	73.13	32.65	72.80	2.38	0.17	9.90	4.38
		21-30	73.00	72.55	310.00	297.00	-13.00	16.90	0.08	0.00	0.00	16.98	72.78	31.95	70.60	2.26	0.16	19.39	6.88

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2000	June	1-10	72.55	72.45	297.00	294.50	-2.50	9.23	0.00	0.00	0.00	9.23	72.50	31.40	54.10	1.70	0.09	11.02	11.17
		11-20	72.45	72.00	294.50	280.00	-14.50	5.63	0.03	0.00	13.61	19.27	72.23	30.80	51.60	1.59	0.08	20.94	11.39
		21-30	72	66.00	280.00	142.00	-138.00	16.42	0.49	0.00	172.00	188.91	69.00	24.35	51.50	1.25	0.06	190.22	52.18
	July	1-10	66	67.40	142.00	172.00	30.00	2.21	0.31	0.00	143.91	146.43	66.70	19.65	10.80	0.21	0.00	146.65	178.62
		11-20	67.4	66.85	172.00	158.50	-13.50	0.00	0.00	0.00	735.71	735.71	67.13	20.40	12.90	0.26	0.00	735.98	724.94
		21-31	66.65	68.70	158.50	200.00	41.50	8.87	0.37	0.00	52.11	61.34	67.68	21.68	57.70	1.25	0.07	62.67	105.12
	Aug	1-10	68.7	70.40	200.00	238.00	38.00	12.96	0.46	0.00	0.00	13.42	69.55	25.17	31.10	0.78	0.02	14.23	52.22
		11-20	70.4	72.70	238.00	301.00	63.00	2.17	0.00	0.00	0.00	2.17	71.55	32.32	28.65	0.93	0.03	3.12	67.59
		21-30	72.7	75.90	301.00	400.00	99.00	1.63	0.00	0.00	272.12	273.75	74.25	37.97	18.80	0.71	0.01	274.48	375.20
	Sept.	1-10	75.8	75.90	400.00	404.00	4.00	1.46	0.00	0.00	153.70	155.16	75.85	38.30	41.20	1.58	0.07	156.80	162.37
		11-20	75.9	76.50	404.00	428.00	24.00	6.92	0.18	0.00	0.00	7.10	76.20	39.07	47.90	1.87	0.09	9.06	33.58
		21-30	76.5	76.85	428.00	440.50	12.50	18.31	0.49	0.00	0.00	18.80	76.68	40.48	51.90	2.10	0.11	21.01	33.41
	Oct.	1-10	76.85	77.00	440.50	447.00	6.50	13.81	0.49	0.00	0.00	14.30	76.93	40.81	48.60	1.98	0.10	16.38	22.80
		11-20	77	77.15	447.00	453.00	6.00	14.46	0.02	0.00	0.00	14.50	77.08	41.18	43.80	1.80	0.08	16.39	22.70
		21-31	77.15	77.15	453.00	453.00	0.00	1.14	0.00	0.00	0.00	1.14	77.15	41.37	64.90	2.68	0.17	4.00	6.99
	Nov.	1-10	77.15	76.90	453.00	453.00	0.00	12.75	0.00	0.00	0.00	12.75	77.03	41.06	57.60	2.37	0.14	15.25	6.90
		11-20	76.9	76.50	443.00	428.00	-15.00	14.68	0.03	0.00	0.00	14.71	76.70	40.25	50.90	2.05	0.10	15.86	3.96
		21-30	76.5	76.10	428.00	412.00	-16.00	15.00	0.49	0.00	0.00	15.49	76.30	39.27	51.80	2.03	0.11	17.63	3.59
	Dec.	1-10	76.1	75.80	412.00	40.00	-372.00	11.86	0.49	0.00	0.00	12.35	75.95	38.50	51.40	1.98	0.10	14.43	5.40
		11-20	75.6	75.40	400.00	387.00	-13.00	14.37	0.32	0.00	0.00	14.69	75.50	37.75	41.10	1.55	0.06	16.30	3.88
		21-30	75.4	74.85	387.00	369.00	-18.00	18.71	0.54	0.00	0.00	19.25	75.13	36.70	41.40	1.52	0.06	20.83	3.13
2001	Jan.	1-10	74.85	74.40	369.00	356.00	-13.00	19.58	0.26	0.00	0.00	19.84	74.63	35.65	39.40	1.40	0.06	21.30	9.12
		11-20	74.4	74.20	356.00	348.00	-8.00	18.15	0.49	0.00	0.00	18.64	74.30	35.00	44.50	1.56	0.07	20.26	19.22
		21-31	74.2	73.85	348.00	336.00	-12.00	15.58	0.39	0.00	0.00	15.97	74.03	34.45	59.40	2.05	0.12	18.14	7.27
	Feb.	1-10	73.85	73.20	336.00	316.00	-20.00	19.58	0.26	0.00	0.00	19.84	73.53	33.45	53.40	1.79	0.10	21.72	5.72
		11-20	73.2	72.60	316.00	298.00	-18.00	18.85	0.49	0.00	0.00	19.34	72.90	32.20	62.60	2.02	0.13	21.48	5.06
		21-30	72.6	72.75	298.00	285.50	-12.50	15.58	0.39	0.00	0.00	15.97	72.68	31.10	45.00	1.40	0.06	17.44	6.22
	March	1-10	72.15	71.55	285.50	268.50	-17.00	17.82	0.33	0.00	0.00	18.14	71.85	30.05	60.60	1.82	0.11	20.07	4.60
		11-20	71.55	71.20	268.50	258.00	-10.50	8.51	0.03	0.00	0.00	8.54	71.38	29.15	69.20	2.02	0.14	10.70	4.14
		21-30	71.2	70.30	258.00	236.00	-22.00	23.06	0.31	0.00	0.00	23.37	70.75	27.75	85.10	2.36	0.20	25.94	5.39
	April	1-10	70.3	69.55	236.00	218.00	-18.00	19.58	0.36	0.00	0.00	19.94	69.93	25.85	83.20	2.15	0.18	22.27	5.96
		11-20	69.55	68.80	218.00	202.00	-16.00	18.20	0.49	0.00	0.00	18.69	69.18	24.30	88.30	2.10	0.18	20.96	6.80
		21-31	68.8	67.85	202.00	181.00	-21.00	20.71	0.26	0.00	0.00	20.98	68.33	22.68	88.10	2.00	0.18	23.15	3.17
	May	1-10	67.85	67.05	181.00	163.50	-17.50	19.70	0.00	0.00	0.00	19.70	67.45	21.02	91.40	1.92	0.18	21.80	4.88
		11-20	67.05	65.90	163.50	140.00	-23.50	20.47	0.31	0.00	0.00	20.79	66.48	19.23	87.40	1.68	0.15	22.61	3.12
		21-30	65.90	65.30	140.00	129.00	-11.00	9.53	0.00	0.00	0.00	9.53	65.60	17.70	97.40	1.72	0.17	11.42	3.18

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2001	June	1-10	65.3	64.80	129.00	118.00	-11.00	16.57	0.49	0.00	0.00	17.06	65.05	16.77	71.70	1.20	0.00	18.35	9.97
		11-20	64.8	66.35	118.00	149.00	31.00	0.81	0.13	0.00	213.27	214.20	65.58	17.66	13.50	0.24	0.00	214.44	247.59
		21-30	66.35	66.25	149.00	146.50	-2.50	4.07	0.00	0.00	76.37	80.44	66.30	18.95	43.50	0.82	0.04	81.30	80.79
	July	1-10	66.25	67.35	146.50	149.00	2.50	3.99	0.41	0.00	303.91	308.32	66.80	19.80	9.60	0.19	0.00	308.51	313.30
		11-20	67.35	67.00	149.00	162.00	13.00	0.00	0.08	0.00	308.03	308.11	67.18	20.46	14.20	0.29	0.00	308.40	324.47
		21-31	67	72.90	162.00	307.00	145.00	0.65	0.03	0.00	101.42	102.10	69.95	25.87	19.70	0.51	0.01	102.62	250.59
	Aug	1-10	72.9	73.85	307.00	340.00	33.00	1.26	0.29	0.00	167.29	168.85	73.43	33.25	11.30	0.38	0.00	169.23	202.23
		11-20	73.85	73.45	340.00	324.50	-15.50	0.31	0.00	0.00	481.00	481.31	73.70	33.80	9.10	0.31	0.00	481.62	466.38
		21-30	73.45	75.60	324.50	394.00	69.50	3.17	0.00	0.00	0.00	3.17	74.53	35.39	35.90	1.27	0.05	4.49	87.69
	Sept.	1-10	75.6	75.55	394.00	430.00	36.00	0.00	0.00	0.00	13.23	13.23	75.58	38.75	30.80	1.19	0.04	14.46	37.21
		11-20	75.55	77.60	430.00	470.00	40.00	8.89	0.23	0.00	0.00	9.12	76.58	41.19	35.70	1.47	0.05	10.64	50.61
		21-31	77.6	78.45	470.00	506.00	36.00	10.21	0.49	0.00	0.00	10.70	78.03	43.55	40.90	1.78	0.07	12.55	48.50
	Oct.	1-10	78.45	79.40	506.00	545.00	39.00	1.45	0.42	0.00	0.00	1.87	78.93	45.80	28.50	1.31	0.04	3.21	42.19
		11-20	79.4	79.00	545.00	568.00	23.00	3.78	0.00	0.00	0.00	3.78	79.20	47.62	40.90	1.95	0.08	5.80	45.38
		21-30	79	79.65	568.00	557.00	-11.00	5.98	0.07	0.00	16.68	22.73	79.33	47.94	46.40	2.22	0.10	25.05	19.90
	Nov.	1-10	79.65	79.35	557.00	543.00	-14.00	17.39	0.49	0.00	20.81	38.69	79.50	47.25	44.50	2.10	0.09	40.89	8.20
		11-20	79.35	79.35	543.00	543.00	0.00	5.64	0.16	0.00	0.00	5.80	79.35	46.87	41.80	1.96	0.08	7.84	8.43
		21-31	79.35	79.00	543.00	528.00	-15.00	16.97	0.49	0.00	0.00	17.46	79.18	46.44	44.80	2.08	0.09	19.64	5.97
	Dec.	1-10	79	78.60	528.00	512.00	-16.00	18.80	0.49	0.00	0.00	19.29	78.80	45.50	45.60	2.07	0.09	21.46	7.38
		11-20	78.6	78.30	512.00	500.00	-12.00	16.06	0.49	0.00	0.00	16.55	78.45	44.62	45.00	2.01	0.09	18.64	7.32
		21-30	78.3	77.85	500.00	482.00	-18.00	15.73	0.58	0.00	0.00	16.31	78.08	43.69	44.50	1.94	0.09	18.34	3.91
2002	Jan.	1-10	77.85	77.50	482.00	466.00	-16.00	13.01	0.61	0.00	0.00	13.62	77.68	42.69	40.90	1.75	0.07	15.44	0.54
		11-20	77.5	77.40	466.00	463.00	-3.00	2.94	0.61	0.00	0.00	3.55	77.45	42.12	45.70	1.92	0.09	5.56	2.65
		21-31	77.4	79.85	463.00	440.50	-22.50	20.19	0.67	0.00	0.00	20.86	78.63	41.30	49.50	2.04	0.10	23.00	0.81
	Feb.	1-10	79.85	76.25	440.50	418.00	-22.50	18.35	0.03	0.00	0.00	18.38	78.05	39.87	46.80	1.87	0.09	20.33	11.73
		11-20	76.25	75.75	418.00	398.50	-19.50	16.38	0.58	0.00	0.00	16.96	76.00	38.60	48.90	1.93	0.10	18.98	2.27
		21-30	75.75	75.35	398.50	385.50	-13.00	14.23	0.49	0.00	0.00	14.72	75.55	37.67	42.60	1.60	0.07	16.39	3.33
	March	1-10	75.35	74.85	385.50	369.00	-16.50	16.89	0.08	0.00	0.00	16.97	75.10	36.65	61.90	2.27	0.14	19.38	2.90
		11-20	74.85	74.30	369.00	351.00	-18.00	17.59	0.58	0.00	0.00	18.17	74.58	35.46	60.20	2.13	0.13	20.44	5.70
		21-31	74.3	73.60	351.00	334.00	-17.00	16.55	0.33	0.00	0.00	16.88	74.05	34.50	77.70	2.68	0.21	19.77	5.17
	April	1-10	73.6	73.45	334.00	324.50	-9.50	8.52	0.47	0.00	0.00	8.99	73.63	33.65	67.80	2.28	0.15	11.42	2.53
		11-20	73.45	72.80	324.50	304.00	-20.50	21.84	0.40	0.00	0.00	22.24	73.13	33.65	80.60	2.71	0.22	25.17	6.40
		21-30	72.8	72.10	304.00	284.00	-20.00	21.53	0.18	0.00	0.00	21.71	72.45	31.30	99.00	3.10	0.31	25.12	6.40
	May	1-10	72.1	71.40	284.00	263.00	-21.00	18.29	0.18	0.00	0.00	18.47	71.75	29.82	94.00	2.80	0.26	21.53	5.26
		11-20	71.40	70.65	263.00	245.50	-17.50	19.93	0.49	0.00	0.00	20.42	71.03	28.45	97.90	2.79	0.27	23.48	6.01
		21-31	70.65	69.90	245.50	226.00	-19.50	21.47	0.12	0.00	0.00	21.59	70.28	26.65	94.20	2.51	0.24	24.33	5.95

TABLE 3-1: Reservoir Operation 1987 to 2003

Year	Month	Period date	Reservoir level		Reservoir capacity		Reservoir capacity Difference Col. 7 - Col. 6	Water Released through			Spillover Quantity through (M.Cum.)	Total releases (M.cum)	Average reservoir level during period (m) (Col. 4+5)	Average reservoir area corresponding to Ave. level	Evaporation depth in mm.	Evaporation losses Mm^3 Col. 15x16 /1000	Other losses	Total Outflow	In flow
			at beginning of period	at end of period	at beginning	at end		RBHR	LBHR	BPO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2002	June	1-10	69.9	69.25	226.00	211.50	-14.50	16.04	0.27	0.00	0.00	16.31	69.58	25.05	92.60	2.32	0.22	20.85	6.15
		11-20	69.25	68.60	211.50	197.00	-14.50	15.94	0.49	0.00	0.00	16.43	68.93	23.85	50.60	1.21	0.06	17.69	4.36
		21-30	68.6	69.06	197.00	207.00	10.00	0.34	0.03	0.00	602.09	602.47	68.83	23.65	7.90	0.19	0.00	602.65	612.58
	July	1-10	69.056	66.20	207.00	146.00	-61.00	0.63	0.00	0.00	219.68	220.31	67.63	21.44	39.20	0.84	0.03	221.19	160.17
		11-20	66.2	66.70	146.00	156.00	10.00	4.08	0.46	0.00	90.73	95.28	66.45	19.25	29.30	0.56	0.02	95.86	106.46
		21-31	66.7	73.95	156.00	340.00	184.00	6.92	0.54	0.00	0.00	7.46	70.33	26.75	30.20	0.81	0.02	8.29	23.55
	Aug	1-10	73.95	76.05	340.00	409.50	69.50	10.20	0.30	0.00	283.68	294.19	75.00	36.40	14.50	0.53	0.01	294.72	364.29
		11-20	76.05	75.10	409.50	377.00	-32.50	0.00	0.00	0.00	388.29	388.29	75.58	37.74	18.70	0.71	0.01	389.01	356.51
		21-30	75.1	76.80	377.00	438.00	61.00	4.18	0.00	0.00	238.97	243.15	75.95	38.50	26.40	1.02	0.03	244.20	305.20
	Sept.	1-10	76.8	76.80	438.00	438.00	0.00	1.58	0.00	0.00	299.05	300.63	76.80	40.50	23.30	0.94	0.02	301.60	301.60
		11-20	76.8	77.60	438.00	480.00	42.00	4.88	0.10	0.00	0.00	4.98	77.30	41.75	36.60	1.53	0.06	6.56	48.53
		21-31	77.8	78.05	480.00	490.00	10.00	9.82	0.49	0.00	0.00	10.31	77.93	43.31	10.20	0.44	0.00	10.76	22.09
	Oct.	1-10	78.05	78.10	490.00	492.00	2.00	10.40	0.49	0.00	0.00	10.89	78.08	43.69	61.60	2.69	0.17	13.74	15.60
		11-20	78.1	77.80	492.00	480.00	-12.00	17.91	0.49	0.00	0.00	18.40	77.95	48.55	68.80	3.34	0.23	21.97	9.76
		21-30	77.8	77.45	480.00	464.50	-15.50	19.16	0.38	0.00	0.00	19.54	77.63	52.56	63.10	3.32	0.21	23.07	8.68
	Nov.	1-10	77.45	77.05	464.50	449.00	-15.50	14.40	0.00	0.00	0.00	14.40	77.25	41.62	50.20	2.09	0.10	16.59	3.79
		11-20	77.05	76.75	449.00	436.50	-12.50	14.81	0.00	0.00	0.00	14.81	76.90	40.75	46.30	1.89	0.09	16.78	6.91
		21-31	76.75	76.60	436.50	432.00	-4.50	3.18	0.00	0.00	0.00	3.18	76.68	40.19	55.20	2.22	0.12	5.52	4.82
	Dec.	1-10	76.6	76.80	432.00	420.00	-12.00	11.77	0.08	0.00	0.00	11.84	76.70	39.62	58.40	2.31	0.14	14.29	4.38
		11-20	76.8	75.75	420.00	398.50	-21.50	17.13	0.49	0.00	0.00	17.62	76.28	38.65	57.20	2.21	0.13	19.96	0.85
		21-30	75.75	75.20	398.50	380.00	-18.50	16.41	0.54	0.00	0.00	16.95	75.48	37.51	46.50	1.74	0.08	18.77	1.92
2003	Jan.	1-10	75.2	74.85	380.00	369.00	-11.00	11.32	0.49	0.00	0.00	11.81	75.03	36.46	42.40	1.55	0.07	13.42	3.61
		11-20	74.85	74.70	369.00	364.00	-5.00	2.72	0.13	0.00	0.00	2.85	74.78	35.94	46.20	1.66	0.08	4.59	3.23
		21-31	74.7	74.15	364.00	346.50	-17.50	18.32	0.00	0.00	0.00	18.32	74.43	35.24	56.50	1.99	0.11	20.42	4.81
	Feb.	1-10	74.15	73.65	346.50	329.00	-17.50	15.57	0.28	0.00	0.00	15.85	73.90	34.20	51.00	1.74	0.09	17.69	1.61
		11-20	73.65	73.15	329.00	314.50	-14.50	17.17	0.61	0.00	0.00	17.78	73.40	33.20	51.00	1.69	0.09	19.56	6.65
		21-30	73.15	72.65	314.50	299.50	-15.00	13.31	0.49	0.00	0.00	13.80	72.90	32.15	53.20	1.71	0.09	15.60	2.59
	March	1-10	72.65	72.05	299.50	282.00	-17.50	16.44	0.41	0.00	0.00	16.85	72.35	31.07	76.80	2.39	0.16	19.42	3.07
		11-20	72.05	71.45	282.00	265.00	-17.00	13.61	0.45	0.00	0.00	14.06	71.75	29.62	72.50	2.16	0.16	16.38	4.60
		21-31	71.45	70.80	265.00	249.00	-16.00	18.47	0.67	0.00	0.00	19.14	71.13	28.65	91.60	2.62	0.24	22.01	7.89
	April	1-10	70.8	70.05	249.00	229.50	-19.50	19.58	0.61	0.00	0.00	20.19	70.43	29.96	88.00	2.64	0.23	23.06	4.82
		11-20	70.05	69.35	229.50	214.00	-15.50	17.92	0.51	0.00	0.00	18.43	69.70	25.30	93.20	2.36	0.22	21.01	5.85
		21-30	69.35	68.60	214.00	197.00	-17.00	16.07	0.08	0.00	0.00	16.15	68.98	23.95	84.60	2.03	0.17	18.35	4.66
	May	1-10	68.6	67.65	197.00	177.00	-20.00	21.13	0.49	0.00	0.00	21.62	68.13	22.31	84.60	1.89	0.16	23.56	3.75
		11-20	67.65	66.90	177.00	160.00	-17.00	15.21	0.18	0.00	0.00	15.39	67.28	20.65	94.40	1.95	0.18	17.52	2.09
		21-30	66.90	66.00	160.00	129.00	-31.00	16.68	0.08	0.00	0.00	16.76	66.45	19.25	99.40	1.91	0.19	18.86	2.56

TABLE 3-2: INFLOW SERIES OF DAMAN GANGA

(ALL FIGURES IN MCM

Month	Ten. days	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03
June	I	0.00	0.00	0.00	0.00	113.87	0.41	0.21	0.00	0.00	8.85	2.02	5.60	0.96	11.17	9.97	6.15
	II	0.41	0.00	26.20	16.71	0.00	7.03	93.56	194.90	0.53	56.05	5.16	43.89	6.96	11.39	247.59	4.36
	III	6.36	0.00	0.00	17.40	22.29	61.63	84.38	529.20	0.00	58.17	53.15	38.73	170.50	52.18	80.79	612.68
July	I	420.43	0.00	47.11	266.32	75.45	14.89	203.46	348.39	0.08	38.68	94.75	277.64	38.53	178.62	313.30	160.17
	II	113.94	727.99	107.05	267.92	530.83	33.94	1200.34	1418.52	262.19	26.99	50.28	163.15	926.26	724.94	324.47	106.46
	III	88.01	770.99	562.99	299.02	1058.45	207.59	257.69	651.68	537.05	548.33	693.78	68.25	405.11	105.12	250.59	23.55
August	I	80.20	398.31	115.84	255.36	265.73	202.42	164.92	168.92	240.20	455.41	558.98	213.14	289.13	52.22	202.23	364.29
	II	225.27	147.03	224.63	777.94	272.90	973.08	103.30	337.61	56.75	266.40	173.28	207.55	183.95	67.59	466.38	356.51
	III	357.98	267.69	520.70	573.89	459.13	174.10	212.25	818.34	90.03	444.99	776.22	177.61	43.58	375.20	87.69	305.20
Sept.	I	78.06	196.08	123.36	182.88	109.88	690.28	226.62	678.85	332.24	451.47	92.08	314.21	33.18	162.37	37.21	301.60
	II	42.67	198.20	40.06	106.39	44.49	124.90	175.50	209.42	107.54	201.66	30.00	894.36	93.60	33.58	50.61	48.53
	III	25.21	243.19	160.61	339.54	24.29	25.96	710.90	53.85	28.88	47.60	80.10	146.68	61.66	33.41	48.50	22.09
Oct	I	25.92	149.08	115.87	142.07	5.52	17.34	176.50	14.98	22.37	66.09	32.00	113.92	215.71	22.80	42.19	15.60
	II	56.73	78.86	15.44	68.11	5.04	7.47	109.32	9.08	23.18	13.11	12.49	92.42	114.41	22.70	45.38	9.76
	III	4.68	47.58	7.81	16.56	5.27	5.08	123.84	9.29	11.89	137.48	9.42	17.25	31.76	6.89	19.90	8.68
Nov.	I	2.84	40.75	0.00	0.00	1.97	0.00	57.41	2.59	0.00	8.37	8.49	27.78	13.43	6.90	8.20	3.79
	II	5.88	12.04	1.51	0.00	4.41	0.00	27.10	5.61	4.37	4.77	9.53	13.68	9.17	3.96	8.43	6.91
	III	9.06	2.44	0.00	0.00	3.49	0.93	3.19	3.65	2.68	4.31	7.45	7.89	7.29	3.59	5.97	4.82
Dec.	I	0.00	2.47	0.00	0.00	0.00	1.35	1.06	2.22	4.28	7.49	6.37	2.86	2.22	5.40	7.38	4.38
	II	0.00	0.00	0.00	0.00	1.12	2.27	0.14	0.00	2.35	4.20	4.17	5.43	9.64	3.88	7.32	0.85
	III	0.00	1.27	0.00	0.00	1.12	0.00	1.91	1.64	0.00	2.16	1.88	3.98	6.29	3.13	3.91	1.92
Jan	I	0.00	0.00	0.00	0.00	0.00	2.13	0.60	0.87	1.95	4.30	1.76	1.98	8.13	9.12	0.54	3.81
	II	0.00	0.81	0.00	0.00	1.80	0.46	0.78	1.99	0.00	6.71	3.29	3.71	1.46	19.22	2.65	3.23
	III	0.00	0.00	0.00	0.00	1.51	0.55	0.00	0.00	2.26	4.86	3.20	2.47	6.07	7.27	0.81	4.81
Feb.	I	0.00	0.00	0.00	0.00	1.68	0.00	0.35	2.19	0.88	3.21	5.09	5.03	2.39	5.72	11.73	1.61
	II	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.16	0.00	6.67	1.54	2.92	5.06	5.06	2.27	6.65
	III	0.00	0.00	0.00	0.00	0.79	0.60	2.20	0.00	0.00	4.54	0.92	2.67	1.41	6.22	3.33	2.59
March	I	0.00	0.00	0.00	1.32	1.14	0.00	0.00	1.02	3.51	4.21	3.91	2.73	2.98	4.60	2.90	3.07
	II	0.00	0.08	0.00	4.01	0.97	0.13	0.12	0.00	0.00	2.55	4.88	3.91	10.00	4.14	5.70	4.60
	III	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.00	2.95	3.60	2.66	5.18	5.39	5.17	7.89
April	I	0.00	0.00	0.00	0.36	0.06	0.00	0.00	0.00	4.40	2.21	4.65	2.02	4.24	5.96	2.53	4.82
	II	0.00	1.14	0.00	0.00	1.42	0.00	0.00	0.00	0.00	2.15	3.81	4.22	4.39	6.80	6.40	5.85
	III	0.00	0.00	0.00	3.69	1.91	28.05	0.00	0.01	0.00	5.25	4.36	5.60	3.69	3.17	6.40	4.66
May	I	0.00	0.41	0.00	0.00	0.00	0.00	1.63	0.08	1.11	0.53	3.21	2.17	6.97	4.88	5.26	3.75
	II	0.00	0.16	0.00	0.00	0.00	0.00	0.00	6.99	1.42	54.19	4.55	28.14	4.38	3.12	6.01	2.09
	III	0.00	0.00	52.56	0.42	2.49	0.00	19.42	0.00	2.33	3.92	3.70	32.47	6.88	3.18	5.95	2.56
Total run-off		1543.68	3286.72	2121.77	3339.90	3019.70	2582.59	3958.68	5472.03	1744.47	2960.85	2754.07	2938.72	2736.58	1980.89	2335.66	2430.

TABLE 3-3

COMPUTATION FOR 90%, 75% & 50% DEPENDABLE YEARS BASED ON ANNUAL RUNOFF

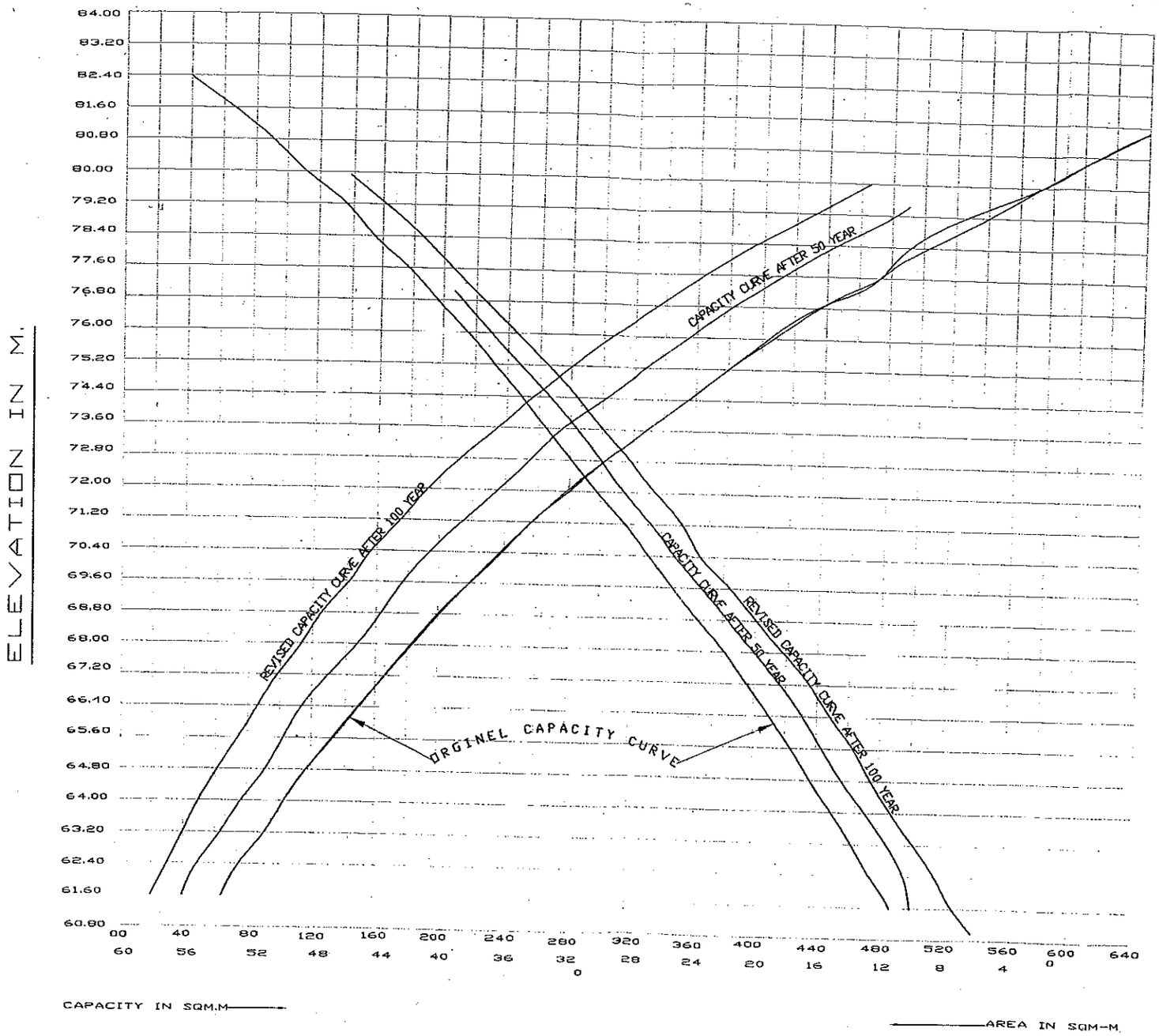
No.	Year	Runoff MCM
1	87-88	1543.68
2	88-89	3286.72
3	89-90	2121.77
4	90-91	3339.90
5	91-92	3019.70
6	92-93	2582.59
7	93-94	3958.68
8	94-95	5472.03
9	95-96	1744.47
10	96-97	2960.85
11	97-98	2754.07
12	98-99	2938.72
13	99-00	2736.58
14	00-01	1980.89
15	01-02	2335.66
16	02-03	2430.28

Runoff arranged in descending order	Ranking
5472.03	1
3958.68	2
3339.90	3
3286.72	4
3019.70	5
2960.85	6
2938.72	7
2754.07	8
2736.58	9
2582.59	10
2430.28	11
2335.66	12
2121.77	13
1980.89	14
1744.47	15
1543.68	16

No. of years for which data is available = 16

Description	Rank	Runoff	Corresponding Year
90% Dep. Year	15	1744.47	95-96
75% Dep. Year	13	2121.77	89-90
50% Dep. Year	9	2736.58	99-00

FIG..3.1AREA CAPACITY CURVE (DAMAN SHP 1&2)



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CHAPTER -4

Power Potential Studies

CHAPTER 4

POWER POTENTIAL STUDIES

4.1 Introduction

Power potential studies have been carried out based on the hydrological study described in the previous chapter. Based on available data of reservoir operation , Annual runoff from 1987 to 2003 period has been worked out for each year based on available ten daily inflows (in Mcum) and is presented in TABLE 3.2.

Power potential study has been carried out on the basis of 75% dependable year (1989-90) generation.

4.2 Hydrology

Detailed hydrological studies are carried out in the previous chapter. Availability of flow for Daman Ganga dam Toe Small Hydropower Project-2 (through Right Bank Head regulator) is presented in TABLE 4.1.

4.3 Head

4.3.1 Reservoir Operating Parameters

Full Reservoir Level (FRL): 79.86 m

Minimum Draw Down Level (MDDL): 61.60 m

4.3.2 Tail Water Levels

For power potential studies the tail water level is assumed as constant, however it will vary with the flow in the channel. It has been assumed that the tail level will increase only during monsoon/ flood condition when the dam level will be maximum. At the time of MWL, the available head shall be more than the maximum operating head and therefore the energy generation will not change drastically. Tail water level varies from 56 m to 61 m. For power potential studies (SHP-2) average tail water level of 58.5 m has been considered.

Head Loss

Head loss **for rated discharge of 24.39 cumec** is calculated. A constant head loss of 2.50m is taken for power studies.

4.4 Operating Conditions

4.4.1 Permissible Operating Head Range

Electro-mechanical equipments are designed for various head and discharge ranges required for specific project requirements and it also varies with the supplier.

Proposed Daman Ganga dam Toe Small Hydropower Project -2 is proposed on dam toe and will operate in various head conditions. The availability of head is summarized below:

Maximum Head available: FRL – TWL – Head Loss

=79.86 – 58.5 –2.5 =18.86 m

Minimum Head available: MDDL – TWL – Head Loss

=61.60 – 58.5 – 0.5* = 2.6 m

** Head loss will be less during low flow condition*

The plant size studies are carried out for rated head of 13 m. Maximum and minimum operating head limits are taken as per USBR manual as well as discussions had with equipment designers/ suppliers, which are given below:

Maximum Head:	1.25 times of rated head
Minimum Head:	0.65 times of rated head

4.4.2 Discharge Range

Minimum Discharge

One unit of **2600 kW** is proposed to generate optimum energy. However sometimes irrigation requirement is less than the minimum operating discharge, which will not be utilised for power generation.

40% of rated discharge is taken as the minimum limit of discharge for generation.

Maximum Discharge

The Daman Ganga Dam Toe SHP-2 is proposed on the existing Right bank Head Regulator. Maximum velocity of 3.0 m/s through the concrete square penstock has been considered as the limiting velocity. Based on limiting velocity of 3.0m/s, about 25 cumec discharge is considered as the maximum discharge for SHP-2.

4.5 Efficiencies

For power and energy computations, it is proposed that one unit of vertical Kaplan turbine would be used for power generation. Following efficiencies of turbine and generator are taken for optimisation studies.

Turbine:	88%
Generator	95%

4.6 Number of Units

Annual energy with single unit is worked out as summarized below:

Installed capacity	One Unit
2600 KW	11.63 MUs

4.7 Detailed Energy calculations

For the finalized option, detailed energy calculations are presented in this report. A series of generated power and energy are separately presented in TABLE 4-1.

4.8 Dependable Year Energy

Annual energy corresponding to 75% dependable year at 95% Plant Availability has been worked out in TABLE 4-1. The annual energy in 75% dependable year is presented below:

Dependable Year(1989-90)	Annual Energy	Plant Load Factor
75% dependable Year	***11.63 MUs***	***53.74 %***

Power Potential Studies in 75% Dependable Year
1989-90 is the 75% dependable year

F.R.L =	79.86 M
M.D.D.L =	61.6 M
Storage Capacity at FRL	567.8 MCM
Storage Capacity at MDDL	64.5 MCM

SHP-II (Dam Toe SHP at the RBHR)		
Combined Efficiency		83.6%
Rated Head		13.00
Rated Discharge		24.39
Limits	Max Head	16.25
	Min Head	8.45
	Max Discharge	24.39
	Min Discharge	9.755
Installed capacity (KW)		2600
Tail Water Level		58.5
Head Losses		2.5

SHP-I (At the Existing Penstock Outlet)		
Combined Efficiency		83.6%
Rated Head		27.00
Rated Discharge		13.55
Limits	Max Head	33.75
	Min Head	17.55
	Max Discharge	13.55
	Min Discharge	2.710
Installed capacity (KW)		3000
Tail Water Level		49.25
Head Losses		1.5

Month	Initial Level	Initial Storage	Inflow for Year 1989-90	Total Storage	Live Capacity	SHP-II								SHP-I							Unused Spill without generation	Total Withdrawal (Col 9+16+22)	Final Storage (Col 5-23)	Final level of Reservoir (Area cap Curve)	Average level of Resevoir (avg of col 2 & 25)	SHP-II		SHP-I		Spill Over (Uncontrolled water)
						Min RBHR Release for Year 1989-90	Additional Release for power-II	Total Release from SHP-II	Utilised water for Power from SHP-II	Net Head for SHP-II (col 28)	Max Power generated from SHP-II	Restricted Power Generated	Generated Units from SHP-II	Balance Live Cap	Released water for SHP-I	Utilised water From SHP-I	Net Head for SHP-I (col 30)	Max Power generated from SHP-I	Restricted Power Generated	Generated Units-I from SHP-I						Net Head Available (Col 26-TWL-Losses)	Net Head used	Net Head Available (Col 26-TWL-Losses)	Net Head used	
	m	MCM	MCM	MCM	MCM	MCM	MCM	MCM	MCM	m	KW	KW	GWh	MCM	MCM	MCM	m	KW	KW	GWh	MCM	MCM	MCM	m	m	m	m	m	m	MCM
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
June	61.60	64.50	0.00	64.50	0.00	0.00		0.00	0.00	0.00	0	0	0.000	0.00		0.00	0.00	0	0	0.000		0.00	64.50	61.60	61.60	0.60	0.00	10.05	0.00	0.00
	61.60	64.50	26.20	90.70	26.20	4.20		4.20	0.00	0.00	0	0	0.000	22.00		0.00	0.00	0	0	0.000		4.20	86.50	62.97	62.28	1.28	0.00	11.53	0.00	0.00
	62.97	86.50	0.00	86.50	22.00	6.56		6.56	0.00	0.00	0	0	0.000	15.44		0.00	0.00	0	0	0.000		6.56	79.94	62.63	62.80	1.80	0.00	12.05	0.00	0.00
July	62.63	79.94	47.11	127.05	62.55	1.46		1.46	0.00	0.00	0	0	0.000	61.09		0.00	0.00	0	0	0.000		1.46	125.59	65.21	63.92	2.92	0.00	13.17	0.00	0.00
	65.21	125.59	107.05	232.64	168.14	3.06		3.06	0.00	0.00	0	0	0.000	165.08		0.00	0.00	0	0	0.000		3.06	229.58	70.02	67.61	6.61	0.00	16.86	0.00	0.00
	70.02	229.58	562.99	792.58	728.08	0.57	22.62	23.19	23.18	13.94	2788	2600	0.686	704.89	12.88	12.88	24.19	2688	2688	0.710		36.07	567.76	79.86	74.94	13.94	13.94	24.19	24.19	188.75
August	79.86	567.76	115.84	683.60	619.10	3.36	17.72	21.08	21.07	16.25	3250	2600	0.624	598.02	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	83.05
	79.86	567.76	224.63	792.39	727.89	0.00	21.08	21.08	21.07	16.25	3250	2600	0.624	706.81	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	191.85
	79.86	567.76	520.70	1088.46	1023.96	0.00	23.19	23.19	23.18	16.25	3250	2600	0.686	1000.77	12.88	12.88	29.11	3234	3000	0.792		36.07	567.76	79.86	79.86	18.86	16.25	29.11	29.11	484.63
Sept.	79.86	567.76	123.38	691.14	626.64	0.00	21.08	21.08	21.07	16.25	3250	2600	0.624	605.56	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	90.60
	79.86	567.76	40.06	607.82	543.32	0.00	21.08	21.08	21.07	16.25	3250	2600	0.624	522.24	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	7.27
	79.86	567.76	160.61	728.37	663.87	0.88	20.20	21.08	21.07	16.25	3250	2600	0.624	642.79	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	127.82
Oct	79.86	567.76	115.87	683.63	619.13	0.34	20.74	21.08	21.07	16.25	3250	2600	0.624	598.05	11.71	11.71	29.11	3234	3000	0.720		32.79	567.76	79.86	79.86	18.86	16.25	29.11	29.11	127.82
	79.86	567.76	15.44	583.20	518.70	2.24	18.84	21.08	21.07	16.25	3250	2600	0.624	497.62	11.71	11.71	28.90	3211	3000	0.720		32.79	550.41	79.45	79.65	18.65	16.25	28.90	28.90	83.08
	79.45	550.41	7.81	558.22	493.72	0.37	22.82	23.19	23.18	16.25	3250	2600	0.686	470.53	12.88	12.88	28.37	3153	3000	0.792		36.07	522.15	78.80	79.12	18.12	16.25	28.37	28.37	0.00
Nov.	78.80	522.15	0.00	522.16	457.66	2.30	18.78	21.08	21.07	16.25	3250	2600	0.624	436.58	11.71	11.71	27.69	3076	3000	0.720		32.79	489.37	78.07	78.44	17.44	16.25	27.69	27.69	0.00
	78.07	489.37	1.51	490.88	426.38	1.52	19.56	21.08	21.07	16.25	3250	2600	0.624	405.30	11.71	11.71	26.94	2993	2993	0.718		32.79	458.09	77.30	77.69	16.69	16.25	26.94	26.94	0.00
	77.30	458.09	0.00	458.09	393.59	0.24	20.84	21.08	21.07	15.91	3181	2600	0.624	372.51	11.71	11.71	26.16	2906	2906	0.697		32.79	425.31	76.52	76.91	15.91	15.91	26.16	26.16	0.00
Dec.	76.52	425.31	0.00	425.31	360.81	2.81	18.27	21.08	21.07	15.05	3010	2600	0.624	339.73	11.71	11.71	25.30	2811	2811	0.675		32.79	392.53	75.58	76.05	15.05	15.05	25.30	25.30	0.00
	75.58	392.53	0.00	392.53	328.03	0.00	21.08	21.08	21.07	14.06	2813	2600	0.624	306.95	11.71	11.71	24.31	2702	2702	0.648		32.79	359.74	74.55	75.06	14.06	14.06	24.31	24.31	0.00
	74.55	359.74	0.00	359.75	295.25	4.11	19.08	23.19	23.18	13.00	2600	2600	0.686	272.06	12.88	12.88	23.25	2583	2583	0.682		36.07	323.68	73.45	74.00	13.00	13.00	23.25	23.25	0.00
Jan	73.45	323.68	0.00	323.68	259.18	0.00	21.08	21.08	21.07	11.92	2384	2384	0.572	238.10	11.71	11.71	22.17	2464	2464	0.591		32.79	290.89	72.39	72.92	11.92	11.92	22.17	22.17	0.00
	72.39	290.89	0.00	290.89	226.39	4.74	16.34	21.08	21.07	10.82	2165	2165	0.520	205.31	11.71	11.71	21.07	2341	2341	0.562		32.79	258.10	71.25	71.82	10.82	10.82	21.07	21.07	0.00
	71.25	258.10	0.00	258.10	193.60	0.67	22.52	23.19	23.18	9.84	1929	1929	0.509	170.41	5.00	5.00	19.89	858	858	0.227		28.19	229.91	70.03	70.64	9.64	9.64	19.89	19.89	0.00
Feb.	70.03	229.91	0.00	229.91	165.41	3.48	17.60	21.08	21.07	8.46	1691	1691	0.406	144.33	7.00	7.00	18.71	1243	1243	0.298		28.08	201.83	68.68	69.46	8.46	8.46	18.71	18.71	0.00
	68.88	201.83	0.00	201.83	137.33	2.19		2.19	0.00	0.00	0	0	0.000	135.14	11.71	11.71	17.82	1980	1980	0.475		13.90	187.93	68.25	68.57	7.57	0.00	17.82	17.82	0.00
	68.25	187.93	0.00	187.93	123.43	0.00		0.00	0.00	0.00	0	0	0.000	123.43		0.00	0.00	0	0	0.000		0.00	187.93	68.25	68.25	7.25	0.00	17.50	0.00	0.00
March	68.25	187.93	0.00	187.93	123.43	6.34		6.34	0.00	0.00	0	0	0.000	117.09		0.00	0.00	0	0	0.000		6.34	181.59	67.56	68.10	7.10	0.00	17.35	0.00	0.00
	67.96	181.59	0.00	181.59	117.09	0.00		0.00	0.00	0.00	0	0	0.000	117.09		0.00	0.00	0	0	0.000		0.00	181.59	67.96	67.96	6.96	0.00	17.21	0.00	0.00
	67.96	181.59	0.00	181.59	117.09	6.50		6.50	0.00	0.00	0	0	0.000	110.59		0.00	0.00	0	0	0.000		6.50	175.09	67.64	67.80	6.80	0.00	17.05	0.00	0.00
April	67.64	175.09	0.00	175.09	110.59	0.00		0.00	0.00	0.00	0	0	0.000	110.59		0.00	0.00	0	0	0.000		0.00	175.09	67.64	67.64	6.64	0.00	16.89	0.00	0.00
	67.64	175.09	0.00	175.09	110.59	4.41		4.41	0.00	0.00	0	0	0.000	106.18		0.00	0.00	0	0	0.000	20.000	24.41	150.68	66.43	67.04	6.04	0.00	16.29	0.00	0.00
	66.43	150.68	0.00	150.68	86.18	4.60		4.60	0.00	0.00	0	0	0.000	81.58		0.00	0.00	0	0	0.000	20.000	24.60	126.08	65.23	65.83	4.83	0.00	15.08	0.00	0.00
May	65.23	126.08	0.00	126.08	61.58	0.00		0.00	0.00	0.00	0	0	0.000	61.58		0.00	0.00	0	0	0.000	20.000	20.00	106.08	64.18	64.70	3.70	0.00	13.95	0.00	0.00
	64.18	106.08	0.00	106.08	41.58	10.95		10.95	10.95	0.00	0	0	0.000	30.63		0.00	0.00	0	0	0.000	25.000	35.95	70.13	62.06	63.12	2.12	0.00	12.37	0.00	0.00
	62.06	70.13	52.56	122.68	58.18	0.00		0.00	0.00	0.00	0	0	0.000	58.18		0.00	0.00	0	0	0.000	58.180	58.18	64.50	61.60	61.83	0.83	0.00	11.08	0.00	0.00
Carry Over	61.60	64.50																												
			2121.77			77.80	404.52	482.42	442.89	Generation in MU			12.240		239.09	239.09	Generation in MU			13.628	143.180										1267.07
										Generation at 95% PA			11.63				Generation at 95% PA			12.95										
										Plant Load Factor			53.74%				Plant Load Factor			51.86%										

CHAPTER -5

Civil Works

CHAPTER -5

CIVIL WORKS

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5.0 General

Dam toe SHP - 2 has been proposed on existing right bank canal of the dam. One unit of 2600 KW is proposed to be provided at SHP – 2 Brief details of civil works are as given below:

5.1 Intake Structure / Right Bank Head Regulator

Existing Right bank Head Regulator in the reservoir of dam has been designed for about 28.32 cumec (1000 cusec) of discharge to meet downstream irrigation, industrial water supply and drinking requirements. Suitable provision for trash – rack, gate & stoplogs has been provided at the entry to R.C.C. duct.

R.C.C. duct of size 2.74m X 2.74m takes off from the intake structure which opens into stilling basin. Irrigation canal takes off from right bank canal head regulator at the exit end of RCC duct. Invert level of RCC duct at exit has been kept at EL 59.06m. After stilling basin, trapezoidal section of canal has been adopted with bottom width of 4.5m & side slope of canal as 1.5:1 (H:V). Design discharge of canal is about 28.32 cumecs.

5.1.1 Steel Penstock

A single steel penstock of dia 2.5m, 74m long & 12mm thick will take off from existing RCC duct of size 2.74m X 2.74m. Further, single penstock of dia 2.5m will be feed one vertical Kaplan Turbine. Butterfly valve of dia 2.5m is proposed to be provided at the beginning of the penstock.

5.1.2 Irrigation Outlet

The provision has been made to let the water for irrigation from below of Power House – 2, after completion of the project.

5.1.3 Power House

Power House is proposed to be constructed independent of the existing irrigation canal on the left bank as shown in the drawing. It is proposed to install one unit of 2600 KW capacity. The main features of the proposed Power House building are as follows.

1. The main building of size 14.5m X 11.7m in plan is provided to accommodate one unit of 2600KW.
2. The height of the building will be about 16m from deepest foundation level at EL 51.5m.
3. Steel roof truss will be provided at the top.
4. Service bay has been provided separately.

5. Switchyard is proposed to be provided near the power house canal where sufficient space is available.

6. RCC columns with brick masonry walls will be provided for the Power House building.

7. One number stop log gate (3 of9m x 0.9m) has been provided to facilitate maintenance / repair of generating unit as and when required.

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CHAPTER -6

Electro-Mechanical Works

ELECTRO-MECHANICAL WORKS 000391

6.1 BROAD SCOPE OF WORKS:

Daman Ganga II H.E. Project envisages an installation of 1 unit of 2.6MW in a surface power house. The scope of EM works includes Design, Engineering, Manufacture, Testing at Works, Supply, Transportation, Insurance, Handling, Storage at site, Erection, Testing and Commissioning of all Electro-Mechanical Equipments, Material and Services as broadly detailed below for commissioning of 1X2.6 MW generating units. The main equipment comprises of: -

- 1 (One) Nos. of Vertical Shaft Kaplan Turbine & Main Inlet Valve of butterfly type complete with all unit auxiliaries like Governing System, Pressure oil System/Hydraulic Pack, High pressure and low pressure compressed air system, Grease Lubrication System, Drainage & dewatering system etc.
- 1(One) Nos. of Hydro Generators complete with Brushless Excitation System with AVR panels, Brake System, cooling water system etc.
- 1 (One) 6.6/34.5 kV, 3.5 MVA, 3 phase, ONAN cooled Generator Step-up Transformer
- 2 (Two) 33/0.433 kV, 150 kVA, 3 phase, ONAN (Oil natural, air natural) cooled Station Auxiliary Transformers.
- 6.6 kV LAVT Panel, Neutral Grounding panel & 6.6 kV Switchgear Panel.
- Unit control Board, PLC panel, Metering, Protection, Annunciation Devices, Line & Transformer Control Panels and Station Aux. supply Panels
- 33 kV high voltage switchgear for outdoor switchyard
- Station D.C equipment comprising of 110 V DC batteries, Battery charging equipment and DC Distribution board
- Power, Control & Instrumentation Cables, Cable Trays, cable supporting racks, Hardware & fittings etc.
- Common Station Auxiliary Equipment comprising of Illumination of Power House & Switchyard, Ventilation & Air conditioning, Fire Protection System and Drainage & Dewatering System
- Electric Overhead Traveling Crane for power house
- Ground Mat & Earthing System for Power House & Switchyard

- Diesel Generating Set for emergency supply
- Power Evacuation Arrangement at 33kV switchyard

6.2 OPERATING CHARACTERISTICS

From the reservoir levels, tail water levels and losses in the water conductor system, operating parameters and heads are determined as a tabulated below

Turbine shall be suitable to operate satisfactorily under this extreme range of heads.

The heads are:

Maximum Net Head 16.25 m

Minimum Net Head 8.45m

Rated Net head 13.0m

The design head i.e. the head at which turbine has best efficiency, is also proposed to be kept same as the rated head i.e. 13.0 m

6.3 BASIC TECHNICAL PARAMETERS OF MAIN EQUIPMENTS:

Sl. No	Equipment/Item	Brief Specifications
1	**Turbine**	
	Type	Vertical Shaft Kaplan with double regulation
	Output	To match the generator output of 2.6 MW at rated head conditions plus 10% continuous overload at rated head.
	Rated and design net Head	13.0 meters (Approx)
	Speed	250 rpm
	Runner Setting	-0.6 meters
	Minimum Tail Water Level	58.5 m
2	**Inlet Valve**	
	Type	Butterfly type
	Diameter	2.9 meters and/or to suit the discharge conditions
3	**Generator**	
	Out put	2.6 MW under rated conditions plus 10 % continuous overload
	Power factor	0.85 lagging

	Speed	250 rpm
	Voltage	6.6 kV
	Excitation System	Brushless Type
	Short Circuit Ratio	> 0.9
4	**Main Generator Transformers**	
	Capacity, three Phase	3.5 MVA
	Voltage Ratio	6.6/34.5 kV
	Cooling Type	ONAN
5	**Switchyard Equipment**	
	33 kVCircuit Breakers	2 Nos. SF_6 / Vacuum Type, 25 kA, 630 A
	33 kV Isolators with/without earthing switch	4 Nos., 630 A, Short Time current rating 25 kA for 1 sec
	33 kV Current Transformers	6 Nos.
	33 kV/√110 V Potential Transformers	6 Nos.
	30 kV Lightning Arresters	6 Nos.
	Structural Steel	As Required
	Miscellaneous Items	Insulators, ACSR Conductor, Connectors, hard ware, GI wire
6	**DC Equipment**	
		Battery 110V , 200 AH , Tubular Type with HDP cells
		2 sets of Battery Chargers each comprising of Float cum Boost chargers
		DC distribution Board with adequate no. of feeders to meet DC normal and emergency load requirements
7	**Crane**	
		18 Tonnes or higher capacity EOT Crane suitable to lift heaviest equipment of the station
8	**Cables**	
		XLPE cables for Interconnection of Generator Terminals to Transformer LV side
		Power & Control Cables as required complete with cable terminations, cable Glands, Lugs and Cable Trays
9	**DG Set**	
		62.5 KVA DG set for emergency Power requirements of the station

6.4 BRIEF SPECIFICATION OF MAJOR EQUIPMENTS:

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GENERAL

It is proposed to install one (1) no. of 6.6 kV, 2.6 MW, 0.85 pf. Synchronous generator. The generator will be connected to 6.6 kV switch board. The generator voltage will be stepped up to 33kV by means of 1 no. of 3.5 MVA, 6.6/34.5 kV, 3 phase Step-up transformers and power will be evacuated to the nearest existing substation at xxxxxx by a single circuit 33kV transmission line. The electrical details of the proposed scheme are shown in single line diagram.

6.5 Turbine

One (1) double regulated vertical Kaplan turbine, with steel spiral casing, coupled rigid to the generator-shaft, consisting of the following components:

Kaplan Runner with 4 adjustable blades in stainless steel, finished grinded, with runner hub, with runner-blade-servomotor, with self-operating mechanism, a set of self-lubricated bearings, links and levers, and runner cone.

Discharge ring of the semi-spherical type, welded design, integral embedded in concrete, welded at site to the draft tube cone, with stainless steel in the range of runner.

Wicket gate assembly consisting of 20 moveable, stainless wicket gates supported by self-lubricated journal bushings, bearing housing including upper and lower bushings for the wicket gate upper stem bearings and bearing bushings for the wicket gate lower trunnions.

Gate operating ring, mounted to the head-cover, gate levers, friction couplings for levers to gate stem, and double-acting servomotor

Wicket gate servomotor located in the turbine pit, wicket gate position transducer mounted on the servomotor.

Stay vane ring welded design

Head cover consisting of outer head cover of fabricated plate steel bolted to the stay vane ring and supporting the upper stems of the wicket gate,

Inner head cover of fabricated plate steel, supporting the turbine shaft seal and guide bearing.

Draft tube cone manufactured of steel-plate, embedded in concrete.

Draft tube bend of steel-plate, embedded in concrete,

Hollow turbine shaft with flange connection to the turbine runner and generator shaft

Turbine guide-bearing designed as split roller-bearing (grease lubricated).

Shaft seal, designed as stuffing box sealing (PTFE coated seal rings) including sealing housing.

Runner servo motor, for adjustment of runner blades, with rotating oil supply head, mounted on top of generator, operating rod through the hollow turbine-generator shaft.

6.6 Control equipment:

Position control runner servo motor
Position control wicket gate servo motor
PT100 for turbine guide bearing
Speed sensor including tooth wheel

6.7 Hydraulic Power Pack (Pressure Oil Supply System)

One (1) Hydraulic power pack suitable for control of the turbine unit operation in parallel with the grid consisting of:

Hydraulic power pack with one ac-motor pump, hand pump and ball valve for manual operation mode, pressure accumulator designed for safe operation of all hydraulic cylinders in case of a fault-out of the pump power supply.

Maximum and minimum pressure monitoring, oil tank with oil level gauge and drainage system, control valve and quick shut off solenoid valves

All necessary fittings and piping from the power pack to the turbine and turbine inlet valve.

The hydraulic power pack unit shall be completely wired to a common terminal box.

The turbine shall be complete with necessary Control, Instruments, indicating and Safety devices.

6.8 Digital Turbine Controller

One (1) Digital Turbine Controller based on Programmable Logic controller shall be provided for control of turbine, generator & unit accessories. The following control modes shall be available. The controller shall be suitable for window operating system and shall have TFT colour display panel. It shall be possible to retrieve actual values, modify target values and failure thresholds, and conduct failure analysis.
Basically, four different types of operation shall be selectable.

Automatic mode:
In automatic mode, the turbine will self-regulate according to the externally defined target value.

Semi-automatic mode:
In semi-automatic mode, the turbine will self-regulate according to the target value setting of the turbine controller.

Manual mode:
In manual mode, the turbine can be opened and closed by pressing the corresponding buttons on the user panel.

Emergency manual mode:
The controller shall be provided with an emergency control unit that allows bypassing of both the Programmable Logic Controller and the touch panel for opening and closing the turbine. For this purpose, the manual emergency plug-in shall be activated via the master switch. After this, the turbine can be opened and closed with a manual potentiometer and push-buttons.

6.9 GENERATOR

The synchronous generators will be 2.6 MW, 6.6 kV, 3 phase 0.85 PF (lag), 50 Hz with brushless excitation system, suitable for parallel operation with the grid. The generator with terminal voltage of 11 kV is also acceptable if it leads to more economical alternative. The speed of the generator will be decided by the Vendor to provide the most economical and optimum design to match the turbine speed. The generator winding will be Class F insulation with temperature rise limited to Class B and will be star connected. The generator neutral will be earthed through neutral grounding transformer with secondary resistance. All six terminals of the generator will be brought out for external connection.

6.10 EXCITATION SYSTEM

The excitation system will be brushless system. The excitation system will include AVR, field suppression equipment, field circuit breaker, and exciter for brushless excitation system, field flashing unit etc. The ceiling voltage of the excitation system will be at least 200% of the normal field voltage and response ratio will be about 2.0. The excitation system shall have the following features:

(a) Maximum and minimum excitation limiter
(b) Over fluxing limiter
(c) Stator Over current limiter

Excitation system will have both auto mode and manual mode. Sufficient redundancy will be built in both rectifier and firing circuits so that failed cards can be identified and replaced on-line.

6.11 3.3 KV SWITCHGEAR

The power generated will be fed to an indoor, metal-enclosed, modularized 3.3 KV switchgear by means of two runs of 1Cx 300 sq.mm, aluminium conductor, XLPE insulated, armoured cable per phase. The connection between 3.3 kV switchgear and 3.3/34.5 kV generator transformer will be by two runs of 1Cx 300 Sq.mm, aluminium conductor, XLPE insulated, armoured cables per phase laid in trenches. Two outgoing feeders with switch and fuse will be provided for feeding the auxiliary transformers from 3.3 KV switchgear.

The main electrical parameters of the switchgear will be:

(a) Rated voltage – 3.3 kV
(b) Rated short circuit breaking current- 25 kA for 1 second
(c) Rated current - 630 A

Type of breaker -SF6 /Vacuum

6.12 GENERATOR TRANSFORMERS

Power generated at 6.6 kV will be stepped up to 33 kV by means of 1 x 3.5 MVA, 6.6 kV / 34.5 kV step-up transformer. The 6.6 kV terminals will be suitable for cable connection. The 33 kV terminals will be brought out through bushings for connection to ACSR conductor.

The main electrical parameters of the transformer will be:

(a) Voltage ratio, 6.6 kV / 34.5 kV, 3 phase, 50 Hz
(b) Rating-3.5 MVA
(c) Cooling Method - ONAN

(d) 6.6 kV connection -delta

(e) 33 kV connection - Star with neutral solidly earthed.

(f) On Load Tap Changer (OLTC) in the range of -15% to +5% in steps of 1.25%, suitable for bi-directional power flow.

6.13 33 kV OUTDOOR SWITCHYARD

Conventional outdoor 33 kV switchgear with necessary equipment such as Circuit breaker; Lightning arrestor; Voltage transformer; current transformer and isolators will be provided for power evacuation by 33 kV outgoing single circuit line to existing/new substation. A 33 kV switchyard with 2 bays (1 transformer bay and 1 line bay) is provided.

6.14 POWER EVACUATION

It is proposed to evacuate the power generated at Daman Ganga II Hydel Scheme to the existing 33 kV substation by using one no. of step-up transformer and a single circuit 33 kV transmission line.

The transmission voltage of 33 kV single circuit with ACSR conductor is selected for power evacuation, considering the quantum of power to be exported and the distance of transmission (Approx. 4 km).

6.15 STATION AUXILIARY POWER SUPPLY ARRANGEMENT AND 415 V SWITCHGEAR

415 V station auxiliary power will be derived by providing 2 x 100%, 150 KVA 6.6 kV/433V auxiliary transformer. The transformer will be connected to the 6.6 kV switchgear by means of fuse and load break switch.

The auxiliary transformers will feed an indoor metal enclosed, modular, and fixed type 415V switchgear by means of suitably rated cables. The 415V switchgear will also include cubicles for feeding the unit auxiliary loads. The auxiliary load for the power plant includes governor oil pumps, cooling water pumps, de-watering pumps, drainage pumps, crane, ventilation, lighting load etc.

The main electrical parameters of the switchgear will be:

(a) Rated Voltage-415V

(b) Rated short circuit breaking current - 25 kA for 1 second

(c) Rated bus bar current - 630 A

The main bus bar will be equipped with the following.

(a) MCCB controlled incomer from auxiliary transformer.

(b) Outgoing feeders to battery chargers / lighting panels, with MCCB units

(c) Motor feeders fitted with air break contactor, high rupturing capacity fuses, thermal overload relays etc

(d) The switchgear will be fitted with the necessary current transformers indicating instruments, relays, lamps, pushbuttons, bus VT, etc.

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During normal operation, power supply to 415 V board will be derived from the 6.6 kV switchboard fed by hydro generator. When the hydro generators are not in operation auxiliary power will be derived from the grid by means of generator transformer. To cater to the eventuality of failure of grid supply, an emergency 62.5 KVA DG set will be provided which will feed the lighting loads of the plant in addition to battery charger. The DG set will be started automatically through AMF panel or manually as required.

The various services in the power plant will be supplied at the following nominal voltages depending upon their ratings and function:

(a)	Motors	- 415V, 3 phase AC supply
(b)	Lighting and space heaters	- 240V, 1 phase AC supply
(c)	Power receptacles	- 415V, 3 phase AC supply
(d)	Control circuits	- 110V, 1 phase grounded AC supply for AC control circuits.
		- 110V ungrounded DC supply for control, indication and Instrumentation & Control system

6.16 DC SUPPLY SYSTEM

The DC system is the most reliable source of supply in the power station and will be used for the control and protection of power plant equipment.

The DC system will be used for the following:

(a) Electrical control of equipment and indications / annunciation on the control panel and protective schemes.

(b) Emergency D.C lighting, in case of AC power failure

The station battery will be sized to cater to the following type of loads:

(a) Momentary load for 1 minute.
(b) Emergency load for 2 hours.
(c) Continuous load for 4 hours.

One set of 110 V, 200AH battery bank with two nos. float cum boost chargers (both operating in parallel) and DC distribution board will meet the DC loads. The batteries will be of stationary lead acid tubular type, complete with racks, porcelain insulators, inter cell and inter-tier connectors.

The chargers will be of silicon rectifier type with automatic voltage control and load limiting features. Under normal conditions, the battery will be on float

charge. The float charger is connected to a distribution board and meets the requirements of DC load. In case of additional demand of load or AC supply failure, the battery will meet the requirements of DC loads. The boost charger will be designed to charge the fully discharged battery in 10 hours before putting it back on float charge.

6.17 CONTROL & PROTECTION SYSTEM

GENERATOR

The following protections will be provided for the generators:

(i) Reverse power
(ii) Voltage Restrained Over current
(iii) Stator earth fault
(iv) Loss of excitation
(v) Over frequency and under frequency
(vi) Over Voltage
(vii) Under Voltage
(viii) Differential
(ix) Negative phase sequence

6.18 STEP-UP TRANSFORMER

The following protections will be provided for step-up transformer:

33kVside

(i) Over current
(ii) Earth fault
(iii) Differential
(iv) O/C and E/F relay for line
(v) Backup earth fault

6.6 kV side

(i) Over current
(ii) Differential
(iii) Winding temperature alarm /trip

33 kV LINE

The following protections will be provided as composite relay for the 33 kV line.

(i) Under voltage

(ii) Over current & Earth Fault

6.19 Relay & Control Panels

The relay and control panel for the generator, step-up transformers/lines will house all the protective relays, meters, switches, etc.; as indicated in the single line diagram and the panels will be located in the control room .

6.20 LIGHTING SYSTEM

The power station lighting system will comprise the following:

Normal 240V AC Lighting

The lighting fittings, fans & receptacles will be fed from 415V, 3 phase, 4 wire, lighting panel which in turn will be fed from the 415V switchgear. The lighting will cover the entire power house areas like TG hall, control room / switchgear room, battery room, maintenance bay, stair case, entrance, transformer area, power house periphery, switchyard etc. The lighting system will be fed by DG to provide lighting to the plant during the grid failure condition.

D.C EMERGENCY LIGHTING

Emergency lamps through rechargeable units shall be used.

Earthing System:

The earth mat system shall comprise of closed current conductor grid of steel flats laid over the excavated surface of powerhouse and shall extend to the penstock/tailrace area, if required. The power house ground mat shall be interconnected with the switchyard mat to lower the earth resistance. The earth mat shall be connected to the following equipment/objects in the power house to switchyard.

i) The neutral point of each equipment through its own independent earth
ii) Equipment framework and other non-current carrying parts
iii) All extraneous metallic frame work not associated with equipment
iv) The earth point of lightning arrestors, capacitive voltage transformers, voltage transformers, coupling capacitors and lightning conductors through their permanent independent earth electrodes
v) Station Fence

The earthing conductor (steel flat) shall be of adequate cross-section to safely withstand the system fault current for time duration of fault clearance by the remotest/backup protective system. Sufficient allowances shall be provided for corrosion of the embedded conductor on account of chemical properties of soil and also due to galvanic action with other embedded systems.

The grounding system shall be designed with the following objectives:

i) To provide low impedance path to fault currents to ensure prompt and consistent operation of protective devices during ground faults.

ii) To keep the maximum voltage gradient along the surface inside and around the project complex within safe limits during ground faults.
iii) To protect the life and property from over voltage.
iv) To stabilize current potentials with respect to ground and limit the overall protection rise.

CHAPTER -7

Environmental & Ecological Aspects

7.1 ENVIRONMENTAL IMPACT ASSESSMENT

7.1.1 Daman Ganga SHP-2 envisages the power generation from existing releases of power outlets. Small hydel development project, while sharing all the benefits of hydro electric generation, harnesses a renewable source of energy in extremely environmentally benign manner. Social cost therefore are almost nil to even an environmental conscious state. Being small it does not involve any additional submergence or violation of the sanctity of forests.

7.1.2 The location of all the components of the project require minimum area of land which comes under Govt. of Gujarat, Irrigation Department. The location of power house is so taken that it requires minimum width and at a safe distance from the existing canal system from the safety point of view during excavation of power house foundation. It does not cause any environmental and ecological imbalance of the area.

7.1.3 The magnitude of construction activity will not induce migration of labour to this area, as sufficient local labour is available in the area, and thus local ecology will not be pressurized.

7.1.4 In addition, it is proposed to do plantation in the scheme area wherever possible.

7.1.5 The water will be passing through turbines for power generation and the surplus water will be discharged & into the existing canal through tail race channel in SHP -2. This project involve minimal acquisition of land which shall be taken on lease from irrigation department and no rehabilitation & resettlement issues are involved. Further no cutting of trees are involved in the project. Therefore no forest clearance is required for this project.

A standard questionnaire issued by Department of Environment for river valley project duly filled is given in Annex 7.1.

QUESTIONNAIRE ISSUED BY THE DEPARTMENT OF ENVIRONMENT

FOR RIVER VALLEY PROJECTS

7.0. Detailed basic information affecting the environment

7.01	Predominant existing land use (agricultural land reserve and the forests etc.) in project area and upto 10 km upstream	:	For agricultural purpose pattern
7.02	Break up of submerged area total submerged area (hectares)	:	SHP-2 on existing canal. No additional submergence is caused due to this small hydel scheme.
	Forest land	:	Nil
	Cultivated land	:	Nil
	Shrubs & fallow	:	Nil
	Rocky outcrop	:	Nil
	Wetland	:	Nil
	Open water	:	Nil
	Other use	:	Nil
7.03	(a) Forest type in Catchment and submerged areas.	:	Not Applicable
	(b) Extent and nature of forest to be cut for construction of roads, colony and other appurtenant works.	:	Nil
7.04	Duration of project's construction	:	Eighteen months

7.05	Estimated peak labour strength Skilled .....20 Unskilled..... 80 Labour to be recruited from affected population skilled ..... NIL unskilled.....NIL	:	No population would be affected by these project, however, labour required would be available from the area.
7.06	Population density in the area per sq. km.	:	Sparsly Populated.
7.07	Number of villages and population to be displaced of any village/No. of villages..Nil town Size of Village .... Nil Affected families in each Village ..... Nil ST ... SC .... Other ..... Nil	:	No displacement
	Occupation of the affected people Agriculture ..... Nil Industrial Labour ..... Nil Forest based ..... Nil Owner cultivators by size of land holdings :	:	There is no displacement of any population due to construction of the
	Marginal (1.0 hect.) Nil Small (1.0 – 2.5 hect.) Nil Medium (2.5 – 5.0 hect.) Nil Large (over 5.0 hect.) Nil		project. The information required is not relevant.
7.08	Resettlement Is a rehabilitation committee being Constituted ?	:	Resettlement is not required.
	Existing guidelines, if any for compensation.	:	Not required
	Level of compensation in cash and kind.	:	N.A.
	Number of oust families likely to be settled in new settlement.	:	N.A.
	Size of proposed new	:	N.A.

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	settlement.		
	Layout plans/masterplans for new settlement.	:	N.A.
	Distance of new settlements from the present habitant.	:	Not applicable
7.09	Number and type of facilities (e.g. School, post offices, bank, panchayat ghar, police station approach road, drainage and water supply etc.) proposed to be provided.	:	All these facilities are existing.
7.10	Is the affected area covered by development programmes like IED, SED, Drought prone area tribal development etc.	:	No
7.11	Any proposal to provide or create employment for outsees – nature and quantum of employment to be provided	:	There would be no outsees due to construction of the project.
7.12	What is the expected rate of siltation ?	:	Not applicable for this project.
	Is downstream area subject to flooding ?	:	Not applicable for this project.
7.13	Wind at Dam site (diagram giving statistical information concerning the direction and speed of the wind at the site.)	:	Not applicable for this project.
7.14	Hurricane, tonadoes, cyclones.	:	Nil
	Frequency of occurrence	:	Not applicable
	Wind velocity (Average)	:	Not available
7.15	Plan of area, on the reservoir periphery subject to erosion, slides and slips.	:	Not applicable

7.16	The depth of round water Table – Maximum Minimum	: :	Not applicable Not applicable
	Quality of ground water potable / non-potable / fit for irrigation / industry.	:	Potable
7.17	Paresent ground water use pattern in the command area under irrigation.	:	Only surface water from canals and pumping sets are used in the command area.
7.18	Based on the experience of similar projects in the area, specify the inter action between the altered surface water patterns and underground acquifers and their recharge.	:	This being hydel project, hence not applicable
7.2	Environmental status		
7.2.1	(a) Indicate known pollution sources in the region (indicate the industrial like chemicals, textiles and other-thermal power unit. Mining operations etc.)	:	Nil
7.2.2	Indicate the industrial and other development project likely to be taken up in the area during the next five to ten years.	:	The area has potential for further industrial development.
7.2.3	(a) Does the area support economically viable aquatic life, fish, crocodiles ?	:	No
	(b) Are there any fish / crocodile breeding ground in the river tributaries in the submergence ?	:	No

7.2.4	Does the site contain a wild life (including birds) habitat, breeding area, feeding area, migration route including the number of wild life available in the area.	:	No
7.2.5	Is the site a potential wild life sanctuary ?	:	No
7.2.6	Specify any rare or endangered species of flora and fauna found in the effected area alongwith their approximate number and measures to salvage / rehabilitate them.	:	No
7.2.7	Is the area a tourist resort ?	:	No
7.2.8	Are any monuments / sites of cultural, historical, religious, archeological or recreational importance including wild life sanctuaries, national parks etc. likely to be affected by the proposed project ? If so, details thereof.	:	No
7.2.9	Does the proposed area suffer from endemic health problems due to water / soil borne diseases ?	:	No
7.3	ENVIRONMENTAL IMPACTS		
7.3.1	What measures are planned to develop the site to enhance its aesthetic aspects (i.e. recreation and water sport facilities and picnic sites etc.	:	The project itself would develop aesthetic surroundings near the site.
7.3.2	Will the project help in flood control, reduction or even eradication of flood havoc down stream ?	:	N.A.

7.3.3	Are any changes in water salinity expected ? If yes, give details of proposed measures to counter act this.	:	No
7.3.4	Are problems of water logging envisaged in the command area ? If so, give details of proposed steps to combat the problem.	:	The project is not expected to change any existing situation.
7.3.5	Will the reservoir be used for fisheries development, fish culture as well as fish breeding, Crocodile farming etc ? If yes, give details thereof.	:	Not applicable
7.3.6	Will fish ladders / lift and like arrangements be provided to allow movements of important migratory fish population ?	:	Not applicable
7.3.7	Measures proposed to prevent grazing the cultivation on reservoir slopes to avoid erosion and premature silting up the impoundment.	:	Not applicable
7.3.8	Will any important natural resources (mineral, coal, timber etc.) be lost or their use precluded because of the presence or operation of the project ? If yes, specify the resource estimate loss	:	No.
7.3.9	What is potential loss in aquatic production on site up and down stream ? Fish and other useful animals and plants	:	No
7.3.10	Will the formation and use of the water body result in the introduction or enhancement of water borne diseases ?	:	Not applicable
7.3.11	Will the impounded	:	There is no additional

	reservoir lead to : -		reservoir due to this scheme.
	(i) Noxious aquatic weeds like salinia, water Hyacinth etc.	:	Nil
	(ii) Intermittent host (Vector) like snails, mosquitoes etc.	:	Nil
7.3.12	How will aquatic weeds be controlled in submerged areas so as to provide an improved habitat as for fishery exploitations.	:	No area would be submerged due to construction of the project.
7.3.13	Will the project induce adverse climatologically changes (regarding temperature. humidity, wind and precipitation including modifications to macro and micro climate	:	No
7.3.14	What impact is expected on geological factors (e.g. seismic impact or reservoir loading) ?	:	No impact
7.3.15	Indicate the magnitude of impact due to population pressure on :-	:	No impact
	(i) Felling of trees for firewood	:	Nil
	(ii) Forest fires	:	Nil
	(iii) Over grazing leading to depletion of the pastures	:	Nil
	(iv) Visual pollution and damage to scenic values.	:	Nil

7.3.16	What arrangements are being made (i) to meet fuel requirements of the labour force during construction period to prevent indiscriminate felling of trees for firewood ?	:	The question of indiscriminate feeling of trees for firewood does not rise. The arrangements of the fuel for labour would be made by the agencies constructing the project.	000411
	(ii) For compensatory aforestation ?	:	N.A.	
	(iii) To enforce anticipating Laws ?	:	Not applicable	
	(iv) To control flow of sediments and pollutants due to fertilizer and pesticide run-off for cultivated area.	:	Not applicable	
	(v) For restoration of land in construction areas (filling, grading and Reforesting etc. to Prevent erosion.	:	Not applicable	
	(vi) For soil conservation in the catchment ?	:	Not applicable	
7.4	Cost of Environmental studies and Project Management	:	Not applicable	
7.4.1	Provision for environmental studies / surveys need for this project.	:	Not applicable	
7.4.2	Cost of proposed remedial and mitigative measures, if any, to protect the environment.	:	Not required	
7.4.3	Has the cost of environmental studies / protection measures been considered in the cost benefit analysis of the project.	:	Not required	

CHAPTER -8

Construction Planning and Schedule

CHAPTER -8

CONSTRUCTION PLANNING AND SCHEDULE

8.0 CONSTRUCTION SCHEDULE

It is proposed to complete the project and commission SHP-2 in a period of 18 months from date of start of the project. The selection of the construction equipment has been made to achieve the objective of completion of Power House in least possible time. The method of construction based on the proposed equipment ensures that all the works are completed in a period of 18 months allowing a period of 2 months for tests on all the units to commission the same at suitable intervals. Detailed Construction Schedule is given as Annex 8.1.

8.1 MAGNITUDE OF WORKS

The various works required to be carried out for the completion of the project are classified under the following headings.

8.1.1 PRE-CONSTRUCTION ACTIVITIES

Pre-construction activities include the following:

i) Tendering process and Award of work.
ii) Preparation of Detailed Designs & Construction Drawings.
iii) Carrying out in-situ settlement test at power house site.

8.1.2 INFRASTRUCTURE FACILITIES

Infrastructure works include construction of buildings, roads workshops, job facilities comprising development of plant areas and arrangements for construction power and other preliminary works.

8.1.3 CIVIL WORKS

Civil works comprise the following:

i) Steel Penstocks
ii) Power house complex comprising Service Bay and Control Room etc
iii) Tail Race Channel
iv) Switchyard

8.1.4 ELECTRICAL WORKS

The electrical works involve installation of all generating units of power house, a switch yard and related auxiliaries and transmission system.

8.2 CONSTRUCTION PROGRAMME

8.2.1 INFRASTRUCTURE WORKS

Infrastructure works such as pre-construction surveys and investigations and the pre-construction facilities like establishing communication links, land acquisition, development of land for plant areas and quarries, construction of buildings, procurement of construction equipments/machinery and arrangements for construction power etc. will be carried out during the initial period of 6 months, where after the main works of the project will be taken up.

8.2.2 STEEL PENSTOCK/BY-PASS PIPE

The fabrication and erection of steel penstock by end of 10th month shall be completed.

8.2.3 POWER HOUSE AND APPURTENANT WORKS

The excavation of the surface power house shall be completed in 7th month; concreting works including the foundation for turbines shall be completed by 16th month from the start of the project.
Installation of hydro mechanical works and electro-mechanical equipment shall be completed by the 16th month from the start of the project.

8.2.4 TAIL RACE CHANNEL

The construction of outfall structure is also envisaged to be completed by the 16th month from the start of the project.

8.2.5 COMMISSIONING OF UNITS

Installation of generating units shall be started after the 1st stage concrete for a particular unit has been placed. The second stage concreting shall continue in co-ordination with the erection of generating plant and equipment. All the two units of SHP-2 are envisaged to be commissioned in 18 months from the date of start of project.

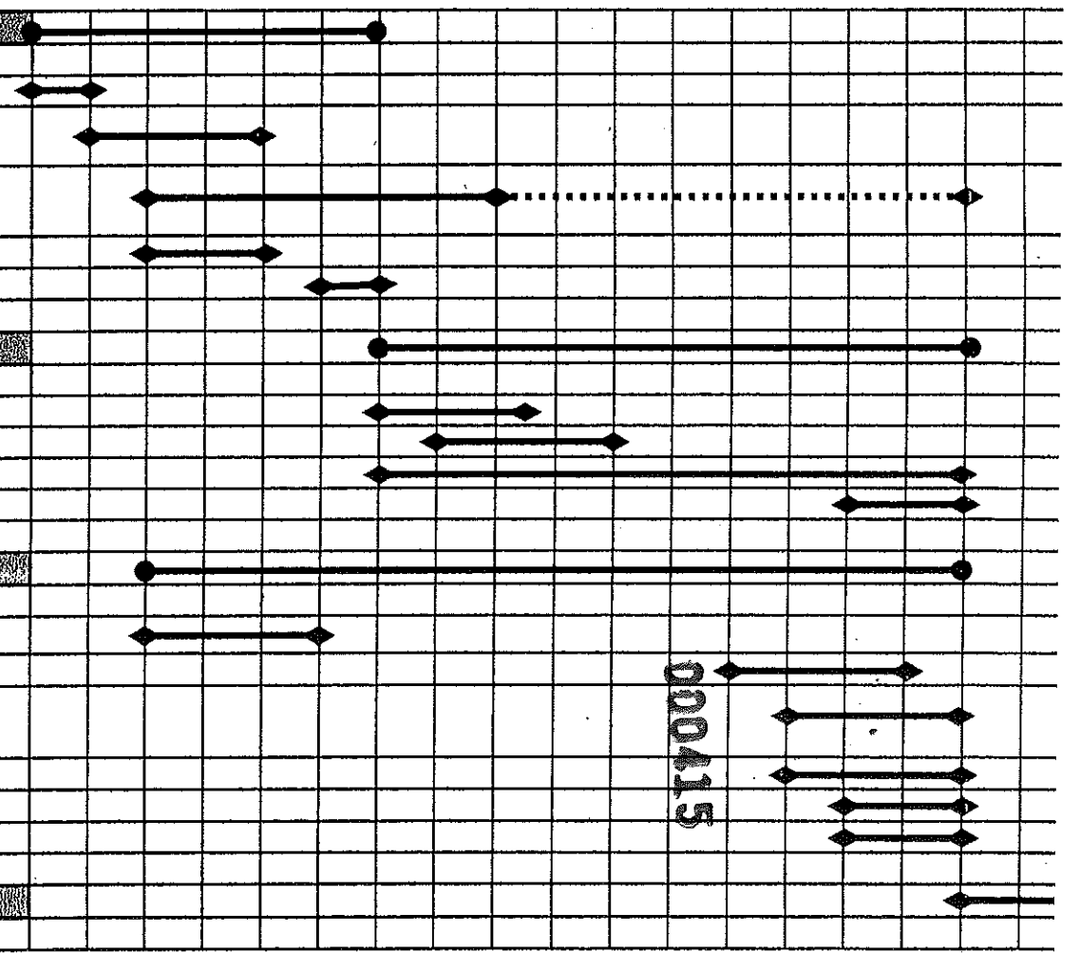
8.2.6 TRANSMISSION SYSTEM

The entire work will be so executed that the transmission lines are tested and commissioned in time to synchronize with the commissioning of the generating units

CONSTRUCTION SCHEDULE

DAMAN GANGA SHP-2 (2600 KW)

Sl. No.	Activity	Total Duration (Months)
1	**Pre Construction Activities**	8
1.1	Examination of DPR & Review	
1.2	Tendering Process & Award of work	
1.3	Detailed design & preparation of Construction Drawing	
1.4	Acquisition of Land	
1.5	Mobilisation of work Force	
2	**Construction of Civil Works**	9
2.1	Steel Penstock	
2.2	Bypass Pipe (Steel)	
2.3	Power House	
2.4	Tailrace Channel & Protection works	
3	**Electro-Mechanical Works**	14
3.1	Tendering Process & Award of work	
3.2	Reciept of Machines at Site	
3.3	Erection of Machines (Turbine & Generator)	
3.4	Erection of Control Panels	
3.5	Installation of Station Auxiliaries	
3.6	Switchyard	
4	**Testing & Commissioning**	2



CHAPTER -9

Cost Estimate

CHAPTER -9

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COST ESTIMATE

9.1 GENERAL

Power generated from SHP-2 with installed capacity of 2.6 MW is proposed to be transmitted to the nearest of GEB's 66KV sub-station at Rakholi which is about 4 Km from the proposed power house site.

9.2 COMPONENTS

The cost estimate of the project include the cost of steel penstocks, power house, tail race channel, hydro-mechanical equipments viz., draft tubes gates and electro-mechanical equipments comprising turbines, generators, transformers, auxiliaries, etc.

Provision has also been made for permanent residential and non-residential buildings, approach roads, and also for preliminary works i.e. topographical surveys, detailed surveys and investigations, preparation of feasibility, and detailed project reports, etc.

9.3 BASIS FOR ESTIMATION OF COST

All the project components are located in Valsad district of Gujarat. The rates given in Standard Schedule of Rates for civil works of Public Works Department, Govt. of Gujarat have been considered with suitable escalation, for working out the cost of various items of works.

The rates for various items of works have been adopted after taking into account the current rates of materials, labour and equipments prevalent in project area keeping in view the rates of items for similar works on Damanganga area.

The quantities of various items have been worked out from the drawings prepared for the project report. Lumpsum provisions for some items which cannot be quantified at this stage of project preparation are based on the experience of similar projects in the area.

9.4 ESTIMATED COST

The total cost of SHP-2 has been worked out as given in Table 9.1. The break-up of the estimated cost for this project is as given below.

S. No.	Description	SHP-2 (Rs. In Lakhs)
1	Civil Works (including Hydro-Mechanical Works)	417.00
2	Electro-Mechanical Works	1026.00
	Total	**1443.00**

9.5 Civil Works

9.5.1 Direct Charges - I. Works

000418

9.5.1.1 A - Preliminary

Provision under this sub-head has been made for expenditure on reconnaissance survey, topographical surveys, geotechnical investigations. The provision also covers the cost of preparation of feasibility and detailed project reports, preparation of tender documents, and detailed engineering including construction drawings, etc. Detailed break up of total cost under this sub-head has been given at **Annex 9.1.1**

9.5.1.2 B - Land

The land for both the power houses will be made available to the private dwelper on lease for a period of 35 years by irrigation department. Therefore only lease charges have been considered and the detailed break-up of total cost under this sub-head is given at **Annex 9.1.2**

9.5.1.3 C - Works

Provision for all civil works, include Intake, Penstock, By pass Arrangement, power house, switchyard, tail race, Spillway Channel etc. has been made on the basis of preliminary designs and drawings. Provision for hydro-mechanical works such as regulating gates and butterfly valves has also been made. Lump sum provision has been made wherever so warranted.

Detailed break-up of total cost is given in **Annex 9.1.3 (3 sheets)**

9.5.1.4 K - Buildings

Provision under this sub-head has been made to cover the cost of permanent residential buildings. The permanent buildings are proposed to be located near power house site for operation and maintenance staff. The plinth area of the permanent residential buildings is as per prevailing norms for different categories of staff. Detailed break-up of total cost is given in **Annex 9.1.4**

9.5.1.5 M – Plantation

A lumpsum provision has been made for plantation of trees in the project area as given at **Annex 9.1.5**

9.5.1.6 **O – Miscellaneous**

Provision under this sub-head has been made to cover expenditure on different amenities and facilities for staff, construction power, running and maintenance of inspection vehicles, ancillary camp facilities and other miscellaneous items. This also includes the capital cost as also the maintenance of electrification, water supply, sewage disposal and storm water devices. It has been worked out as 3% of cost of I-works less cost of A-Preliminary & B-Land. **(Refer Abstract of Cost) – Tables 9.1.**

9.5.1.7 **P – Maintenance**

Provision under this sub-head has been made to cover expenditure on maintenance of works during construction.

This has been worked out @ 1% of cost of I-Works less cost of A-Preliminary & B-Land. **(Refer Annex 9. 1.6).**

9.5.1.8 **R – Communication**

The requirement of new approach roads to power house will be minimum as infrastructure is already available for both the power houses. However provision of Rs. 10 Lakhs has been considered as given at **Annex 9.1.7**

9.5.1.9 **Project Management**

Provision for project management charges has been made @ 5% of the cost of I-Works (less B-Land). **(Refer Abstract of Cost-Table 9.1).**

9.6 **Electro-Mechanical Works**

Provision under this has been made to cover the cost of generating units, switchgear and control panels, transformer, etc., overhead travelling crane and other items of equipment including taxes & duties, transportation, supervision of E&M charges etc. Budgetary prices have been obtained from the suppliers of the generating units. The prices of auxiliary equipment are based on the prevailing prices.

The total cost is given in **Table 9.1** for the **E & M Equipment** and annexure 9.1.8

9.7 **Transmission Line**

The total length of 11/33 KV transmission will be 4 Km up to existing GEB's 66 KV substation at Rakholi. Transmission Line cost has been considered in SHP-1.

TABLE 9.1

ABSTRACT OF PROJECT COST SHP-II

S. No.	Name of Item	Estimated Cost (Rs. In Lakhs)	Reference Annex
I.	**Works**		
1	A - Preliminary	22.00	9.1.1
2	B - Land	20.00	9.1.2
3	**C - Works**		
	Intake Structure, Penstock and Bypass structure	140.91	
	Power House and Tail-race Channel	137.35	9.1.3
	Spill Channel	32.65	
	Total C-Works (Including A & B)	**352.91**	
4	K - Buildings	4.80	9.1.4
5	M- Plantation	0.50	9.1.5
6	O - Miscellaneous @ 3% of I Works (Excluding items 1 and 2)	10.02	
7	P - Maintenance	5.00	9.1.6
8	R - Communication	3.00	9.1.7
	Total I-Works	**376.23**	
9	Contigencies @ 3% of C- Works	9.32	
10	Charges for Project Management during construction including charges for construction supervision @ 5% of I-Works less B- Land	17.81	
	Total (item 1 to 10)	**403.36**	
II.	**Indirect Charges**		
11	Consultancy charges, Hire charges, administrative expenses, foreign travel expenses, proffessional charges, subscription, bank charges, entertainment charges and other charges for obtaining liecense etc.	10.00	
12	Indirect Charges @ 1% of I- Works to cover audit and accounts charges	3.76	
	Total Cost of Civil Works	**417.12** **Say 417**	
	Total Cost of Electro - Mechanical Equipment	**1026.00**	9.1.8
	Total Project Cost	**1443.00**	

A- PRELIMINARY

Annex 9.1.1

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	(a) Reconnaissance survey including visit to site, identification of project area, topographical surveys, geological surveys etc. and preparation of feasibility report and observanation and detailed project report.	LS	7.00
2	Detailed Engineering Design and Construction Drawings for Civil works and checking of vendor Drawings for Hydro-Mechanical and Electro-Mechanical works.	LS	15.00
	TOTAL		**22.00**

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B- LAND

Annex 9.1.2

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. in Lakhs)
1	Acquisition of Government Land from Irrigation Deptt. Including leagal charges	LS	20.00
	TOTAL		20.00

INTAKE STRUCTURE, PENSTOCK AND BY-PASS STRUCTURE

S. NO.	ITEM	UNIT	QUANTITY	RATE	AMOUNT (Lakh Rs.)
1	Canal diversion and care of canal during construction	LS	1	200000	2.00
2	Excavation in all type of rock requiring controlled blasting for all leads and lifts including dewatering and disposal of excavited metarial to earmarked dumping sites.	Cum	1500	250	3.75
3	Compacted backfill with selected earth including all leads an lifts in all respects.	Cum	200	80	0.16
4	Providing and placing in position vivrated cement concrete at specify temperature for plain/reinforced concrete including cost of cement and agreegate, cost of form works, vibration, finishing, curing, and cleaning but excluding cost of reinforcement steel.				
	I) M-10	Cum	150	2000	3.00
	II) M-20	Cum	750	4000	30.00
5	Providing, fabricating and placing in position Tor Steel reinforcement for RCC works including cleaning, stratining, cutting, bending, lapping, welding wherever required, binding with 1.25 mm dia anneled steel wire includiong cost of all metarials, machinery, labours etc. as directed and complete with all leads and lifts.	MT	75	35000	26.25
6	Providing and fixing in position Steel Penstock including By-pass pipe of dia 2.74 m, 12 mm thick confirming to IS:2002 grade III including fabrication stiffeners complete in all respects.	MT	41	75000	30.75
7	Butter Fly valve	Nos.	2	2000000	40.00
8	Miscellancus	LS	1	500000	5.00
	TOTAL				140.91

POWER HOUSE AND TAILRACE

S. NO.	ITEM	UNIT	QUANTITY	RATE	AMOUNT (Lakh Rs.)
1	Excavation in all type of rock requiring controlled blasting for all leads and lifts including dewatering and disposal of excavited metarial to earmarked dumping sites.	Cum	4500	250	11.25
2	Compacted backfill with selected earth including all leads an lifts in all respects.	Cum	1350	80	1.08
4	Providing and placing in position vivrated cement concrete at specify temperature for plain/reinforced concrete including cost of cement and agreegate, cost of form works, vibration, finishing, curing, and cleaning but excluding cost of reinforcement steel.				
	I) M-10	Cum	120	2000	2.40
	II) M-20	Cum	1100	4000	44.00
	III) M-25	Cum	50	5000	2.50
4	Providing, fabricating and placing in position Tor Steel reinforcement for RCC works including cleaning, stratining, cutting, bending, lapping, welding wherever required, binding with 1.25 mm dia anneled steel wire includiong cost of all metarials, machinery, labours etc. as directed and complete with all leads and lifts.	MT	115	35000	40.25
5	Providing and laying random rubble stone masonry in CM 1:4	Cum	150	2000	3.00
6	Providing and fixing railing in position complete in all respects.	RM	50	400	0.20
7	Providing and fixing gates (1 Nos. of 5.3 m x 2.45 m, 1 No.of 8.0 m x 1.8m and 1 No. of 10.0m x 2.2m) in position including supply of all metarials, fabrication, erection, hoisting arrangement and complete in all respects.	LS	3	450000	13.50

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8	Providing and fixing of raw water drainage pipes (150 mm dia) including cost of Bends, Collars and jointing metarials and complete in all respects.	RM	80	2000	1.60
9	Providing and fixing in position M.S. Rolling shutter with frame including cost of all fittings,cost of all material and complete in all respects.	SQM	25	2200	0.55
10	Providing and fixing/installations in position Alluminium glazed doors/windows with frames including cost of all fittings, metarials, finishing and completing all respects.	SQM	40	2200	0.88
11	Providing and placing of 250 x 250 mm size terrazzo tiles over 30 mm thick Cement Concrete base flooring including cost of all materials, finishing and complete in all respects.	SQM	100	500	0.50
12	Providing and placing of 50 mm thick acid-proof/chemical resistant tiles in floors and walls of Battery room including the cost of all materials, finishing and concrete in all respects.	SQM	21	1600	0.34
13	Supply, fabrication and fixing of tubular trusses, structural steel works including roof covering and complete in all respects	LS	1	400000	4.00
14	Sanatery and water supply arrangement for power house.	LS	1	300000	3.00
15	Civil works of switchyard.	LS	1	300000	3.00
16	Providing and placing white glazed tiles in toilet.	SQM	20	1500	0.30
17	Miscellanous	LS	1	500000	5.00
	TOTAL				**137.35**

000425

SPILL CHANNEL

S. NO.	ITEM	UNIT	QUANTITY	RATE	AMOUNT (Lakh Rs.)
1	Excavation in all type of rock requiring controlled blasting for all leads and lifts including dewatering and disposal of excavited metarial to earmarked dumping sites.	Cum	4000	250	10.00
2	Compacted backfill with selected earth including all leads an lifts in all respects.	Cum	12600	100	12.60
4	Providing and placing in position vivrated cement concrete at specify temperature for plain/reinforced concrete including cost of cement and agreegate, cost of form works, vibration, finishing, curing, and cleaning but excluding cost of reinforcement steel.				
	I). M-10	Cum	100	2000	2.00
	II) M-20	Cum	25	4000	1.00
4	Providing, fabricating and placing in position Tor Steel reinforcement for RCC works including cleaning, stratining, cutting, bending, lapping, welding wherever required, binding with 1.25 mm dia anneled steel wire includiong cost of all metarials, machinery, labours etc. as directed and complete with all leads and lifts.	MT	3	35000	1.05
5	Providing and laying random rubble stone masonry in CM 1:4	Cum	200	2000	4.00
17	Miscellanous	LS	1	200000	2.00
	TOTAL				32.65

K- BUILDINGS

PERMANENT RESIDENTIAL BUILDINGS

Provision under this sub-head has been made to cover the cost of permanent residential buildings, which shall be located near power house site for operational and maintenance staff.

000427

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	Residential Buildings for station incharge, switch board attendent/turbine operator, helpers and watch-men.	LS	4.80
	TOTAL		4.80

M- PLANTATION

Annex 9.1.5

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. in Lakhs)
1	A Lumpsum provision has been made for plantation of trees in the project area.	LS	0.50
	TOTAL		0.50

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P- MAINTENANCE

Annex 9.1.6

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	Maintenance of work during construction	LS	5.00
	TOTAL		**5.00**

000429

R- COMMUNICATION

Annex 9.1.7

S.No.	Name of Item	Raten(Rs.)	Amount (Rs. In Lakhs)
1	Construction of Approch Road to power house.	LS	3.00
	TOTAL		**3.00**

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COST ESTIMATE OF DAMAN SHP-II

ELECTRO-MECHANICAL WORKS- (1x2.6 MW)

Generator , Turbine & Accessories

000431

SL. No.	Item Particulars	Qty.	Rate (Rs.Lakhs)	Amount (Rs. Lakhs	E D 16.48%	CD 10%	Total (Rs. Lakhs)
1	2	3	4	5	6		7
1	(a) Supply of 1x2.6 MW, 250 rpm, 13.0 m head, vertical shaft Kaplan turbine with matching 3.3 kV, 1.5 MW 0.85 pf, 50 Hz, generating sets including MIV, excitation system, AVR, centralised lubrication system, HP/LP compressed air system, unit control boards, instrumentation, drainage and dewatering system, cooling water system etc. including spares (b) 3.3 kV, 500 amps,S/C XLPE cables along with terminal equipment comprising of NG cubicles, 3.3 kV LAVT cubicle etc. (c) Lube oil & turbine oil for first filling	1 No.		832.16		83.22	915.38
2	3.3/33kva, 3 phase, 50 Hz, 3.0 MVA, Generator transformer along with all accessories & first filling of oil.	1	12 Rs 350 per kVA	12.00	1.92		13.92
3	Station Auxiliary transformer 3.3/.433 kV, 150 kVA, 3 phase, 50 Hz	1	3 Rs.	3.00	0.48		3.48
4	LTAC switchgear for aux.supply to power house and outdoor switchyard	1 set	6.00	6.00	0.96		6.96
5	110 V, 200 Ah battery with boost and float chargers, DCDB and emergency lighting	1 Set	5.00	5.00	0.80		5.80
6	Power station communications 25 lines EPABX & PA system		2.00	2.00	0.32		2.32
7	62.5 kVA, 415 V Diesel Generating for emergency power supply	2 Set	5.00	10.00	1.60		11.60
8	Power & control cables for PH and switchyard	LS	6.00	6.00	0,96		6.96
9	Cable racks & trays	LS	1.00	1.00	0.16		1.16
10	Power House earthing & materials	LS	1.00	1.00	0.16		1.16
11	Illumination of power house & switchyard	LS	1.00	1.00	0.16		1.16

12	Fire fighting equipment for power house, transformers, cable gallery and detection & alrarm system	LS	2	2	0.33		2.33
13	Ventilation & air conitioning power house and control room	LS	2	2	0.33		2.33
14	Transformer oil filteration & oil storage plants, piping and turbine oil purification plant	LS	2	2	0.33		2.33
15	Filtered water for power house	LS	1	1	0.16		1.16
16	33 kV, SF6 circuit, 630 Amps 12.5 kA breaking current capacity	3	4.00	12.00	1.98		13.98
17	33 kV, isolators with/without earthing blade,630 A, 12.5 kA	6	0.40	2.40	0.40		2.80
18	33 kV Current transformers	3	0.60	1.80	0.30		2.10
19	33 kV potential transformers	3	0.60	1.80	0.30		2.10
20	30 kV, gapless type Lightning arrestors	3	0.60	1.80	0.30		2.10
21	Post Insulators	4	0.20	0.80	0.13		0.93
22	Busbar conductor, earthwire, connectors, insulators,hardwares and miscellaneous accessories	LS		5.00	0.82		5.82
23	Galvanised steel structure for gantries and equipment	8 MT	0.60	4.80	0.79		5.59
24	Misc. items like gate,fencing, transformer track etc	LS		3.00	0.49		3.49
26	Cost of civil works			3.00			3.00
27	Contingencies , Spare etc.						6.05
	Total						1026.00

CHAPTER 10

FINANCIAL ANALYSIS

10. FINANCIAL ANALYSIS

10.1 Introduction to financial analysis

The financial analysis for Daman Ganga SHP-2 has been carried out to ascertain the financial viability of the scheme.

The financial analysis consists of a cash flow during the project life. The financial evaluation suggests the Internal Rate of Return (IRR) of the project, and debt service cover ratio (DSCR), payback period, return on equity and return on investment.

10.2 Major Assumptions

Assumptions and inputs for financial analysis are presented in TABLE 10-1. Major assumptions made for the financial evaluation are as follows:

10.2.1 Project Cost

Base Cost

Cost of the project is taken as discussed in the previous chapter. The cost is estimated in the base year of July 2007.

Escalation in cost

As the implementation period is less, escalation has not been accounted.

IDC

Interest during construction is worked out based on the disbursement of cash flow. The interest rate is taken as 13.00% p.a.

Phasing

Capital cost for the project will be disbursed during the project construction period of 18 months. A linear disbursement of funds has been considered from 0% to 100% during the construction period of 18 months.

10.2.2 Financing

It is assumed that the project shall be financed at an interest of 13.0% p.a. 70% of capital cost is considered for debt, which shall be paid back in 8 years after 18 months of construction period.

10.2.3 Energy Benefits

The financial analysis is based on the energy output on 75% dependable year flows as per current practice and guidelines for small hydropower projects.

0.5% auxiliary consumption, 0.5% transformation and 1% transmission losses have been considered.

The rate of energy per KWH is taken as Rs. 2.90 for Damanganga SHP-2 without escalation.

Water royalty of Rs. 0.23 per unit (KWh) has been considered for financial evaluation of the project.

10.2.4 Annual Costs

Annual operation and maintenance expenses and insurance costs have been taken as 1.5% of the capital cost, which shall be escalated by 4% annually.

10.2.5 Depreciation

Straight line method depreciation is calculated to 2.57 % p.a. for the project life of 35 years with 10% salvage value. No depreciation is taken in the value of land.

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10.2.6 Tax

To promote the hydro power development, the Govt has declared the tax holiday for first 10 years. After 10 years of generation 35 % tax is taken in financial analysis.

10.2.7 Tariff

Tariff per unit of energy has been worked out with 14% return on equity.

10.2.8 Others

Economic life of the project is 35 years.

Discount rate is taken as 12%.

10.3 Major Financial Results

The financial analysis is presented as per following:

A: Daman Ganga Dam Toe Small Hydropower Project-2

10.4 Financial Indicators

Based on the base case parameters, the financial parameters of the project over the project life of 35 years are as given below:

PARAMETERS	SHP-2
FIRR ON NET CASH-FLOW (TOTAL CAPITAL)	18.17%
FIRR ON NET CASH-FLOW (EQUITY CAPITAL)	21.65%

10.5 Cost of Generation

Cost of generation with 14% return on equity is worked out as per TABLE 10.7 The results are as given below:

PARAMETERS	SHP-2
Cost of Generation in First year Without Return on Equity	Rs.2.0
Cost of Generation in First year With Return on Equity	Rs.2.57
Levellised Cost of Generation (With Return on Equity) @ 12% Discounting rate	Rs.2.10

10.6 Conclusions and Recommendations

The above financial analysis have been carried out based on assumptions for funds and financing available in India, and the construction cost, as well as the energy purchase rate of Rs.2.90 per unit for Damanganga SHP-2 without escalation.

The levellised tariff (with 14% return on equity) for 35 years of project life @ 12% discounting rate works out to Rs. 2.10 per KWh. The FIRR and DSCR show that the project is commercially viable @ sale price of Rs. 2.90 KWh.

NOTE: ALL FIGURES IN LACS

INPUT DATA SHEET

TABLE-10.1 000437

Name of the Project				DAMAN GANGA DAM TOE SHP-2
Installed Capacity of Project in KW	(1 X 2600 KW)			**2600**
Costs				
Cost of Land				**20.00**
Estimated Cost of Civil Works				**397.00**
Estimated Cost of E&M Works i/c Transmission Works				**1026.00**
Others				**0.00**
Total Cost				**1443.00**
Inflation in Cost per Year				**5.00%**
Financing & Other Expenses (% 0f Projected Cost)				**1.00%**
Working Capital				
Period in Months of O&M Expenses				**1**
Period in Months of receivable revenue				**2**
Cost for Maintenance Spares for Working Capital L.S per Year				**2.00**
Escalation in Maintenance Spares for Working Capital per Year				**4.00%**
Margin Money as % of Working Capital				**30.00%**
Implementation Period Proposed in Years				**2**
First Year of Implementation				**2007**
Phasing of Expenditure (% of Capital Cost)				
First Year				**2%**
Second Year				**30%**
Third Year				**68%**
Expenses				
O&M Expenses including Insurance % of Projected Capital Cost				**1.50%**
Escalation in O&M every Year				**4.00%**
Energy				
Generated Units in Millions in	**75%** Dependable Year			**11.63**
Auxiliary Consumption				**0.50%**
Loss due to Transformation				**0.50%**
Loss due to Transmission				**1.00%**
Water Royalty		**@ Rs.**	**0.23**	**per KWh**
Energy Unit Price				
Basic Selling Price in First Generation Year in Rupees				**2.90**
Escalation in Selling Price per year				**0.00%**
Interest Rate				
Interest Rate on Term Loan				**13.00%**
Interest rate on Working Capital				**13.50%**
Period for Repayment of Term Loan (in years)				**7**
Debt Equity Ratio				
Without Interest During Construction (IDC)				
Equity				**31.45%**
Loan				**68.55%**
With IDC				
Equity				**29.8%**
Loan				**70.2%**

NOTE: ALL FIGURES IN LACS

INPUT DATA SHEET

TABLE-10.1 000438

Name of the Project		DAMAN GANGA DAM TOE SHP-2
Depreciation		
Salvage Value (% of the Cost)		10.00%
For Civil Works & Others		2.57%
For E&M Works		2.57%
For Calculation As per I. T. Act		
For Civil Works		15.00%
For E&M Works		15.00%
Tax		
MAT including Serice Tax & Cess for Fist 10 years of generation (Tax Free Years)		11.24%
Tax rate including Serice Tax & Cess on Taxable Income after 10 years		33.71%
Tariff Calculation		
Life of the Project		35
Discounting Factor		12.00%
Return on Equity		14.00%
Subsidy Consideration	Yes/ NO	Yes
Source of Subsidy		
As per MNES policy, the capital subsidy may be available after commissioning of the project at the end of generation year		1
Amount of Subsidy shall be	(Rs. Lacs)	241.08
Carbon Credit Consideration	Yes/ NO	NO
Amount of carbon credit shall be per annum	(Rs. Lacs)	0.00

SUBSIDYAS PER DEC 2006 (NEW)

KW	Amount in Lacs =1.5*P^0.646	Increament
1000	130.0	
1500	169.0	38.9
2000	203.5	34.5
2500	235.1	31.6
3000	264.4	29.4
3500	292.1	27.7
4000	318.4	26.3
4500	343.6	25.2

DAMAN GANGA DAM TOE SHP-2

TABLE 10-2

CAPITALIZED COST & ENERGY CALCULATIONS

Inflation Rate = 5.00% (ALL COST FIGURES IN LACS)

Phasing of Expenditures

Year		Phasing	Cost	Civil Works & Others	E & M Works & Land	No of Months	Escalation in Civil works only	Projected Cost
1	2007	2%	28.86	7.94	20.92	6.00	0.10	28.96
2	2008	30%	432.90	119.10	313.80	12.00	5.96	438.86
3	2009	68%	981.24	269.96	711.28	6.00	23.62	1004.86
TOTAL		**100.00%**	**1443.00**	**397.00**	**1046.00**	**24.00**	**29.68**	**1472.68**

Calculation of Interest During Construction

Interest Rate = 13.00%

Year		Phasing of Loan (% of Projected Cost)		Opening Balance	Loan During The Year	No of Months	Interest During Const	Closing Balance
1	2007	2.00%	19.85	0.00	19.85	6.00	0.65	20.50
2	2008	30.00%	300.84	20.50	300.84	12.00	22.22	343.55
3	2009	68.00%	688.83	343.55	688.83	6.00	44.72	1077.10
			1009.52		**1009.52**	24.00	**67.58**	**1077.10**

Debt with IDC and Equity

Year		Projected Cost	Financial & Other Expenses	Intt. During Const.	Equity	Loan	Total Cost
1	2007	28.96	0.29	0.65	9.11	20.79	29.89
2	2008	438.86	4.39	22.22	138.02	327.44	465.46
3	2009	1004.86	10.05	44.72	316.03	743.60	1059.63
TOTAL		1472.68	14.73	67.58	**463.16**	**1091.83**	**1554.98**

Debt Equity Ratio

	Without IDC	% of Total Cost	With IDC	% of Total Cost
Total Cost	1472.68		1554.98	
Equity =	463.16	**31.45%**	463.16	**29.8%**
Loan =	1009.52	**68.55%**	1091.83	**70.2%**

Energy Generated and Saleable (Million Units)

Generated Units in Millions in	**75%**	**Dependable Year**		**11.630**
Auxiliary Consumption		@	0.50%	0.058
Loss due to Transformation		@	0.50%	0.058
Loss due to Transmission		@	1.00%	0.116
Net Energy at Bus Bar				**11.397**

DAMAN GANGA DAM TOE SHP-2
FINANCIAL EVALUATION
PROFITABILITY STATEMENT

TABLE 10-3

Details	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Energy (MU) for Sale in 75%	Dependable Year		11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397
Energy Unit Price in Rs.			2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900
Revenue from sale of energy in Lacs in Rs.			330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525
Carbon Credit			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Revenue in Lacs in Rs.			330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52
Expenses												
Capital Cost I/c IDC= *1555.0* Lacs												
O&M including Insurance @ *1.50%*	0.00	0.00	23.32	24.26	25.23	26.24	27.29	28.38	29.51	30.69	31.92	33.20
PBIDT	*0.00*	*0.00*	*307.20*	*306.27*	*305.30*	*304.29*	*303.24*	*302.15*	*301.01*	*299.83*	*298.60*	*297.33*
Depreciation			39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Interest on Term Loan @ *13.00%*			139.38	92.37	79.12	65.87	52.62	39.37	26.13	12.88	5.72	5.74
& Working Capital @ *13.50%*												
Water Royalty @ 0.23	Rs. per KWh		26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
Total Expenses			228.33	182.25	169.97	157.73	145.53	133.38	121.26	109.20	103.26	104.56
Operational Profit Before Tax			102.19	148.28	160.55	172.79	184.99	197.15	209.26	221.33	227.26	225.97
Taxation			0.00	0.00	0.00	0.95	11.72	15.11	18.19	21.01	22.92	23.83
Profit after Tax			102.19	148.28	160.55	171.84	173.27	182.04	191.07	200.32	204.34	202.14
Add Depreciation			39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Cash Accruals before Loan Installment			141.60	187.68	199.96	211.25	212.68	221.45	230.48	239.72	243.75	241.54
Installment for Loan repayment			136.48	102.04	102.04	102.04	102.04	102.04	102.04	102.04	0.00	0.00
Cash Accruals after Loan Installment			5.12	85.65	97.92	109.21	110.64	119.41	128.44	137.69	243.75	241.54
Cumulative Cash Accruals			5.1	90.8	188.7	297.9	408.5	528.0	656.4	794.1	1037.8	1279.4
Return on Equity (Without Depreciation)			1.11%	18.49%	21.14%	23.58%	23.89%	25.78%	27.73%	29.73%	52.63%	52.15%
Return on Equity (on PAT)			22.06%	32.01%	34.67%	37.10%	37.41%	39.30%	41.25%	43.25%	44.12%	43.64%

FIRR on Net Cash-Flow (Total Capital) 18.17%
FIRR on Net Cash Flow (Equity Capital) After tax 21.65%

000440

DAMAN GANGA DAM TOE SHP-2
FINANCIAL EVALUATION
PROFITABILITY STATEMENT

TABLE 10-3

Details	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25
OPERATION YEAR	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*
Energy (MU) for Sale in 75%	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397
Energy Unit Price in Rs.	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900
Revenue from sale of energy in Lacs in Rs.	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525
Carbon Credit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Revenue in Lacs in Rs.	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52
Expenses													
Capital Cost t/c IDC= *1555.0* Lacs													
O&M including Insurance @ *1.50%*	34.53	35.91	37.34	38.84	40.39	42.01	43.69	45.43	47.25	49.14	51.11	53.15	55.28
PBIDT	*296.00*	*294.62*	*293.18*	*291.69*	*290.13*	*288.52*	*286.84*	*285.09*	*283.27*	*281.38*	*279.42*	*277.37*	*275.25*
Depreciation	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Interest on Term Loan @ *13.00%*	5.76	5.78	5.80	5.83	5.85	5.88	5.90	5.93	5.96	5.99	6.02	6.06	6.09
& Working Capital @ *13.50%*													
Water Royalty @ 0.23	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
Total Expenses	105.91	107.31	108.77	110.29	111.87	113.51	115.21	116.99	118.84	120.76	122.75	124.83	126.99
Operational Profit Before Tax	224.62	223.21	221.76	220.24	218.66	217.02	215.31	213.54	211.69	209.77	207.77	205.69	203.53
Taxation	73.73	75.55	77.00	78.15	79.02	79.66	80.10	80.37	80.48	80.46	80.31	80.07	79.72
Profit after Tax	150.88	147.66	144.75	142.09	139.64	137.35	135.21	133.17	131.21	129.31	127.46	125.63	123.81
Add Depreciation	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Cash Accruals before Loan Installment	190.29	187.07	184.16	181.50	179.05	176.76	174.62	172.58	170.62	168.72	166.87	165.04	163.22
Installment for Loan repayment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Accruals after Loan Installment	190.29	187.07	184.16	181.50	179.05	176.76	174.62	172.58	170.62	168.72	166.87	165.04	163.22
Cumulative Cash Accruals	1469.7	1656.7	1840.9	2022.4	2201.4	2378.2	2552.8	2725.4	2896.0	3064.7	3231.6	3396.6	3559.9
Return on Equity (Without Depreciation)	41.09%	40.39%	39.76%	39.19%	38.66%	38.16%	37.70%	37.26%	36.84%	36.43%	36.03%	35.63%	35.24%
Return on Equity (on PAT)	32.58%	31.88%	31.25%	30.68%	30.15%	29.66%	29.19%	28.75%	28.33%	27.92%	27.52%	27.12%	26.73%

FIRR on Net Cash-Flow (Total Capital) 18.17%
FIRR on Net Cash Flow (Equity Capital) Afte 21.65%

000441

DAMAN GANGA DAM TOE SHP-2
FINANCIAL EVALUATION
PROFITABILITY STATEMENT

TABLE 10-3

Details	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
Energy (MU) for Sale in 75%	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397	11.397
Energy Unit Price in Rs.	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900	2.900
Revenue from sale of energy in Lacs in Rs.	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525	330.525
Carbon Credit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Revenue in Lacs in Rs.	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52	330.52
Expenses												
Capital Cost I/c IDC= *1555.0* Lacs												
O&M including Insurance @ *1.50%*	57.49	59.79	62.18	64.67	67.25	69.94	72.74	75.65	78.68	81.82	85.10	88.50
PBIDT	*273.04*	*270.74*	*268.34*	*265.86*	*263.27*	*260.58*	*257.78*	*254.87*	*251.85*	*248.70*	*245.43*	*242.02*
Depreciation	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Interest on Term Loan @ *13.00%*	6.12	6.16	6.20	6.24	6.28	6.32	6.37	6.41	6.46	6.51	6.57	6.62
& Working Capital @ *13.50%*												
Water Royalty @ 0.23	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
Total Expenses	129.24	131.57	134.00	136.53	139.16	141.89	144.73	147.69	150.76	153.96	157.29	160.74
Operational Profit Before Tax	201.29	198.95	196.52	194.00	191.37	188.63	185.79	182.84	179.76	176.56	173.24	169.78
Taxation	79.29	78.78	78.19	77.54	76.83	76.05	75.21	74.32	73.37	72.37	71.32	70.20
Profit after Tax	122.00	120.17	118.33	116.45	114.54	112.58	110.58	108.51	106.39	104.19	101.92	99.58
Add Depreciation	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Cash Accruals before Loan Installment	161.41	159.58	157.74	155.86	153.95	151.99	149.99	147.92	145.80	143.60	141.33	138.98
Installment for Loan repayment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash Accruals after Loan Installment	161.41	159.58	157.74	155.86	153.95	151.99	149.99	147.92	145.80	143.60	141.33	138.98
Cumulative Cash Accruals	3721.3	3880.9	4038.6	4194.5	4348.4	4500.4	4650.4	4798.3	4944.1	5087.7	5229.0	5368.0
Return on Equity (Without Depreciation)	34.85%	34.46%	34.06%	33.65%	33.24%	32.82%	32.38%	31.94%	31.48%	31.00%	30.51%	30.01%
Return on Equity (on PAT)	26.34%	25.95%	25.55%	25.14%	24.73%	24.31%	23.87%	23.43%	22.97%	22.50%	22.01%	21.50%

FIRR on Net Cash-Flow (Total Capital) 18.17%
FIRR on Net Cash Flow (Equity Capital) Afte 21.65%

000442

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-2

CALCULATION OF DEPRECIATION **TABLE 10-4**

Cost with IDC

Land	21.55
Civil Works	427.81
E & M Work	1105.62
Others	0.00
Total Cost	1554.98 Lacs

Year				Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
OPERATION YEAR				*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
I. AS PER I. E. ACT (SLM)														
Salvage Value	10.00%													
Depreciation @														
on Land	21.55	@	0.00%			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
on Civil Works & Others	427.81	@	2.57%			**10.99**	**10.99**	**10.99**	**10.99**	**10.99**	**10.99**	**10.99**	**10.99**	**10.99**
on E&M Works	1105.62	@	2.57%			**28.41**	**28.41**	**28.41**	**28.41**	**28.41**	**28.41**	**28.41**	**28.41**	**28.41**
Total Depreciation						**39.41**	**39.41**	**39.41**	**39.41**	**39.41**	**39.41**	**39.41**	**39.41**	**39.41**
II. AS PER INCOME TAX														
Civil Works & Others		@	15.00%											
	Opening Cost					427.81	363.64	309.09	262.73	223.32	189.82	161.35	137.15	116.57
	Depreciation					64.17	54.55	46.36	39.41	33.50	28.47	24.20	20.57	17.49
	Written Down Value					363.64	309.09	262.73	223.32	189.82	161.35	137.15	116.57	99.09
E & M Works		@	15.00%											
	Opening Cost					1105.62	939.78	798.81	678.99	577.14	490.57	416.99	354.44	301.27
	Depreciation					165.84	140.97	119.82	101.85	86.57	73.59	62.55	53.17	45.19
	Written Down Value					939.78	798.81	678.99	577.14	490.57	416.99	354.44	301.27	256.08
Total Depreciation						**230.01**	**195.51**	**166.19**	**141.26**	**120.07**	**102.06**	**86.75**	**73.74**	**62.68**

CALCULATION OF TAXATION

Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Profit Before Tax			102.19	148.28	160.55	172.79	184.99	197.15	209.26	221.33	227.26
Add: Depreciation as per IE ACT (SLM)			39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Less: Depreciation as per I T Act			230.01	195.51	166.19	141.26	120.07	102.06	86.75	73.74	62.68
Taxable Profit			**-88.41**	**-7.83**	**33.78**	**70.95**	**104.33**	**134.50**	**161.92**	**187.00**	**204.00**
Loss B/F			0.00	-88.41	-96.24	-62.46	0.00	0.00	0.00	0.00	0.00
Loss C/F			-88.41	-96.24	-62.46	0.00	0.00	0.00	0.00	0.00	0.00
Taxable Income			**0.00**	**0.00**	**0.00**	**8.48**	**104.33**	**134.50**	**161.92**	**187.00**	**204.00**
Deduction u/s 80 IA			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Taxable Income			0.00	0.00	0.00	8.48	104.33	134.50	161.92	187.00	204.00
Tax Liability			**0.00**	**0.00**	**0.00**	**0.95**	**11.72**	**15.11**	**18.19**	**21.01**	**22.92**

000443

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-2

CALCULATION OF DEPRECIATION

TABLE 10-4

Cost with IDC	Land	21.55
	Civil Works	427.81
	E & M Work	1105.62
	Others	0.00
	Total Cost	1554.98

Year			Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
OPERATION YEAR			*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
I. AS PER I. E. ACT (SLM)																	
Salvage Value	10.00%																
Depreciation @																	
on Land	21.55	@ 0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
on Civil Works & Others	427.81	@ 2.57%	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99
on E&M Works	1105.62	@ 2.57%	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41
Total Depreciation			39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
II. AS PER INCOME TAX																	
Civil Works & Others		@ 15.00%															
	Opening Cost		99.09	84.22	71.59	60.85	51.72	43.97	37.37	31.77	27.00	22.95	19.51	16.58	14.09	11.98	10.18
	Depreciation		14.86	12.63	10.74	9.13	7.76	6.59	5.61	4.76	4.05	3.44	2.93	2.49	2.11	1.80	1.53
	Written Down Value		84.22	71.59	60.85	51.72	43.97	37.37	31.77	27.00	22.95	19.51	16.58	14.09	11.98	10.18	8.66
E & M Works		@ 15.00%															
	Opening Cost		256.08	217.67	185.02	157.27	133.68	113.62	96.58	82.09	69.78	59.31	50.42	42.85	36.43	30.96	26.32
	Depreciation		38.41	32.65	27.75	23.59	20.05	17.04	14.49	12.31	10.47	8.90	7.56	6.43	5.46	4.64	3.95
	Written Down Value		217.67	185.02	157.27	133.68	113.62	96.58	82.09	69.78	59.31	50.42	42.85	36.43	30.96	26.32	22.37
Total Depreciation			53.28	45.28	38.49	32.72	27.81	23.64	20.09	17.08	14.52	12.34	10.49	8.92	7.58	6.44	5.48

CALCULATION OF TAXATION

Year	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26
OPERATION YEAR	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
Profit Before Tax	225.97	224.62	223.21	221.76	220.24	218.66	217.02	215.31	213.54	211.69	209.77	207.77	205.69	203.53	201.29
Add: Depreciation as per IE ACT (SLM)	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Less: Depreciation as per I T Act	53.28	45.28	38.49	32.72	27.81	23.64	20.09	17.08	14.52	12.34	10.49	8.92	7.58	6.44	5.48
Taxable Profit	**212.10**	**218.74**	**224.13**	**228.45**	**231.84**	**234.43**	**236.33**	**237.64**	**238.43**	**238.76**	**238.69**	**238.27**	**237.53**	**236.50**	**235.22**
Loss B/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loss C/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable Income	**212.10**	**218.74**	**224.13**	**228.45**	**231.84**	**234.43**	**236.33**	**237.64**	**238.43**	**238.76**	**238.69**	**238.27**	**237.53**	**236.50**	**235.22**
Deduction u/s 80 IA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Taxable Income	212.10	218.74	224.13	228.45	231.84	234.43	236.33	237.64	238.43	238.76	238.69	238.27	237.53	236.50	235.22
Tax Liability	**73.83**	**73.73**	**75.55**	**77.00**	**78.15**	**79.02**	**79.66**	**80.10**	**80.37**	**80.48**	**80.46**	**80.31**	**80.07**	**79.72**	**79.29**

000444

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-2

CALCULATION OF DEPRECIATION

TABLE 10-4

Cost with IDC	Land	21.55
	Civil Works	427.81
	E & M Work	1105.62
	Others	0.00
	Total Cost	1554.98

Year				Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR				*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
I. AS PER I. E. ACT (SLM)														
Salvage Value	10.00%													
Depreciation @														
on Land	21.55	@	0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
on Civil Works & Others	427.81	@	2.57%	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99
on E&M Works	1105.62	@	2.57%	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41	28.41
Total Depreciation				39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
II. AS PER INCOME TAX														
Civil Works & Others		@	15.00%											
	Opening Cost			8.66	7.36	6.25	5.32	4.52	3.84	3.26	2.77	2.36	2.00	1.70
	Depreciation			1.30	1.10	0.94	0.80	0.68	0.58	0.49	0.42	0.35	0.30	0.26
	Written Down Value			7.36	6.25	5.32	4.52	3.84	3.26	2.77	2.36	2.00	1.70	1.45
E & M Works		@	15.00%											
	Opening Cost			22.37	19.01	16.16	13.74	11.68	9.93	8.44	7.17	6.10	5.18	4.40
	Depreciation			3.36	2.85	2.42	2.06	1.75	1.49	1.27	1.08	0.91	0.78	0.66
	Written Down Value			19.01	16.16	13.74	11.68	9.93	8.44	7.17	6.10	5.18	4.40	3.74
Total Depreciation				4.65	3.96	3.36	2.86	2.43	2.06	1.76	1.49	1.27	1.08	0.92

CALCULATION OF TAXATION

Year	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION YEAR	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
Profit Before Tax	198.95	196.52	194.00	191.37	188.63	185.79	182.84	179.76	176.56	173.24	169.78
Add: Depreciation as per IE ACT (SLM)	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Less: Depreciation as per I T Act	4.65	3.96	3.36	2.86	2.43	2.06	1.76	1.49	1.27	1.08	0.92
Taxable Profit	**233.71**	**231.98**	**230.04**	**227.92**	**225.61**	**223.14**	**220.49**	**217.68**	**214.70**	**211.57**	**208.27**
Loss B/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loss C/F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable Income	**233.71**	**231.98**	**230.04**	**227.92**	**225.61**	**223.14**	**220.49**	**217.68**	**214.70**	**211.57**	**208.27**
Deduction u/s 80 IA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Taxable Income	233.71	231.98	230.04	227.92	225.61	223.14	220.49	217.68	214.70	211.57	208.27
Tax Liability	**78.78**	**78.19**	**77.54**	**76.83**	**76.05**	**75.21**	**74.32**	**73.37**	**72.37**	**71.32**	**70.20**

000445

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-2

TABLE 10-6

TERM LOAN REPAYMENT SCHEDULE
& CALCULATION OF INTEREST

Subsidy available in the end of year 1

Subsidy amount in Lacs Rs. 241.08

	Before Subsidy	After Subsidy
Loan Amount	1091.83	714.27
Rate of Interest	13.00%	13.0%
Period for repayment of Term Loan (Years)	8	7
Annual Installment of Loan	136.48	102.04
Monthly	11.37	8.50

Year		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
OPERATION YEAR		*CONSTRU CTION*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1st Month	Opening			1091.83	714.27	612.23	510.19	408.15	306.12	204.08	102.04
	Interest			11.83	7.74	6.63	5.53	4.42	3.32	2.21	1.11
2nd Month	Opening after Instalment			1080.45	705.77	603.73	501.69	399.65	297.61	195.57	93.54
	Interest			11.70	7.65	6.54	5.43	4.33	3.22	2.12	1.01
3rd Month	Opening after Instalment			1069.08	697.26	595.22	493.19	391.15	289.11	187.07	85.03
	Interest			11.58	7.55	6.45	5.34	4.24	3.13	2.03	0.92
4th Month	Opening after Instalment			1057.71	688.76	586.72	484.68	382.64	280.61	178.57	76.53
	Interest			11.46	7.46	6.36	5.25	4.15	3.04	1.93	0.83
5th Month	Opening after Instalment			1046.34	680.26	578.22	476.18	374.14	272.10	170.06	68.03
	Interest			11.34	7.37	6.26	5.16	4.05	2.95	1.84	0.74
6th Month	Opening after Instalment			1034.98	671.75	569.71	467.68	365.64	263.60	161.56	59.52
	Interest			11.21	7.28	6.17	5.07	3.96	2.86	1.75	0.64
7th Month	Opening after Instalment			1023.59	663.25	561.21	459.17	357.13	255.10	153.06	51.02
	Interest			11.09	7.19	6.08	4.97	3.87	2.76	1.66	0.55
8th Month	Opening after Instalment			1012.22	654.75	552.71	450.67	348.63	246.59	144.55	42.52
	Interest			10.97	7.09	5.99	4.88	3.78	2.67	1.57	0.46
9th Month	Opening after Instalment			1000.84	646.24	544.21	442.17	340.13	238.09	136.05	34.01
	Interest			10.84	7.00	5.90	4.79	3.68	2.58	1.47	0.37
10th Month	Opening after Instalment			989.47	637.74	535.70	433.66	331.63	229.59	127.55	25.51
	Interest			10.72	6.91	5.80	4.70	3.59	2.49	1.38	0.28
11th Month	Opening after Instalment			978.10	629.24	527.20	425.16	323.12	221.08	119.04	17.01
	Interest			10.60	6.82	5.71	4.61	3.50	2.40	1.29	0.18
12th Month	Opening after Instalment			966.72	620.73	518.70	416.66	314.62	212.58	110.54	8.50
	Interest			10.47	6.72	5.62	4.51	3.41	2.30	1.20	0.09
Available Subsidy				241.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Closing Balance				714.27	612.23	510.19	408.15	306.12	204.08	102.04	0.00
Interest on Term Loan				133.81	86.78	73.51	60.25	46.98	33.72	20.45	7.19
Interest on Working capital				5.58	5.59	5.61	5.62	5.64	5.66	5.68	5.70
Total Interest				139.38	92.37	79.12	65.87	52.62	39.37	26.13	12.88
Installment of Debt				136.48	102.04	102.04	102.04	102.04	102.04	102.04	102.04

00046

NOTE: ALL FIGURES IN LACS

DAMAN GANGA DAM TOE SHP-2

DEBT SERVICE COVERAGE RATIO (DSCR) **TABLE 10-7**

Details	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
A - SERVICE											
Net Profit after Tax			102.19	148.28	160.55	171.84	173.27	182.04	191.07	200.32	
Depreciation			39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	
Interest on term Loan			139.38	92.37	79.12	65.87	52.62	39.37	26.13	12.88	
TOTAL - A			**280.99**	**280.05**	**279.08**	**277.12**	**265.30**	**260.82**	**256.60**	**252.61**	**2152.57**
B - DEBT											
Installment on Term Loan			136.48	102.04	102.04	102.04	102.04	102.04	102.04	102.04	
Interest on Term Loan			139.38	92.37	79.12	65.87	52.62	39.37	26.13	12.88	
TOTAL - B			**275.86**	**194.41**	**181.16**	**167.91**	**154.66**	**141.41**	**128.17**	**114.92**	**1358.50**
DSCR			**1.02**	**1.44**	**1.54**	**1.65**	**1.72**	**1.84**	**2.00**	**2.20**	**1.58**

AVERAGE DSCR **1.68**
MINIMUM DSCR **1.02**
MAXIMUM DSCR **2.20**

000447

DAMAN GANGA DAM TOE SHP-2

TABLE 10-8

COMPUTATION OF GENERATION COST

Details	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
OPERATION YEAR	*IMPLEMENTATION PERIOD*		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
CAPACITY CHARGES											
1 Interest on Term Loan			*133.81*	*86.78*	*73.51*	*60.25*	*46.98*	*33.72*	*20.45*	*7.19*	*0.00*
2 Depreciation			*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*
TOTAL (1 +2)			*173.21*	*126.18*	*112.92*	*99.65*	*86.39*	*73.12*	*59.86*	*46.59*	*39.41*
ENERGY CHARGES											
1 O&M and Insurance @ 1.50%			23.32	24.26	25.23	26.24	27.29	28.38	29.51	30.69	31.92
2 Interst on Working Capital			5.58	5.59	5.61	5.62	5.64	5.66	5.68	5.70	5.72
3 Water Royalty @ 0.23	Rs per KWh		26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
4 Tax			0.00	0.00	0.00	0.95	11.72	15.11	18.19	21.01	22.92
TOTAL			55.12	56.07	57.05	59.03	70.87	75.36	79.60	83.62	86.77
Total Capacity & Energy Charges in Lacs in Rupees			**228.33**	**182.25**	**169.97**	**158.68**	**157.25**	**148.49**	**139.46**	**130.21**	**126.18**
Net Energy in MU			**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**
GENERATION COST WITHOUT RETURN ON EQUITY in Rs			**2.00**	**1.60**	**1.49**	**1.39**	**1.38**	**1.30**	**1.22**	**1.14**	**1.11**
LEVELLISED COST OF GENERATION (W/O ROE) @ 12.0% Discount Factor = Rs **1.53**			1.000 2.003	0.880 1.407	0.774 1.155	0.681 0.949	0.600 0.827	0.528 0.688	0.464 0.568	0.409 0.467	0.360 0.398
WITH RETURN ON EQUITY											
5 Return on Equity @ 14.0%			64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84
Total Capacity & Energy Charges in Lacs in Rupees			**293.2**	**247.1**	**234.8**	**223.5**	**222.1**	**213.3**	**204.3**	**195.1**	**191.0**
Net Energy in MU			**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**
TARIFF WITH RETURN ON EQUITY in Rs			**2.57**	**2.17**	**2.06**	**1.96**	**1.95**	**1.87**	**1.79**	**1.71**	**1.68**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.10**											
WITH CARBON CREDIT											
carbon Credit			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Less Tariff against carbon Credit			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NET TARIFF in Rs			**2.57**	**2.17**	**2.06**	**1.96**	**1.95**	**1.87**	**1.79**	**1.71**	**1.68**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.10**											

DAMAN GANGA DAM TOE SHP-2

COMPUTATION OF GENERATION COST

TABLE 10-8

Details	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24
OPERATION YEAR	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
CAPACITY CHARGES													
1 Interest on Term Loan	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
2 Depreciation	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*
TOTAL (1 +2)	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*
ENERGY CHARGES													
1 O&M and Insurance @ 1.50%	33.20	34.53	35.91	37.34	38.84	40.39	42.01	43.69	45.43	47.25	49.14	51.11	53.15
2 Interst on Working Capital	5.74	5.76	5.78	5.80	5.83	5.85	5.88	5.90	5.93	5.96	5.99	6.02	6.06
3 Water Royalty @ 0.23	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
4 Tax	23.83	73.73	75.55	77.00	78.15	79.02	79.66	80.10	80.37	80.48	80.46	80.31	80.07
TOTAL	88.98	140.23	143.45	146.36	149.03	151.48	153.76	155.91	157.95	159.91	161.80	163.66	165.49
Total Capacity & Energy Charges in Lacs in Ru	**128.39**	**179.64**	**182.86**	**185.77**	**188.43**	**190.89**	**193.17**	**195.32**	**197.36**	**199.32**	**201.21**	**203.07**	**204.90**
Net Energy in MU	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**
GENERATION COST WITHOUT RETURN ON EQ	**1.13**	**1.58**	**1.60**	**1.63**	**1.65**	**1.67**	**1.69**	**1.71**	**1.73**	**1.75**	**1.77**	**1.78**	**1.80**
LEVELLISED COST OF GENERATION (W/O ROE) @ 12.0% Discount Factor = Rs **1.53**	0.316	0.279	0.245	0.216	0.190	0.167	0.147	0.129	0.114	0.100	0.088	0.078	0.068
	0.357	0.439	0.393	0.352	0.314	0.280	0.249	0.222	0.197	0.175	0.156	0.138	0.123
WITH RETURN ON EQUITY													
5 Return on Equity @ 14.0%	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84
Total Capacity & Energy Charges in Lacs in Ru	**193.2**	**244.5**	**247.7**	**250.6**	**253.3**	**255.7**	**258.0**	**260.2**	**262.2**	**264.2**	**266.1**	**267.9**	**269.7**
Net Energy in MU	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**
TARIFF WITH RETURN ON EQUITY in Rs	**1.70**	**2.15**	**2.17**	**2.20**	**2.22**	**2.24**	**2.26**	**2.28**	**2.30**	**2.32**	**2.33**	**2.35**	**2.37**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.10**													
WITH CARBON CREDIT													
carbon Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Less Tariff against carbon Credit	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NET TARIFF in Rs	**1.70**	**2.15**	**2.17**	**2.20**	**2.22**	**2.24**	**2.26**	**2.28**	**2.30**	**2.32**	**2.33**	**2.35**	**2.37**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.10**													

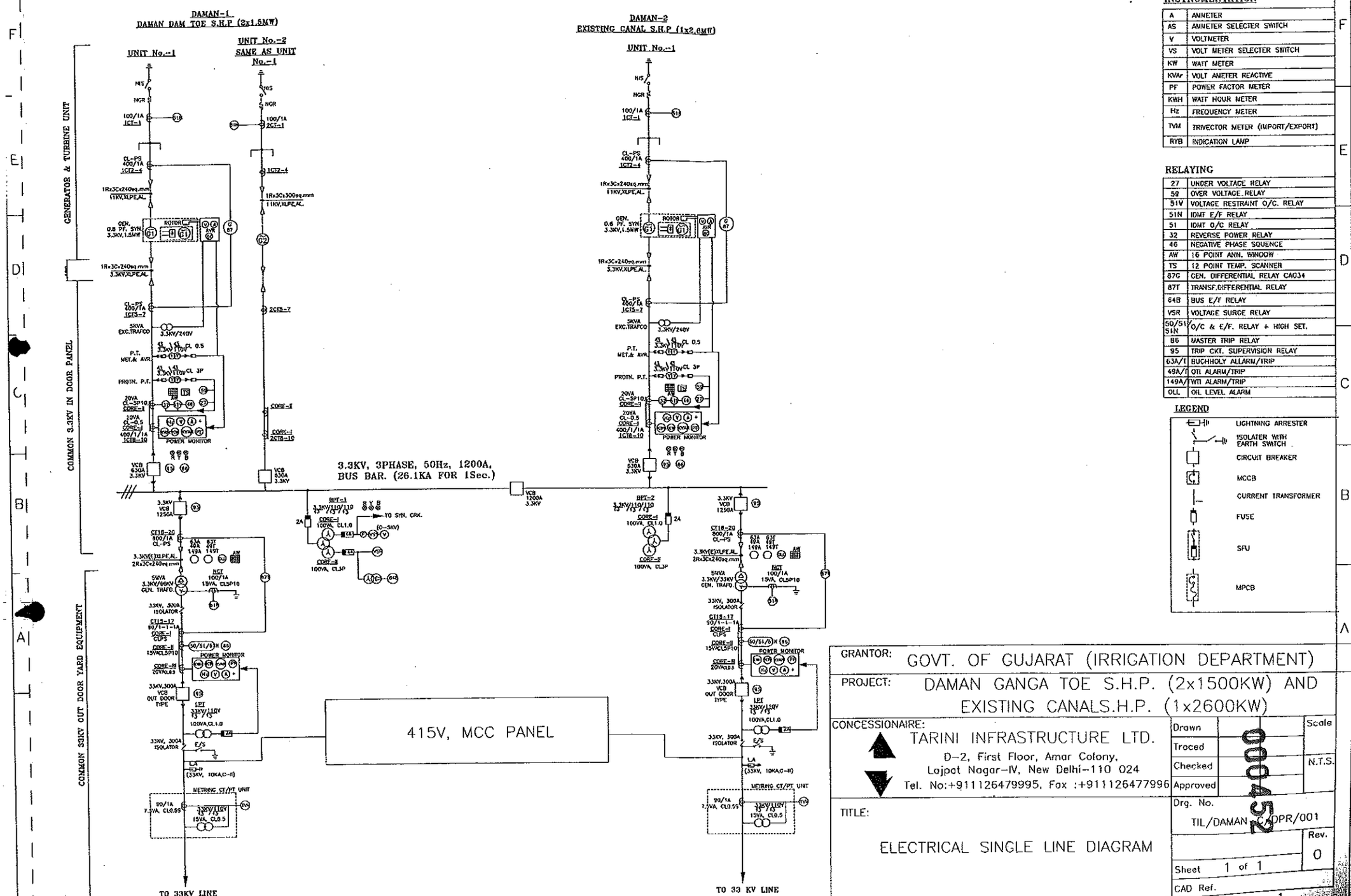
DAMAN GANGA DAM TOE SHP-2

TABLE 10-8

COMPUTATION OF GENERATION COST

Details	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34	Year 35	Year 36	Year 37
OPERATION.YEAR	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*
CAPACITY CHARGES													
1 Interest on Term Loan	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
2 Depreciation	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*
TOTAL (1 +2)	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*	*39.41*
ENERGY CHARGES													
1 O&M and Insurance @ 1.50%	55.28	57.49	59.79	62.18	64.67	67.25	69.94	72.74	75.65	78.68	81.82	85.10	88.50
2 Interst on Working Capital	6.09	6.12	6.16	6.20	6.24	6.28	6.32	6.37	6.41	6.46	6.51	6.57	6.62
3 Water Royalty @ 0.23	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
4 Tax	79.72	79.29	78.78	78.19	77.54	76.83	76.05	75.21	74.32	73.37	72.37	71.32	70.20
TOTAL	167.30	169.12	170.94	172.79	174.66	176.57	178.53	180.54	182.60	184.73	186.92	189.19	191.54
Total Capacity & Energy Charges in Lacs in Ru	**206.71**	**208.53**	**210.35**	**212.20**	**214.07**	**215.98**	**217.94**	**219.9**	**222.0**	**224.1**	**226.3**	**228.6**	**230.9**
Net Energy in MU	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**
GENERATION COST WITHOUT RETURN ON EQ	**1.81**	**1.83**	**1.85**	**1.86**	**1.88**	**1.90**	**1.91**	**1.93**	**1.95**	**1.97**	**1.99**	**2.01**	**2.03**
LEVELLISED COST OF GENERATION (W/O ROE) @ 12.0% Discount Factor = Rs **1.53**	0.060	0.053	0.047	0.041	0.036	0.032	0.028	0.025	0.022	0.019	0.017	0.015	0.013
	0.109	0.097	0.086	0.076	0.068	0.060	0.053	0.047	0.042	0.037	0.033	0.030	0.026
WITH RETURN ON EQUITY													
5 Return on Equity @ 14.0%	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84	64.84
Total Capacity & Energy Charges in Lacs in Ru	**271.6**	**273.4**	**275.2**	**277.0**	**278.9**	**280.8**	**282.8**	**284.8**	**286.9**	**289.0**	**291.2**	**293.4**	**295.8**
Net Energy in MU	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**	**11.40**
TARIFF WITH RETURN ON EQUITY in Rs	**2.38**	**2.40**	**2.41**	**2.43**	**2.45**	**2.46**	**2.48**	**2.50**	**2.52**	**2.54**	**2.55**	**2.57**	**2.60**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.10**													
WITH CARBON CREDIT													
carbon Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Less Tariff against carbon Credit	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NET TARIFF in Rs	**2.38**	**2.40**	**2.41**	**2.43**	**2.45**	**2.46**	**2.48**	**2.50**	**2.52**	**2.54**	**2.55**	**2.57**	**2.60**
LEVELLISED COST OF GENERATION (WITH ROE) @ 12.0% Discount Factor = Rs **2.10**													

DRAWINGS



INSTRUMENTATION

A	AMMETER
AS	AMMETER SELECTER SWITCH
V	VOLTMETER
VS	VOLT METER SELECTER SWITCH
KW	WATT METER
KVAr	VOLT AMETER REACTIVE
PF	POWER FACTOR METER
KWH	WATT HOUR METER
Hz	FREQUENCY METER
TVM	TRIVECTOR METER (IMPORT/EXPORT)
RYB	INDICATION LAMP

RELAYING

27	UNDER VOLTAGE RELAY
59	OVER VOLTAGE RELAY
51V	VOLTAGE RESTRAINT O/C. RELAY
51N	IDMT E/F RELAY
51	IDMT O/C RELAY
32	REVERSE POWER RELAY
46	NEGATIVE PHASE SQUENCE
AW	16 POINT ANN. WINDOW
TS	12 POINT TEMP. SCANNER
87G	GEN. DIFFERENTIAL RELAY CAG34
87T	TRANSF.DIFFERENTIAL RELAY
64B	BUS E/F RELAY
VSR	VOLTAGE SURGE RELAY
50/51 51N	O/C & E/F. RELAY + HIGH SET.
86	MASTER TRIP RELAY
95	TRIP CKT. SUPERVISION RELAY
63A/T	BUCHHOLY ALLARM/TRIP
49A/T	OTI ALARM/TRIP
149A/T	WTI ALARM/TRIP
OLL	OIL LEVEL ALARM

LEGEND

- LIGHTNING ARRESTER
- ISOLATER WITH EARTH SWITCH
- CIRCUIT BREAKER
- MCCB
- CURRENT TRANSFORMER
- FUSE
- SFU
- MPCB

GRANTOR: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN GANGA TOE S.H.P. (2x1500KW) AND EXISTING CANALS.H.P. (1x2600KW)

CONCESSIONAIRE:
TARINI INFRASTRUCTURE LTD.
D-2, First Floor, Amar Colony,
Lajpat Nagar-IV, New Delhi-110 024
Tel. No:+911126479995, Fax :+911126477996

Drawn		Scale
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Checked		N.T.S.
Approved		

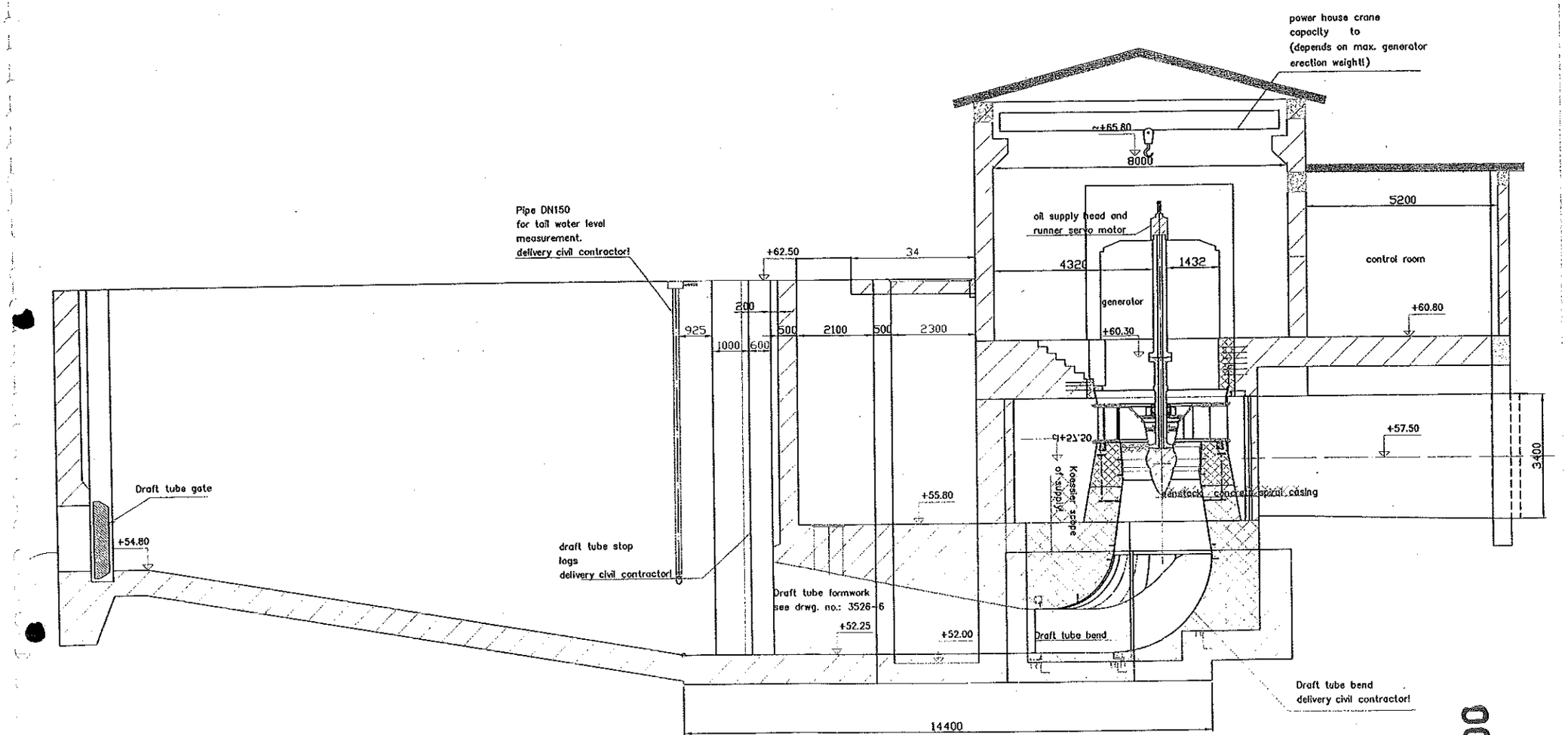
TITLE: ELECTRICAL SINGLE LINE DIAGRAM

Drg. No. TIL/DAMAN GANGA/DPR/001

Rev. 0

Sheet 1 of 1

CAD Ref.

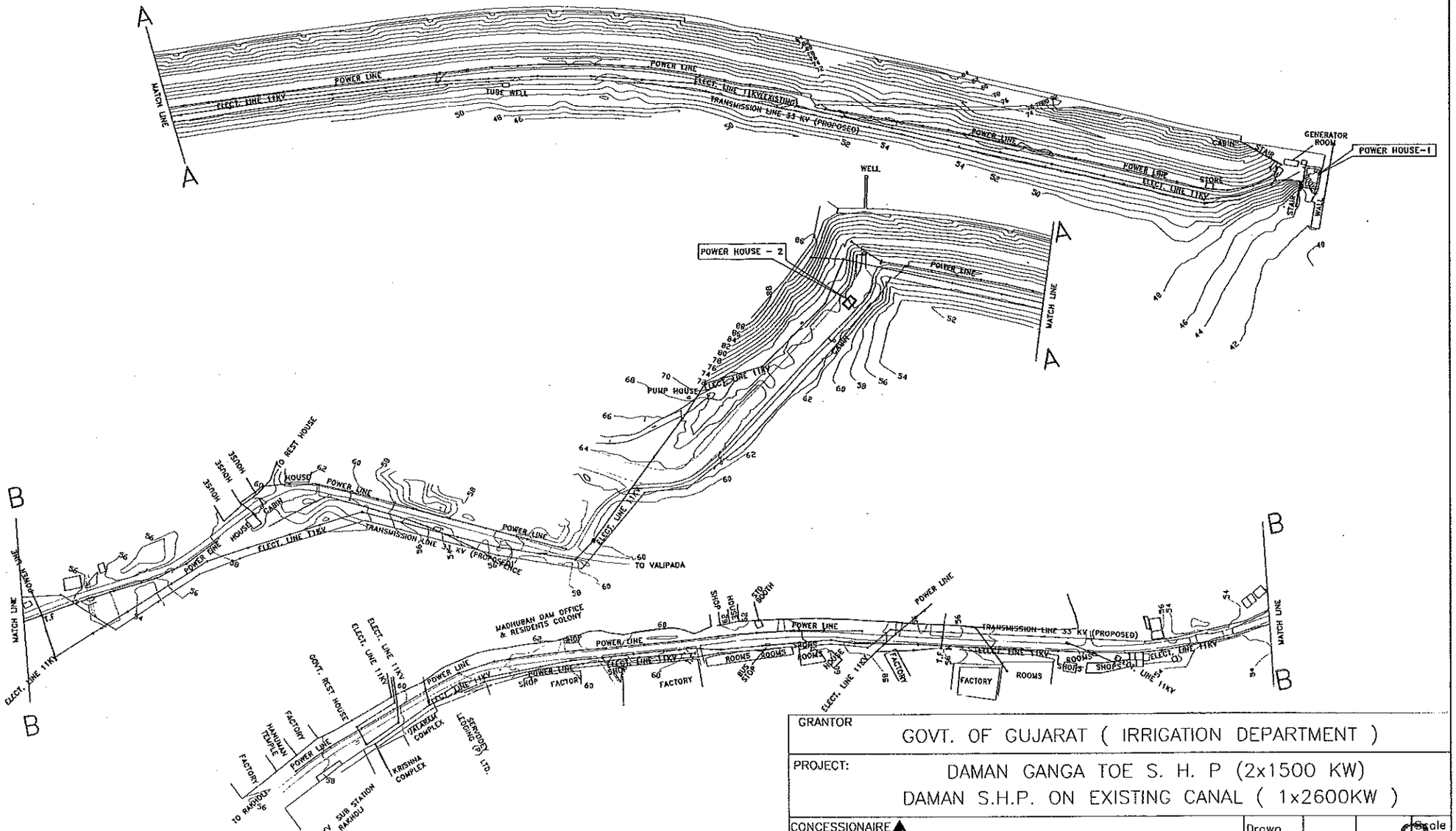


SECTION A–A

000453

GRANTOR:	GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)			
PROJECT:	DAMAN GANGA S.H.P.ON EXITING CANAL (1x2600KW)			
CONCESSIONAIRE	TARINI INFRASTRUCTURE LTD. D-2, First Floor, Amar Colony, Lajpat Nagar-IV, New Delhi-110 024 Tel. No:+911126478995, Fax :+911126477995	Drawn / Traced / Checked / Approved		Scale 1:100 H.T.S.
TITLE	L-SECTION ALONG THE ℄ OF UNIT	Drg. No. TIL/DAMAN-2/DPR./003	Rev. 0	Sheet 2 of 2
		CAD Ref.		

Rev. No.	Modification	Date



Rev. No.	Modification	Date	Sign

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GRANTOR: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN GANGA TOE S. H. P (2x1500 KW)
DAMAN S.H.P. ON EXISTING CANAL (1x2600KW)

CONCESSIONAIRE: TARINI INFRASTRUCTURE LTD.
D-2, First Floor, Amar Colony,
Lajpat Nagar-IV, New Delhi-110 024
Tel. No: +911126479995, Fax : +911126477996

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Approved			

Org. No. TIL/DAMAN-C/DPR/002

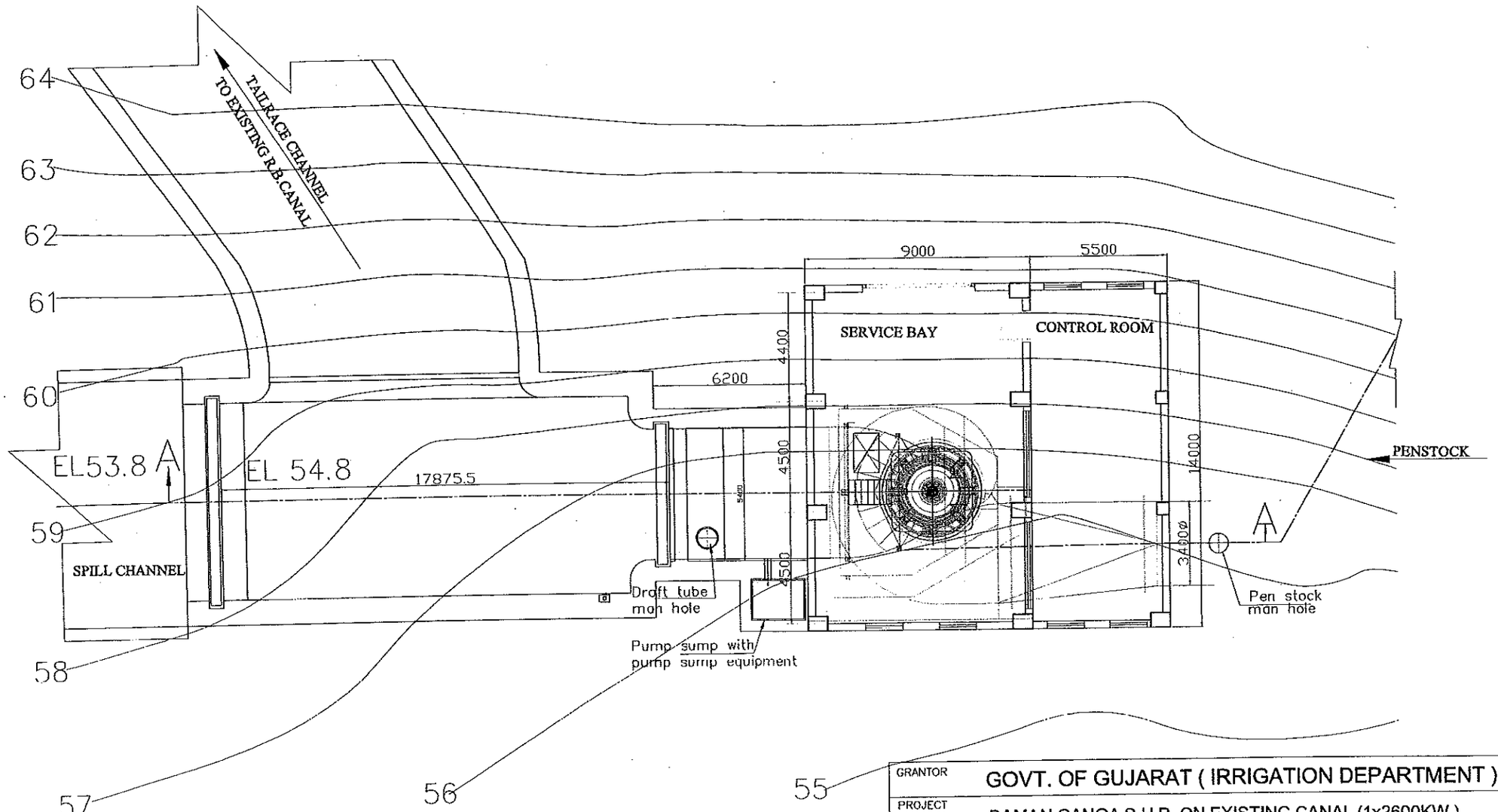
Rev. 0

Sheet 1 of 1

CAD Ref.

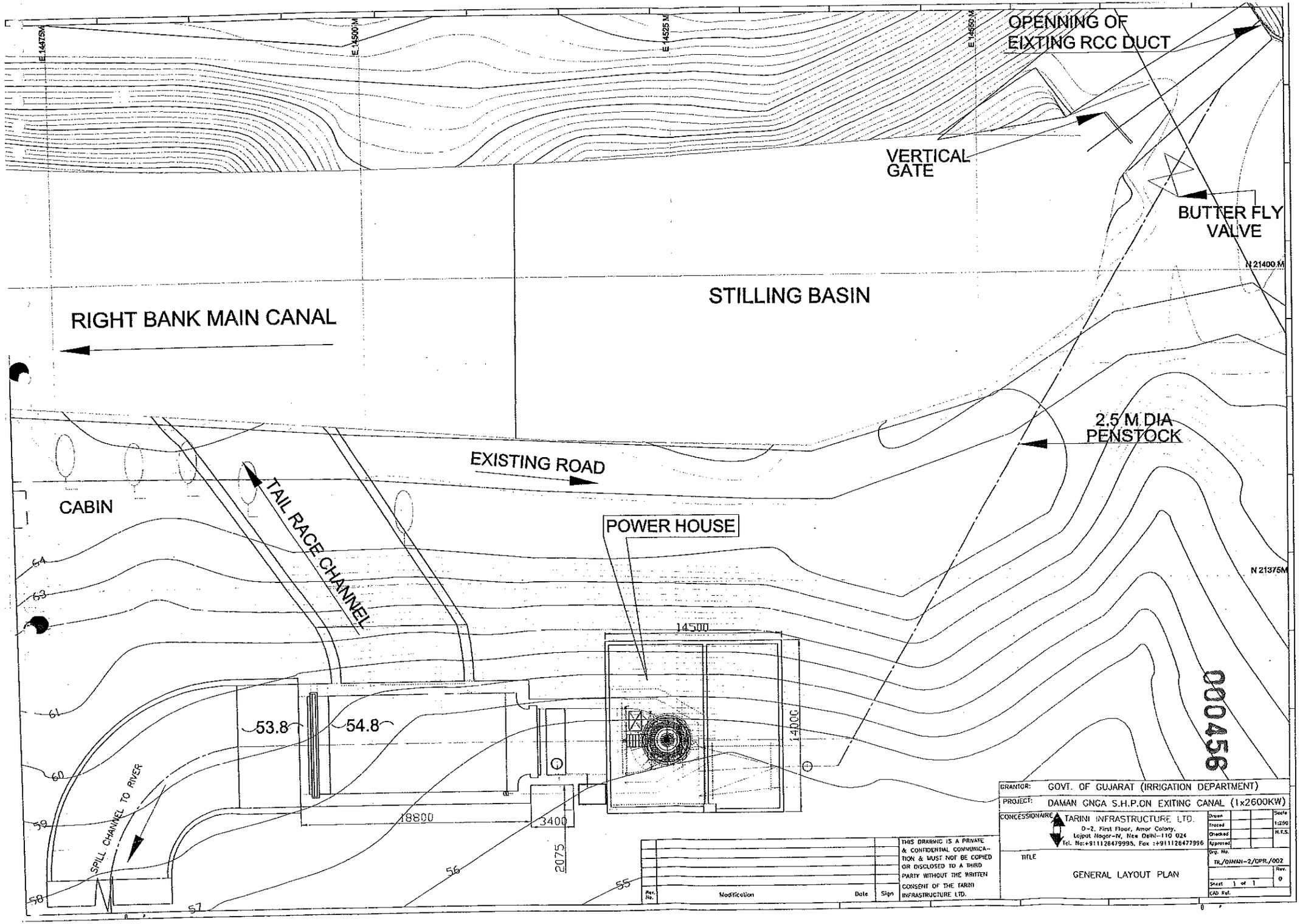
TITLE: TRANSMISSION LINE

006454



GRANTOR	GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)		
PROJECT	DAMAN GANGA S.H.P. ON EXISTING CANAL (1x2600KW)		
CONCESSIONAIRE	TARINI INFRASTRUCTURE LTD. D-2, First Floor, Amar Colony, Lajpat Nagar-IV, New Delhi-110 024 Tel. No: +911126479995, Fax : +911126477996	Drown / Traced / Checked / Approved	Scale: N.T.S.
TITLE	POWER HOUSE PLAN ANNEXE-2	Drg. No. TIL/DAMAN-S/DPR/003	Rev. 0
		Sheet 1 of 2	
		CAD Ref.	

Rev. No.	Modification	Date	Sign



GRANTOR: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN GNGA S.H.P.ON EXITING CANAL (1x2600KW)

CONCESSIONAIRE: TARINI INFRASTRUCTURE LTD.
D-2, First Floor, Amar Colony,
Lajpat Nagar-IV, New Delhi-110 024
Tel. No:+911126479995, Fax :+911126477996

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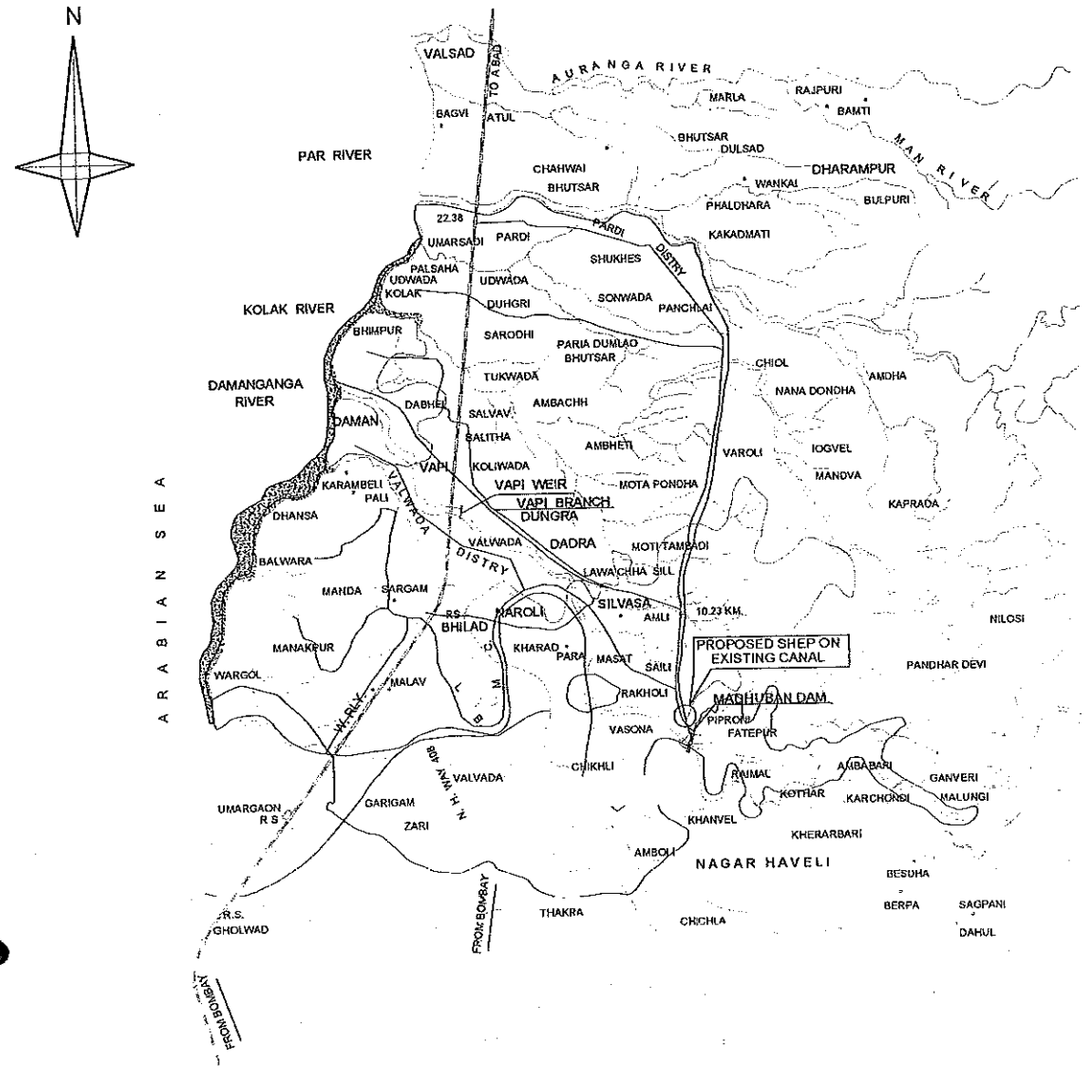
Drg. No. TIL/DAMAN-2/DPR./002 | Rev. 0

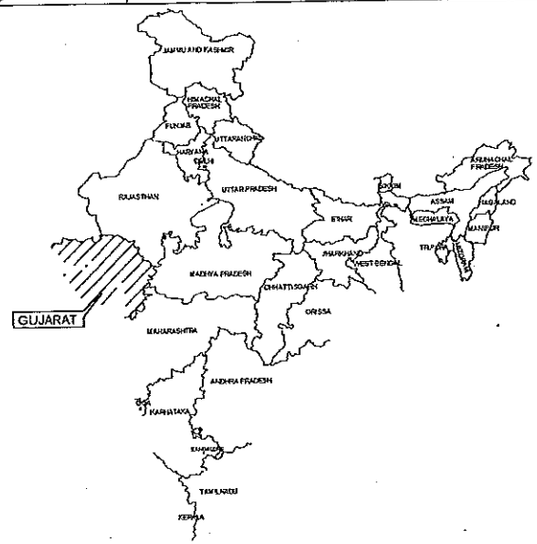
Sheet 1 of 1 | CAD Ref.

TITLE: GENERAL LAYOUT PLAN

Rev. No.	Modification	Date	Sign



INDEX MAP OF
DAMANGAGA RESERVIOR PROJECT
SCALE: 1 INCH = 4 MILE



MAP OF INDIA

LEGEND:-

1. MADHUBAN DAM
2. VAPI PICKUP WEIR
3. COMMAND AREA OF DAMANGANGA PROJECT
4. CANLAS
5. AREA UNDER SUBMERGENCE
6. STATE BOUNDARY OF GUJRAT
7. BOUNDARY OF GUJARAT
8. NATIONAL HIGHWAY
9. STATE HIGHWAY
10. RIVER AND NALAS
11. RAILWAY (B G)
12. RAIN GAUGE STATION
13. I.M.D STATION

GRANTOR: GOVT. OF GUJARAT (IRRIGATION DEPARTMENT)

PROJECT: DAMAN GANGA S.H.P. ON EXISTING CANAL (1x2600KW)

CONCESSIONAIRE: TARINI INFRASTRUCTURE LTD.
D-2, First Floor, Amar Colony,
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Tel. No: +911126479995, Fax : +911126477996

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Rev. 0

Sheet 1 of 1

CAD Ref.

TITLE: LOCATION AND VICINITY MAP

Rev. No.	Modification	Date	Sign

000458

SHP-I

ANNEXURE-P-6 (Colly)

POWER PURCHASE AGREEMENT (3 MW)

BETWEEN

TARINI INFRASTRUCTURE LIMITED

AND

GUJARAT URJA VIKAS NIGAM LIMITED

29th January , 2008

T.I.I.D. New Delhi TARINI INFRAS

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

000459

INDEX

TARINI INFRASTRUCTURE LTD. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

TARINI INFRASTRUCTURE LTD. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

000461

भारतीय गैर न्यायिक

एक सौ रुपये

Rs. 100

ONE HUNDRED RUPEES

₹. 100

सत्यमेव जयते

भारत INDIA

INDIA NON JUDICIAL

ગુજરાત ગુજરાત GUJARAT

G 085449

This Power Purchase Agreement is made and entered into at Vadodara on this 29th day of January 2008 by and between

(I) M/s TARINI Infrastructure Ltd, a private Power Producer with limited liability incorporated in India under the Companies Act 1956 and Generating Company as defined under sub-section 28, of Section 2 of the Electricity Act 2003 to commission, operate and maintain an electricity generating station and having its registered office at D-2, 1st Floor, Amar Colony, Lajpat Nagar, New Delhi 110024, , India (hereinafter referred to as "Power Producer", which expression shall, unless repugnant to the context or meaning thereof, include its successors and assignees), as party of the first part.

TARINI INFRASTRUCTURE LTD. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

AND

Gujarat Urja Vikas Nigam Limited, (hereinafter referred to as "GUVNL") a company incorporated under the provisions of the Companies Act, 1956 and carrying on the business of bulk purchase and bulk supply to distribution licensees and having its registered office at Sardar Patel Vidyut Bhavan, Race Course, Vadodara 390 007, (hereinafter referred to as "Procurer", which expression shall, unless repugnant to the context or meaning thereof, include its successors and assignees) as party of the second part.

WHEREAS the Power Producer desires to set-up a Hydel facility under the Gujarat Electricity Regulatory Commission (Power procurement from renewable sources) Regulations, 2005 (15 of 200) principally by small Hydel Projects generated (3 MW River bed –SHP-I) by the **M/s TARINI Infrastructure Limited located at Daman Ganga (Madhuban) Dam,Gujarat** The Hydel facility shall consist of small Hydel Projects and Hydel turbine generator complete with step-up transformer(s), switchyard, pipelines, grid paralleling / interfacing equipment and other auxiliary equipment.

AND WHEREAS the "Power Producer" will arrange with Gujarat Energy Transmission Corporation Ltd. (hereinafter referred to as "GETCO") for the construction, ownership, operation and maintenance of an appropriate transmission line and interconnection facilities (up to the Delivery Point,)

AND WHEREAS GUVNL will purchase the "Contracted Capacity" and the Power Producer will supply the "Contracted Capacity" to GUVNL on First Right basis on the terms and subject to the conditions set out in this Agreement.

NOW THEREFORE IN VIEW OF THE FOREGOING PREMISES AND IN CONSIDERATION OF THE MUTUAL COVENANTS AND CONDITIONS HEREINAFTER SET FORTH, GUVNL AND THE POWER PRODUCER, EACH TOGETHER WITH THEIR RESPECTIVE SUCCESSORS AND PERMITTED ASSIGNS, A PARTY AND COLLECTIVELY THE PARTIES, HEREBY AGREE AS FOLLOWS:

TARINI INFRASTRUCT. PVT. LTD. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

ARTICLE 1

DEFINITIONS

1.1 For all purposes of this Agreement, the following words and expressions shall have the respective meanings set forth below:. Each defined word or expression when used in this Agreement has been identified by capitalizing the first letter of that word or expression.

a. "Agreement" shall mean this Power Purchase Agreement executed hereof, including the schedules hereto, amendments, modifications and supplements made in writing by the Parties from time to time.

b. "Approvals" means the agreements, permits, clearances, licenses and consents as are listed in Schedule 3 hereto and any other statutory approvals or necessary agreements.

c. Availability: shall mean that the Generating Unit is available to its contracted capacity at the delivery point and declared to SLDC as per Grid Code of GERC and Availability Based Tariff Regulation of GERC as amended from time to time.

d. "Billing Date" shall be the first Business Day after the Metering Date of each Billing Period.

e. "Small/small Hydel" means projects upto 100KW station capacity are called Micro Hydel,101 KW to 2000KW (Unit size upto 1000KW) are called Mini Hydel and 2001KW to 15 MW(Unit size upto 5 MW) are called small Hydel power projects.

f. "Billing Period" means (subject to Clause 6.1 of the Agreement) the calendar month ending with the Metering Date. The first Billing Period shall commence from the Commercial Operation Date and end with the Metering Date corresponding to the month in which the Commercial Operation Date occurs.

g. "Business Day" means a day other than Sunday or a statutory holiday, on which the banks remain open for business in Vadodara.

h. "CDM" is defined in Clause 4.1 h

i. "Commercial Operation Date" with respect to the Project shall mean the date on which the Project is available for commercial operation and such date as specified in a written notice given at least ten days in advance by the Power Producer to GUVNL and in any case, shall not be beyond the

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GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

Scheduled Commercial Operation Date. GUVNL have right to refuse to off take power more than three (3) months prior to Schedule Commercial Operation Date.

j. "Commission" means Gujarat Electricity Regulatory Commission.

k. "Construction" means one or more main contractors appointed by the Power Producer to design, engineer and construct the Project.

l. "Contracted Capacity means 3 MW.

m. "Construction Default" shall mean failure to begin Commercial Operation by 20 months following execution of this Agreement or failure to commence Construction within 12 months following execution of this Agreement

n. "Contract Year" shall mean, with respect to the "initial Contract Year" the period beginning on the Commercial Operation Date of the Project and ending at 12.00 midnight on 31st March of that Fiscal Year. Each successive Contract Year shall coincide with the succeeding Fiscal Year, except that the final Contract Year shall end on the date of expiry of the Term or on Termination of this Agreement whichever is earlier.

o. "Delivered Energy" means the kilowatt hours of Electricity actually fed and measured by the energy meters at the Delivery Point in a Billing Period and certified in the SEA of Gujarat SLDC. The imported energy supplied by the respective DISCOMs to the Project shall be similarly measured during such Billing Period for which the payment shall be made by the Power Producer to the respective DISCOM at the appropriate tariff.

p. "Delivery Point" shall be the dead end tower in Power Project switchyard of the Power Producer.

q. "Due Date of Payment" means the sixtieth (60th) day after a Monthly Bill is received by GUVNL (or, if such day is not a Business Day, the immediately succeeding day) by which date such bill is payable by GUVNL

r. "Electricity" shall mean the electrical energy in kilowatt-hours.

s. "Electricity Laws" shall mean the Electricity Act, 2003 and the relevant rules, notifications, and amendments issued there under and all other

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URJA VIKAS NIGAM LIMITED VADODARA

Laws in effect from time to time and applicable to the development, financing, construction, ownership, operation or maintenance or regulation of electric generating companies and Utilities in India, and the rules, regulations and amendments issued by the Commission from time to time.

t. "Emergency" means a condition or situation of physical damage to the electrical system including the Grid System, which threatens the safe and reliable operation of such system or which is likely to result in disruption of safe, adequate and continuous electric supply by GETCO Grid System or could endanger life or property.

u. "Financing Documents" mean the agreements and documents (including asset leasing arrangements) entered/to be entered into between the Power Producer and the Financing Parties relating to the financing of the Project.

v. "Financial Closure" means the signing of the Financing Documents for financing of the Project and fulfilment of all the conditions precedent to the initial availability of funds there under and the receipt of commitments for such equity as required by the Power Producer in order to satisfy the requirements of the lenders, provided however that the Power Producer has immediate access to funds (subject to giving the required drawdown notices) regarded as adequate by the Power Producer and in any case shall be achieved within 12 (twelve) months from the date of signing of this Agreement.

w. "Financing Parties" means the parties financing the Project, pursuant to the Financing Documents

x. "Fiscal Year" shall mean, with respect to the initial Fiscal Year, the period beginning on the Commercial Operation Date and ending at 12.00 midnight on the following March 31. Each successive Fiscal Year shall begin on April 1 and end on the following March 31, except that the final Fiscal Year shall end on the date of expiry of the Term or on termination of this Agreement, whichever is earlier.

y. "Force Majeure Event" shall have the meaning set forth in Article 8

z. "GETCO means Gujarat Energy Transmission Corporation Limited.

aa. "GERC" means the Gujarat Electricity Regulatory Commission.

TARINI INFRASTRUCTURE L. P. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

bb. "GoI" means the Government of the Republic of India and any agency, legislative body, department, political subdivision, authority or instrumentality thereof.

cc. "GoG" means the Government of the State of Gujarat and any agency, legislative body, department, political subdivision, authority or instrumentality thereof.

dd. "Government Instrumentality" means the GoI, the GoG and their ministries, inspectorate, departments, agencies, bodies, authorities, legislative bodies.

ee. "Grid System" means GETCO / Distribution network through which Delivered Energy is evacuated and distributed

ff. "GUVNL" means Gujarat Urja Vikas Nigam Limited.

gg. "Installed Capacity" means the capacity of the Project at the generating terminal(s) and shall be equal to 3 MW of electrical energy

hh. "Interconnection Facilities" in respect of the Power Producer shall mean all the facilities installed by the Power Producer to enable GETCO to receive the Delivered Energy from the Project at the Delivery Point, including transformers, and associated equipment, relay and switching equipment, protective devices and safety equipment

ii. "KV" means Kilovolts.

jj. "KWH" means Kilowatt-hour.

kk. "Law" means any valid legislation, statute, rule, regulation, notification, directive or order, issued or promulgated by any Governmental Instrumentality.

ll. Letter of Credit" shall mean the letter of credit established pursuant to Article 7.

mm. Metering Date" for a Billing Period, means the midnight of the last day of the calendar month.

nn. "Metering Point" for purposes of recording of Delivered Energy will be the Delivery Point and shall include two separate sets of electronic meters, main meter and the check meter installed by the GETCO in the Project Switchyard on the Project property and both sealed by the Power Producer and GETCO, having facilities to record both export and import of electricity to/from the grid.

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oo. "Minimum Guaranteed Offtake Energy" means guaranteed offtake by GUVNL of seventy per cent (70%) of the Contracted Capacity during the Fiscal Year excluding force Majeure period , if any.

pp. "Minimum Guaranteed Supply Energy" means guaranteed supply by Power Producer of seventy per cent (70%) of the Contracted Capacity during the Fiscal Year excluding force Majeure period , if any.

qq. "Monthly Charge" shall have the meaning set forth in Article 5.

rr. "MW" means Megawatts.

ss. "O & M Default" shall mean (i) the Project fails to operate because of equipment or maintenance failure for a continuous period of at least ninety (90) consecutive days after commencing Commercial Operations and the Power Producer does not follow Prudent Utility Practices to remedy the operating problem

tt. "Project" means a Small power station to be established by the Power Producer at Daman Ganga (Madhuban) Dam in the State of Gujarat comprising of one (1) Hydel turbine generator (River bed–SHP-I) capable of producing 3 MW of Electricity and shall include land, buildings, machinery, ancillary equipment, material, switch-gear, transformers, protection equipment, transmission lines and the like necessary to deliver Electricity generated by the Project to GETCO at the Delivery Point.

uu. "Project Site" means any and all parcels of real property, rights-of-way, easements and access roads located at Daman Ganga (Madhuban) Dam in the State of Gujarat, upon which the Project and its related infrastructure will be located, as described in Schedule 1 hereto.

vv. "Prudent Utility Practices" means those practices, methods, techniques and standards, that are generally accepted for use in electric utility industries taking into account conditions in India, and commonly used in prudent electric utility engineering and operations to design, engineer, construct, test, operate and maintain equipment lawfully, safely, efficiently and economically as applicable to power stations of the size, service and type of the Project, and that generally conform to the manufacturers' operation and maintenance guidelines.

ww. "SBAR" means the prime lending rate per annum applicable for loans with one (1) month maturity as on 1st April of the respective Fiscal Year by the State Bank of India. In the absence of such rate, any other arrangement that substitutes such prime lending rate as mutually agreed to by the Parties.

xx. "Scheduled Commercial Operation Date" means 20 months from signing of this Agreement

yy. "Scheduled Energy "means the quantum of energy to be delivered by the Power Producer at the delivery point as scheduled by the SLDC;

zz. "SEA" means the State Energy Account issued by SLDC, Gujarat on monthly basis and amendments thereto

aaa. "SLDC" means the State Load Despatch Centre as notified by the State Government.

bbb. "Tariff" shall have the meaning set forth in Article 5.

ccc. "Tariff Invoices" shall have the meaning set forth in Article 7.

ddd. "Technical Limits" means the limits and constraints described in Schedule 2, relating to the operations, maintenance and despatch of the Project".

eee. "Term" means the term of the Agreement as defined in Article 9.1."

fff. "Voltage of Delivery" means the voltage at which the Electricity generated by the Project is required to be delivered to GETCO and shall be 66KV or such other KV as is acceptable to GETCO.

Interpretation:

(a) Unless otherwise stated, all references made in this Agreement to "Articles", "Schedules" and Exhibits shall refer, respectively, to Articles of, and Schedules to and Exhibits of this Agreement. The Schedules to this Agreement form part of this Agreement and will be in full force and effect as though they were expressly set out in the body of this Agreement.

(b) In this Agreement, unless the context otherwise requires (i) the singular shall include plural and vice versa; (ii) words denoting persons shall include partnerships, firms, companies (iii) the words "include" and "including" are to be construed without limitation and (iv) a reference to any Party includes that Party's successors and permitted assigns.

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ARTICLE 2

LICENCES, PERMITS

2.1 The Power Producer, at its sole cost and expense, shall acquire and maintain in effect all agreements, clearances, consents, permits, licences and approvals including specified under Schedule-3 required from time to time by all Government Instrumentalities in order to enable it to perform its obligations under the Agreement. GUVNL will render all reasonable assistance to the Power Producer to enable the latter to obtain such clearances without any obligation on part of GUVNL.

Provided, however, non-rendering or partial rendering of assistance shall not in any way absolve the Power Producer of its obligations to obtain such agreements and clearances. Nor shall it mean to confer any right or indicate any intention to waive the need to obtain such agreements or clearances.

ARTICLE 3

CONSTRUCTION AND OPERATION

3.1 The Power Producer shall complete the Construction of the Project on or before the Scheduled Commercial Operation Date.

3.2 For the purposes of such completion of the Project, the Power Producer and GUVNL shall together endeavour to ensure that all Approvals pursuant to Article 2.1 are cleared within the Scheduled Commercial Operation Date.

3.3 For the purposes of such completion of the Project, the Power Producer shall take all necessary steps for obtaining Approvals pursuant to Article 2.1.

3.4 If the Power Producer commits a Construction Default other than due to Force Majeure Events, GUVNL shall give notice of 90 days in writing to the Power Producer, calling upon the Power Producer to remedy such default and if the Power Producer fails to take steps to remedy such default within the aforesaid period, the Agreement shall stand terminated.

3.5 The Power Producer shall provide to GETCO, SLDC and GUVNL information regarding electrical energy generated during testing, commissioning, synchronization and startup.

3.6 Upon the occurrence of a Force Majeure Event in GETCO's evacuation system for safe operation of its Grid, GUVNL / GETCO has the right to shut down the line and has no obligation to evacuate the Electricity nor to pay any compensation during such period. The Power Producer shall suitably back down their generation. GUVNL / GETCO will, however, make reasonable endeavours to remedy such Emergency, and bring back normalcy at the earliest.

3.7 Power Producer shall use commercially reasonable efforts to operate the Project in accordance with the Operating Procedures set forth in Exhibit A and the Interconnection Procedures set forth in Exhibit B.

3.8 The Power Producer shall comply with the provisions of the applicable law including, in particular, GERC Grid Code as amended form time to time regarding operation and maintenance of the Power Project and all matters incidental thereto.

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ARTICLE 4

UNDERTAKINGS

4.1. Obligations of the Power Producer

a. The Power Producer shall obtain all statutory approvals, clearances and permits necessary for the Project in addition to those Approvals as listed in Schedule 3.

b. The Power Producer shall construct the Project, including Interconnection Facilities for which prior approval from GETCO shall be obtained.

c. The Power Producer shall undertake at its own cost maintenance of the Interconnection Facilities in accordance with Prudent Utility Practices.

d. The transmission line from the Delivery Point in the Plant Switchyard to the sub-station of GETCO's shall be constructed by GETCO, the cost of which shall be borne by Power Producer. Power Producer is to co-ordinate with GETCO and finalise the evacuation arrangement including the appropriate sub-station which GETCO will decide.

e. The Power Producer shall operate and maintain the Project in accordance with Prudent Utility Practices.

f. The Power Producer shall be responsible for all payments on account of any taxes, cesses, duties or levies imposed by the GoG and GoI or its competent statutory authority on the land, equipment, material or works of the Project or on the Electricity generated or consumed by the Project or by itself or on the income or assets owned by it. The taxes duties, cesses leviable in future on generation of power by GoG and GoI or any other competent authority shall be payable to power producer if approved by GERC.

g. The Power Producer shall make available the Contracted Capacity on First Right basis from the Project to GUVNL and not to sell to any third party. In case GUVNL refuse to off-take power, power producer may sell such power to third party after obtaining the consent from GUVNL.

h. The Power Producer shall pass through to GUVNL, through a reduction of the monthly bills, an amount equal to 25% of Clean Development

Mechanism (CDM) benefits that it has accrued during such billing period on account of the sale of the Project's Available Capacity to GUVNL.

i. For evacuation facility and maintenance of the transmission, the power producer shall enter into separate agreement with GETCO, if applicable.

j. To procure start up power required for the plant from respective Discom.

k. Fulfilling all other obligations undertaken by power producer under this Agreement.

l. The Power Producer can not inject the power three months earlier to Scheduled Commercial Operation Date from Project

m. Power Producer shall comply with the provisions of the applicable Law including, in particular, Grid Code ABT order as amended form time to time regarding operation and maintenance, Availability declaration, scheduling of the Power from the Project and all other matters incidental thereto.

n. To supply the Minimum Guaranteed power as specified at Article-1(qq) or else pay the compensation for difference between Minimum Guaranteed Supply energy and Actual Energy declared available to SLDC/ GUVNL at the Rs 0.60 per kWh within thirty days to GUVNL

4.2. Obligations of GUVNL:

GUVNL agrees:

a. To pay the Power Producer for the Scheduled Energy as certified in the SEA by SLDC with in due date

b. To offtake the Minimum Guaranteed power as specified at Article-1(pp) or else pay the compensation for difference between Minimum Guaranteed offtake energy and Actual Scheduled Energy subject to the Power Producer has made available the Capacity up to Minimum Guaranteed off take at the Rs. 0.60 per kWh within thirty days to Power Producer.

4.3 Liquidated damages for delay in Commissioning of the Project beyond Scheduled Commercial Operation date

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If the project is not Commissioned by its Scheduled Commercial Operation Date other than the reasons mentioned below, the Power Producer shall pay to the GUVNL liquidated damages for delay at the rate of Rs. 3000 per day per MW for a maximum period of 365 days after which GUVNL may terminate this Agreement or give a chance to the Power Producer to complete the construction to get to the Commercial Operation. If GUVNL does not terminate this Agreement the Power Producer has to abide by all the obligations of this Agreement. However, the liquidated damages will not be applicable if:-

1. The project cannot be Commissioned by Scheduled Commercial Operation Date because of Force Majeure event; or

2. The Power Producer is prevented from performing its obligations because of material default on part of GUVNL.

ARTICLE 5

RATES AND CHARGES

5.1 Monthly Energy Charges: GUVNL shall pay to the Power Producer every month for Scheduled Energy as certified in the monthly SEA by SLDC the amounts (the "Tariff) set forth in Article 5.2 herein.

5.2 GUVNL shall pay the tariff determined by GERC. GERC has determined a tariff of Rs. 3.29 per KWH for the year 2007-08. This rate of 2007-08 will be escalated at 3% per annum till the Commercial Operation Date. The tariff so arrived at the time of Commercial Operation Date (COD) would be applicable for the entire project life as per GERC's order No: 853 of 2005 dated 14th June 2007. It is the responsibility of Power Producer to satisfy the conditions for qualifying as a Small Hydel Projects project as specified by GERC and in case the Project is not so qualified, then the tariff shall be worked out based on GERC's Terms & Conditions of tariff regulations subject to ceiling of Rs.3.29 per Unit.

5.3 For each KVARH drawn from the grid, the Power Producer shall pay at the rate of as determined by the Commission to GETCO from time to time for each KVARH drawn.

5.4 Upon the implementation of the Intra-State ABT (Intra State Availability Based Tariff) in the State, the provisions of the Intra-State ABT Regulations shall become applicable automatically and all the charges including Unscheduled Interchange shall be borne by the Power Producer.

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ARTICLE 6

METERING AND COMMUNICATION

6.1 Reading and Correction of Meters

(i) The Commission has kept Small Hydel Projects in the purview of the settlement mechanism linked with UI rate (which comes into play in case of deviations) under Intra State ABT. Therefore, for the purpose of energy accounting, the power producer shall provide ABT compliant meters at the interface points. Interface metering shall conform to the Central Electricity Authority (Installation and Operation Meters) Regulation, 2006. Commercial settlement of Small Hydel Projects shall be in accordance with the Commission's order No: 3 of 2006 dated 11.8.2006.

(ii) The GETCO and the power producer shall jointly read the Metering System on the first (1st) day of every month at the Delivery Point

(iii) In the event that the Main Metering System is not in service as a result of maintenance, repairs or testing, then the Backup Metering System shall be used during the period the Main Metering System is not in service and the provisions above shall apply to the reading of the Backup Metering System.

(iv) Meter reading taken jointly at the appointed date and time will be signed by the representatives of GETCO and the Power Producer. If Power Producer's representative is not present, then the GETCO shall provide the Power producer with a signed copy of the meter reading of the Main Metering System or Back up Metering System as the case may be. Such meter readings shall be treated as the accurate and final measurement, unless proved otherwise, of the energy supplied to the GUVNL by the Power Producer for the preceding month for the purpose of payment.

6.2 Sealing and Maintenance of Meters.

(i) The Main Metering System and the Backup Metering System shall be sealed in the presence of representatives of Power Producer and GETCO.

(ii) When the Main Metering System and/or Backup Metering System and/or any component thereof is found to be outside the acceptable limits of accuracy or otherwise not functioning properly, it shall be repaired, re-calibrated or replaced by the Power Producer and/or the GUVNL/GETCO at Power Producer's cost, as soon as possible.

(iii) Any meter seal(s) shall be broken only by the GETCO's representative in the presence of Power Producer's/GUVNL representative whenever the Main Metering System or the Backup Metering System is to be inspected, tested, adjusted, repaired or replaced.

(iv) All the main and check meters shall be calibrated every six month.

(v) In case, both the main meters and check meter are found to be beyond permissible limit of error, both the meters shall be calibrated immediately and the correction applicable to main meter shall be applied to the energy registered by the main meter at the correct energy for the purpose of energy account/ billing for the actual period during which inaccurate measurements were made, if such period can be determined or, if not readily determinable, shall be the shorter of:

a. the period since the immediately preceding test of the relevant Main meter, or

b. one hundred and eighty (180) days immediately preceding the test at which the relevant Main meter was determined to be defective or inaccurate.

6.3 Records

Each Party shall keep complete and accurate records and all other data required by each of them for the purposes of proper administration of this Agreement and the operation of the Power Plant. Among such other records and data, the Power Producer shall maintain an accurate and up-to-date operating log at the Power Plant with records of:-

a. Fifteen minutes logs of real and reactive power generation, frequency, transformer tap position, bus voltage(s), Main Meter and Back up Meter readings and any other data mutually agreed ; Till the Intra-State ABT is implemented the details under this clause shall be maintained half hourly basis instead of 15 minutes.

b. any unusual conditions found during operation/ inspections;

c. chart and printout of event loggers, if any, for system disturbances/ outages.

All the records will be preserved for a period of 36 months.

ARTICLE 7

BILLING

7.1 Tariff Invoices.

Power Producer shall prepare invoices on a monthly basis and shall submit the same to GUVNL along with the copy of SEA on the second business day of the following month. The invoice shall show the amount of Scheduled Energy as per SEA, to GUVNL during such month period. The invoice shall also show any adjustments for sharing of CDM benefits. Based upon such information, the amount due to be paid by GUVNL shall be determined and stated.

7.2 Payment:

GUVNL shall make payment of the amounts due in Indian Rupees, on or before the Due Date.

7.3.1 Late Payment:

For payment of monthly bill by GUVNL, if paid after Due Date of Payment, a late payment charge shall be payable by GUVNL to the Power Producer at the rate of two (2) percent in excess of the applicable SBAR rate per annum, on the unpaid amount outstanding calculated on a week or part thereof basis according to the following formula:

$$= \frac{(\text{SBAR} + 2\%)}{52} \text{ per week or part thereof.}$$

7.3.2 Rebate:

For payment of Monthly Bill by GUVNL, if paid before Due Date of Payment, a Rebate shall be deducted by GUVNL at the rate of two (2) percent in excess of the applicable SBAR per annum, on the amount paid before due date, calculated on a week or part thereof basis viz.

$$= \frac{(SBAR + 2\%)}{52} \text{ per week or part thereof.}$$

7.3.3 Compensation towards Minimum Guaranteed Offtake by GUVNL

In case, GUVNL fails to take "Minimum Guarantee Oftake Energy" on yearly basis as defined at Article-1 (pp). GUVNL will pay the compensation for difference between Minimum Guaranteed Off-take energy and actual scheduled energy subject to power producer has made available the energy upto the minimum guaranteed off take, at the rate of Rs.0.60/KWh within 30 days to Power Producer. However, the minimum guaranteed off-take compensation shall be worked out on cumulative basis and settled on monthly basis.

7.3.4 Compensation towards Minimum Guaranteed Supply by Power Producer

In case, Power Producer fails to make available "Minimum Guaranteed Supply Energy" on yearly basis as defined in Article-1(qq). Power producer shall pay the compensation for difference between minimum guaranteed supply and actual energy declared available to GUVNL/SLDC at the rate of Rs 0.60/KWh within 30 days to GUVNL. However, the Minimum Guaranteed Supply Energy compensation shall be worked out on cumulative basis and settled on monthly basis.

7.4. Letter of Credit:

7.4.1 GUVNL shall establish and maintain irrevocable and unconditional revolving Letter of Credit from the bank where the GUVNL revenue is deposited every month in favour of, and for the sole benefit of, the Power Producer for the said Project for the amount equivalent to one months invoice amount for one year and renewed thereafter on yearly basis during the term of this agreement.

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7.4.2 The Letter of Credit shall be established in favour of, and issued to, the Power Producer on the date hereof and made operational thirty (30) days prior to the Commercial Operation Date of the Project and shall be maintained consistent herewith by GUVNL at any and all times during the Term of the Agreement. The cost of the LC shall be borne by the Power Producer.

7.4.3 Such Letter of Credit shall be in form and substance acceptable to both the Parties and shall be issued by any GUVNL Bank and be provided on the basis that:

(i) In the event a Tariff Invoice or any other amount due and undisputed amount payable by GUVNL pursuant to the terms of this Agreement is not paid in full by GUVNL as and when due, the Letter of Credit may be called by the Power Producer for payment in full of the unpaid Tariff Invoice

(ii) The amount of the Letter of Credit shall be equal to one month's projected payments.

(iii) The GUVNL shall replenish the Letter of Credit to bring it to the original amount within 30 days in case of any valid drawdown.

(iv) The Letter of Credit shall be renewed and/or replaced by the GUVNL not less than 60 days prior to its expiration.

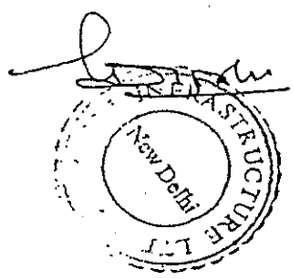
7.5 Payment under the Letter of Credit: The draw down under the Letter of Credit in respect of a Tariff Invoice shall require:

1. A copy of the state energy account issued by the SLDC Gujarat
2. A certificate from the Power Producer stating that the amount payable by GUVNL in respect of such Tariff Invoice has not been paid by GUVNL by the Due Date of Payment of the Tariff Invoice and disputed by the GUVNL till due date of payment of the tariff invoice.

7.6 Disputes: In the event of a dispute as to the amount of any Tariff Invoice/other item, GUVNL shall notify the Power Producer of the amount in dispute and GUVNL shall be liable to pay 100% of the undisputed

amount plus 85% of the disputed amount within the due date provided either party shall have the right to approach the GERC to effect a higher or lesser payment on the disputed amount.

The Parties shall discuss within a week from the date on which GUVNL notifies the Power Producer of the amount in dispute and try and settle the dispute amicably. If the dispute is not settled during such discussion then the payment made by GUVNL shall be considered as a payment under protest Upon resolution of the dispute, in case the Power Producer is subsequently found to have overcharged, then it shall return the overcharged amount with an interest of SBAR plus 2 % per annum for the period it retained the additional amount. GUVNL/Power Producer shall not have the right to challenge any Tariff Invoice, or to bring any court or administrative action of any kind questioning/modifying a Tariff Invoice after a period of three years from the date of the Tariff Invoice is due and payable. Where any Dispute arising out of or in connection with this Agreement is not resolved mutually then such Dispute shall be submitted to adjudication by the Appropriate Commission as provided under section 79 or 86 of the Electricity Act, 2003 and the Appropriate Commission may refer the matter to Arbitration as provided in the said provision read with section 158 of the said Act. For disputes beyond the power conferred upon the Appropriate Commission, such disputes shall be subject to the jurisdiction of the High Courts of Gujarat.



ARTICLE 8

FORCE MAJEURE

8.1 Force Majeure Events:

a. Neither Party shall be responsible or liable for or deemed in breach hereof because of any delay or failure in the performance of its obligations hereunder (except for obligations to pay money due prior to occurrence of Force Majeure Events under this Agreement) or failure to meet milestone dates due to any event or circumstance (a "Force Majeure Event") beyond the reasonable control of the Party experiencing such delay or failure, including the occurrence of any of the following:

(i) acts of God;

(ii) typhoons, floods, lightning, cyclone, hurricane, drought, famine, epidemic, plague or other natural calamities;

(iii) acts of war (whether declared or undeclared), invasion or civil unrest;

(iv) any requirement, action or omission to act pursuant to any judgment or order of any court or judicial authority in India (provided such requirement, action or omission to act is not due to the breach by the Power Producer or GUVNL of any Law or any of their respective obligations under this Agreement);

(v) inability despite complying with all legal requirements to obtain, renew or maintain required licenses or Legal Approvals;

(vi) earthquakes, explosions, accidents, landslides;

(vii) fire;

(viii) expropriation and/or compulsory acquisition of the Project in whole or in part;

(ix) chemical or radioactive contamination or ionising radiation; or

(x) Non availability of transmission network, damage to or breakdown of transmission facilities of GETCO.

(xi) exceptional adverse weather condition which are in excess of statistical measure of the last hundred (100) years.

8.1 b The availability of Article 8.1 (a) to excuse a Party's obligations under this Agreement due to a Force Majeure Event shall be subject to the following limitations and restrictions:

(i) the affected party gives the other Party written notice describing the particulars of the Force Majeure Event soon as practicable after its occurrence;
(ii) the suspension of performance is of no greater scope and of no longer duration than is required by the Force Majeure Event and the repairs required due to the Force Majeure Event;
(iii) the affected Party is able to resume performance of its obligations under this Agreement, it shall give the other Party written notice to that effect;
(iv) the Force Majeure Event was not caused by the affected Party's negligence or intentional acts, errors or omissions, or by its negligence/failure to comply with any material Law, or by any material breach or default under this Agreement;
(v) in no event shall a Force Majeure Event excuse the obligations of a Party that are required to be completely performed prior to the occurrence of a Force Majeure Event.

8.2 Available Relief for a Force Majeure Event : No party shall be in breach of its obligations pursuant to this agreement to the extent that the performance of its obligations was prevented, hindered or delayed due to a Force Majeure Event.For avoidance of doubt, GUVNL's obligation to make payments of money already due and payable prior to Force Majeure Event shall not be suspended or excused due to the occurrence of a Force Majeure Event.

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ARTICLE 9

TERM, TERMINATION AND DEFAULT

9.1 Term of the Agreement: This Agreement shall become effective upon the execution and delivery thereof by the Parties hereto and unless terminated pursuant to other provisions of the Agreement, shall continue to be in force till August, 2042

9.2 Events of Default:

9.2.1 Power Producer's Default: The occurrence of any of the following events shall constitute an Event of Default by Power Producer:

a. O&M Default on part of Power Producer.
b. Repeated failure or refusal by Power Producer to operate the Project in accordance with GERC Grid code/ Indian Electricity Grid code and ABT regulation.
c. Power Producer fails to credit GUVNL for the amounts due to GUVNL pursuant to the provisions of Article 4.1(h) within three (3) months after the accrual of such payment by Power Producer.
d. Power Producer (i) assigns or purports to assign all of its assets and rights in violation of this Agreement except as required by Power Producer's lenders or (ii) transfers or novates any of its rights and / or obligations under this Agreement in violation of this Agreement.
e. Due to the gross negligence of Power Producer, the Power Producer becomes voluntarily or involuntarily the subject of a proceeding under any bankruptcy or insolvency laws or goes into liquidation or dissolution or has a receiver appointed over it or a liquidator is appointed, pursuant to Law, except where such dissolution of the Power Producer is for the purpose of a merger, consolidation or reorganization and where the resulting entity has the financial standing to perform its obligations under this Agreement and creditworthiness similar to the Power Producer and expressly assumes all obligations under this Agreement and is in a position to perform them; or
f. The Power Producer repudiates this Agreement by executing a power purchase agreement with another buyer for the same Electric Energy to be

provided to GUVNL hereunder, except in accordance with the terms of this Agreement.

9.2.2 GUVNL's Default: The occurrence of any of the following shall constitute an Event of Default by GUVNL:

(i) Undisputed payment default by the GUVNL for a continuous period of ninety (90) days.

9.3 Termination:

9.3.1 Termination for Power Producer's Default:

Upon the occurrence of an event of default as set out in sub-clause 9.2.1 above, GUVNL may deliver a Default Notice to the Power Producer in writing which shall specify in reasonable detail the Event of Default giving rise to the default notice, and calling upon the Power Producer to remedy the same.

At the expiry of 90 (ninety) days from the delivery of this default notice and unless the Parties have agreed otherwise, or the Event of Default giving rise to the default notice has been remedied, GUVNL may deliver a Termination Notice to the Power Producer. GUVNL may terminate this Agreement by delivering such a Termination Notice to the Power Producer and intimate the same to the Commission. Upon delivery of the Termination Notice this Agreement shall stand terminated and GUVNL shall stand discharged of all its obligations. The Power Producer shall have liability to make payment within 30 days from the date of termination notice toward compensation to GUVNL equivalent to three years billing. The amount of three years billing shall be worked out on 'Minimum Guaranteed off-take energy'.

The Bills towards compensation shall be paid on monthly basis and the provisions of Billing and Payment will apply Mutatis Mutandis in this case also. However, all payment obligations as per the Article 7 prior to the date of termination of the Agreement shall be met by the Parties.

Where a Default Notice has been issued with respect to an Event of Default, which requires the co-operation of both GUVNL and the Power Producer to remedy, GUVNL shall render all reasonable co-operations to enable the Event of Default to be remedied without any legal obligations.

9.3.2 Termination for GUVNL's Default:

Upon the occurrence of an Event of Default as set out in sub-clause 9.2.2 above, the Power Producer may deliver a Default Notice to GUVNL in writing which shall specify in reasonable detail the Event of Default giving rise to the Default Notice, and calling upon GUVNL to remedy the same.

At the expiry of 90 (ninety) days from the delivery of the Default Notice and unless the Parties have agreed otherwise, or the Event of Default giving rise to the Default Notice has been remedied, the Power Producer may serve a "Suspension Notice" to GUVNL for a duration not exceeding one year ("Suspension Period").

During the "Suspension Period" mentioned herein above, GUVNL shall allow the Power Producer to sell power from the project, to any HT consumers of the State, in the open market either by finding the said consumers on its own or through any Central / State power trading utilities. In case of wheeling of power to such third parties, the transmission charges, transmission losses, wheeling charges and losses SLDC charges and cross subsidy surcharge etc. shall be applicable as per GERC's regulation remain force from time to time and paid directly to respective agencies by third party. No banking facility shall be allowed to Power Producer and third parties.

On expiry of the Suspension Period, GUVNL will be entitled to cure its default and buy power from the Power Producer. In the event GUVNL fails to cure the default, the Power Producer may terminate this Agreement by delivering a Termination Notice to GUVNL / its successor entity and in such an event GUVNL shall have liability to make payment within 30 days from the date of termination notice toward compensation to Power Producer equivalent to three years billing. The amount of three years billing shall be worked out on 'Minimum Guarantee off-take energy' or in such an event, power producer shall be allowed to sale the power from the project to any of the consumers in the State in open market. In case of wheeling of power to such third party, the transmission charges of GETCO and wheeling charges of any of the four subsidiary companies of GUVNL (i.e. DGVCL, MGVCL, PGVCL, UGVCL) which are in excess of 5% of the power purchase rate shall be reimbursed by GUVNL for remaining term of PPA. Moreover, subsidiary companies of GUVNL (i.e. DGVCL, MGVCL, PGVCL, UGVCL) shall also waive their cross subsidy surcharge applicable during the relevant period on the sale of power by power producer to any consumer of these Distribution companies up to the ceiling of power at Minimum Guaranteed Off-take Energy.

The Bills towards reimbursement of transmission and wheeling charges shall be paid on monthly basis and the provisions of Billing and Payment will apply in this case also.

In case of default by GUVNL, the power producer will select any of the option mentioned above for compensation towards termination of the agreement and inform to GUVNL with default notice.

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ARTICLE 10

DISPUTE RESOLUTION

10.1 Disputes or differences between the Parties arising out of or in connection with this Agreement which are not subject to the provisions of Section 7.6 of this Agreement and the Electricity Act of 2003, shall be first tried to be settled through mutual negotiation.

10.2 The Parties hereto agree to attempt to resolve all disputes arising hereunder promptly, equitably and in good faith.

10.3 Each Party shall designate in writing and communicate to the other Party the name of its representative who shall be authorized to resolve any dispute arising under this Agreement in an equitable manner and, unless otherwise expressly provided herein, to exercise the authority of the Parties hereto to make decisions by mutual agreement.

10.4 In the event that such differences or disputes between the Parties are not settled through mutual negotiations within sixty (60) days, after such dispute arises, then the dispute shall be referred to GERC for adjudication as per provisions of Electricity Act 2003.

ARTICLE 11

INDEMNITY

11.1 Power Producer's Indemnity: The Power Producer agrees to defend, indemnify and hold harmless GUVNL, its officers, directors, agents, employees and affiliates (and their respective officers, directors, agents and employees) from and against any and all claims, liabilities, actions, demands, judgements, losses, costs, expenses, suits, actions and damages arising by reason of bodily injury, death or damage to property sustained by third parties that are caused by an act of negligence or the willful misconduct of the Power Producer, or by an officer, director, sub-contractor, agent or employee of the Power Producer except to the extent of such injury, death or damage as is attributable to the willful misconduct or negligence of, or breach of this Agreement by, GUVNL, or by an officer, director, sub-contractor, agent or employee of the GUVNL.

11.2 GUVNL's Indemnity: GUVNL agrees to defend, indemnify and hold harmless the Power Producer, its officers, directors, agents, employees and affiliates (and their respective officers, directors, agents and employees) from and against any and all claims, liabilities, actions, demands, judgements, losses, costs, expenses, suits, actions and damages arising by reason of bodily injury, death or damage to property sustained by third parties that are caused by an act of negligence or the wilful misconduct of GUVNL, or by an officer, director, sub-contractor, agent or employee of GUVNL except to the extent of such injury, death or damage as is attributable to the wilful misconduct or negligence of, or breach of this Agreement by, the Power Producer, or by an officer, director, sub-contractor, agent or employee of the Power Producer.

INFRASTRUCTURE New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

Article 12

Representation and Warranties:

a. Power Producer makes to Buyer the representations and warranties set forth in Exhibit C hereto.

b. GUVNL makes to Power Producer the representations and warranties set forth in Exhibit D hereto.

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ARTICLE 13

MISCELLANEOUS PROVISIONS

13.1 Governing Law: This Agreement shall be interpreted, construed and governed by the Laws of India.

13.2 Insurance: The Power Producer shall obtain and maintain necessary insurance during the Term of this Agreement consistent with Prudent Utility Practice and provide the copy of same to GUVNL.

13.3 Books and Records: The Power Producer shall maintain books of account relating to the Project in accordance with Indian generally accepted accounting principles.

13.4. Waivers: Any failure on the part of a Party to exercise, and any delay in exercising, exceeding three years, any right hereunder shall operate as a waiver thereof. No waiver by a Party of any right hereunder with respect to any matter or default arising in connection with this Agreement shall be considered a waiver with respect to any subsequent matter or default.

13.5. Limitation Remedies and Damages: Neither Party shall be liable to the other for any consequential, indirect or special damages to persons or property whether arising in tort, contract or otherwise, by reason of this Agreement or any services performed or undertaken to be performed hereunder.

13.6. Notices: Any notice, communication, demand, or request required or authorized by this Agreement shall be in writing and shall be deemed properly given upon date of receipt if delivered by hand or sent by courier, if mailed by registered or certified mail at the time of receipt, if sent by fax when dispatched (provided if the sender's transmission report shows the entire fax to have been received by the recipient and only if the transmission was received in legible form), to :

FRASTRUCTURE New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

In case of the Power Producer: M/s

Name- Gangadutt Kuberdutt Joshi
Designation Regional Director
Address: C-1, Saket housing society, Susan-Tarsali Road,
Vadodara-390010

In case of GUVNL:

Designation : General Manager (Commerce)
Address : Gujarat Urja Vikas Nigam Ltd, Sardar Patel Vidyut Bhavan
Race Cource Vadodara - 390007
Ph. Nos.: 0265 - 2340504 Fax No.: 0265 – 2344543

With a copy to : Managing Director on above address

13.7. Severability: Any provision of this Agreement, which is prohibited or unenforceable in any jurisdiction, shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions hereof and without affecting the validity, enforceability or legality of such provision in any other jurisdiction.

13.8. Amendments: This Agreement shall not be amended, changed, altered, or modified except by a written instrument duly executed by an authorized representative of each Party. However, GUVNL at the request of power producer, may consider any amendment(s) or change(s), that the Lenders may require to be made to this Agreement, provided the same are appropriate in opinion of GUVNL.

13.9. Assignment:

(i) Neither Party shall assign this Agreement or any portion hereof without the prior written consent of the other Party, provided further that any assignee shall expressly assume the assignor's obligations thereafter arising under this Agreement pursuant to documentation satisfactory to such other Party. However

GUVNL shall not unreasonably withhold any of Power Producer's request for consent to transfer to any successor all of its right and obligation under this agreement and such successor shall be bound by all the obligations under this agreement.

In furtherance of the foregoing, GUVNL acknowledges that the Financing Documents may provide that upon an event of default by the Power Producer under the Financing Documents, the Financing Parties may cause the Power Producer to assign to a third party the interests, rights and obligations of the Power Producer thereafter arising under this Agreement. GUVNL further acknowledges that the Financing Parties, may, in addition to the exercise of their rights as set forth in this Section, cause the Power Producer to sell or lease the Project and cause any new lessee or purchaser of the Project to assume all of the interests, rights and obligations of the Power Producer thereafter arising under this Agreement.

13.10. Entire Agreement, Appendices: This Agreement constitutes the entire agreement between GUVNL and the Power Producer, concerning the subject matter hereof. All previous documents, undertakings, and agreements, whether oral, written, or otherwise, between the Parties concerning the subject matter hereof are hereby cancelled and shall be of no further force or effect and shall not affect or modify any of the terms or obligations set forth in this Agreement, except as the same may be made part of this Agreement in accordance with its terms, including the terms of any of the appendices, attachments or exhibits. The appendices, attachments and exhibits are hereby made an integral part of this Agreement and shall be fully binding upon the Parties.

In the event of any inconsistency between the text of the Articles of this Agreement and the appendices, attachments or exhibits hereto or in the event of any inconsistency between the provisions and particulars of one appendix, attachment or exhibit and those of any other appendix, attachment or exhibit GUVNL and the Power Producer shall consult to resolve the inconsistency. In case, explicit provisions are not made under this Agreement, the provisions of Electricity Act 2003, Grid Code, Availability Based Tariff order etc. shall be appropriately applicable.

13.11. Further Acts and Assurances: Each of the Parties after convincing itself agrees to execute and deliver all such further agreements, documents and instruments, and to do and perform all such further acts and things, as shall be necessary or convenient to carry out the provisions of this Agreement and to consummate the transactions contemplated hereby.

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed by their fully authorised officers, and copies delivered to each Party, as of the day and year first above stated.

For and on behalf of

Gujarat Urja Vikas Nigam Ltd

(S. B. KHYALIA)
General Manager (Comm)
GUVNL, BARODA.

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

Signature with Seal

Witness:

1 (J. M. VACHHANI)
EXECUTIVE ENGINEER (Tariff)
GUVNL, VADODARA.

2 A. N. KHAMBHATTI
Deputy Engineer (Commerce)
Commerce Deputy Manager
GUVNL
VADODARA.

For and on behalf of

TARINI Infrastructure Limited

For Tarini Infrastructure Ltd.

Authorised Signatory

TARINI INFRASTRUCTURE LTD. New Delhi

Signature with Seal

Witness:

1 M.K. Balthwal
Nakshidham Society
Tarsali, Baroda

2 (Jitendra Sura)
MD
Conark Engg Ltd
B'bay Shopping Centre
Baroda

SCHEDULE-1

PARAMETERS AND TECHNICAL LIMITS OF SUPPLY

- Three phase alternating current
- Nominal declared frequency : 50.0 Hz
- Final Voltage at Delivery Point 66 kV
- Short circuit rating: As a part of the detailed design process, the Power Producer shall calculate the short circuit rating (minimum and maximum), and supply this information to the GUVNL
- The Project shall be designed and capable of being synchronized and operated within a frequency range of 48.0 to 51.5 Hertz and voltage of 66 KV and ___ KV and a power factor (at maximum rated power) between 0.9 lagging and 0.95 leading at the generator terminals.
- Power Factor: Generator shall have a power factor rating of 0.90 lagging. The Power Producer shall also provide capacitors of sufficient rating at the power Project itself to compensate for reactive KVA drawn from the system by induction generators and to maintain average monthly power factor of not less than 0.9 lagging at the point of inter-connection. The Power Producer shall provide suitable protection devices, so that the Electric Generators could be isolated automatically when grid supply fails.
- Connectivity criteria like short circuit level (for switchgear), neutral Grounding, fault clearance time, current unbalance (including negative and zero sequence currents), limit of harmonics etc. shall be in accordance with the IEGC, Gujarat Electricity Grid code and the Grid Connectivity standards as may be specified by the Central Electricity Authority.
- The Project Site is located at Daman Ganga (Madhuvan) Dam in the State of Gujarat

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

SCHEDULE 2

TECHNICAL LIMITS

1. The nominal steady state electrical characteristics of the system shall be in accordance with the provisions made in the IEGC, Gujarat State Grid Code, Indian Electricity Rules, 1956 and other applicable Standards.

2. Operation of the Project outside the"nominal voltage and frequency "specified above will result in reduction of power output consistent with generator capability curves.

SCHEDULE 3

APPROVALS

1 Consent from GETCO for the evacuation scheme for evacuation of the power generated by the 3 MW Small Hydel Projects vide letter _____

2 Permission from State Government and all other statutory and non-statutory bodies required for the Project.

3 Clearance from the Central Water Commission/State Government Department of Irrigation

4 Clearance from the Airport Authority of India, if required.

5 Clearance from the Ministry of Environment & Forests, Department of Forest, Ecology and Environment, State Pollution Control Board, if required.

6 Order of the Commission dated June14,2007

SCHEDULE 4

TESTING PROCEDURES

Power Producer and GUVNL shall evolve suitable testing procedures three (3) months before the Commercial Operation Date of the Project considering relevant standards.

EXHIBIT A Operating & Maintenance

1 *OPERATION AND MAINTENANCE*

Power Producer shall comply with the provisions of the applicable Law including, in particular, Grid Code ,ABT order as amended form time to time regarding operation and maintenance Availability, scheduling of the Power Project and all matters incidental thereto.

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

INFRASTRUCTURE New Delhi

EXHIBIT B Details of Interconnection Facilities

To be submitted by Power Producer within six months after financial closure

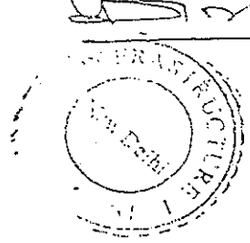

EXHIBIT C Representations and Warranties of Power Producer

1. Power Producer is a corporation duly organized, validly existing and in good standing under the laws of India and is qualified to do business as a foreign owned corporation, and has the power and authority to own, lease or otherwise have a possessory interest in its properties, to carry on its business as now being conducted and as proposed to be conducted and to enter into this Agreement and carry out the transactions contemplated hereby and to perform and carry out all covenants and obligations on its part to be performed under and pursuant to this Agreement.

2. The Project will have a nominal rated capacity of electricity output of 3 MW and when constructed will generate approximately 12960000 KWH of electric energy annually.

3. Power Producer is in material compliance with all applicable material laws, judicial and administrative orders, and rules and regulations with respect to the ownership and operation of the Project.

4. Power Producer is not prohibited from entering into this Agreement or discharging and performing all covenants and obligations on its part to be performed under and pursuant to this Agreement.

5. The execution and delivery of this Agreement, the consummation of the transactions contemplated hereby and the fulfilment of and compliance with the provisions of this Agreement will not conflict with or constitute a breach of or a default under, any of the terms, conditions or provisions of any applicable law, order of any court or other agency of government, the certificate of incorporation or by-laws of the Power Producer or any contractual limitation, corporate restriction or outstanding trust indenture, deed of trust, mortgage, loan agreement, other evidence of indebtedness or any other Agreement or instrument,

to which the Power Producer is a Party or by which it or any of its property is bound, or result in a breach of or a default under any of the foregoing.

6. This Agreement is the legal, valid and binding obligation of the Power Producer enforceable in accordance with its terms, except as limited by bankruptcy, insolvency, reorganization, moratorium, or other laws of general application relating to or affecting enforcement of creditors' rights, whether such enforcement is sought in a proceeding in equity or at law.

7. Power Producer has taken all such corporate action as may be necessary to authorize this Agreement, the execution and delivery thereof, the consummation of the Transactions and the carrying out of all covenants and obligations on its part to be performed under and pursuant to this Agreement.

EXHIBIT D Representations and Warranties of GUVNL

1. GUVNL is a Gujarat Government owned utility duly organized, validly existing and qualified to do business under the laws of India ,is in good standing under the laws of India, has the power and authority to own its properties, to carry on its electric utility business as now being conducted and to enter into this Agreement and to carry out the transactions contemplated hereby and to perform and carry out all covenants and obligations on its part to be performed under and pursuant to this Agreement.

2. GUVNL is not prohibited from entering into this Agreement or discharging and performing all covenants and obligations on its part to be performed under and pursuant to this Agreement.

3. The execution and delivery of this Agreement, the consummation of the transactions contemplated hereby and the fulfilment of and compliance with the provisions of this Agreement will not conflict with or constitute a breach of or a default under, any of the terms, conditions or provisions of any applicable law, order of any court or other agency of government, the certificate of incorporation or by-laws of GUVNL, or any contractual limitation, corporate restriction or outstanding trust indenture, deed of trust, mortgage, loan agreement, other evidence of indebtedness or any other agreement or instrument to which GUVNL is a Party or by which it or any of its property is bound or result in a breach of or a default under any of the foregoing.

4. This Agreement is the legal, valid and binding obligation of GUVNL enforceable in accordance with its terms, except as limited by bankruptcy, insolvency, reorganization, moratorium, or other laws of general application relating to or affecting enforcement of creditors' rights, whether such enforcement is sought in a proceeding in equity or at law.

5. All consents and authorizations required for GUVNL to execute, deliver

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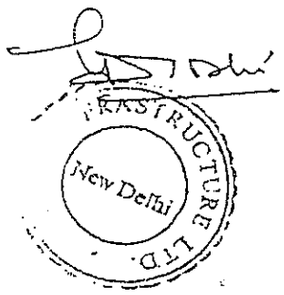
GAS NIGAM LIMITED

and perform this Agreement have been obtained.

6 GUVNL has taken all such corporate action as may be necessary to authorize this Agreement, the execution and delivery thereof, the consummation of the Transactions and the carrying out of all covenants and obligations on its part to be performed under and pursuant to this Agreement.



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POWER PURCHASE AGREEMENT

BETWEEN

TARINI INFRASTRUCTURE LIMITED

AND

GUJARAT URJA VIKAS NIGAM LIMITED

29th January , 2008

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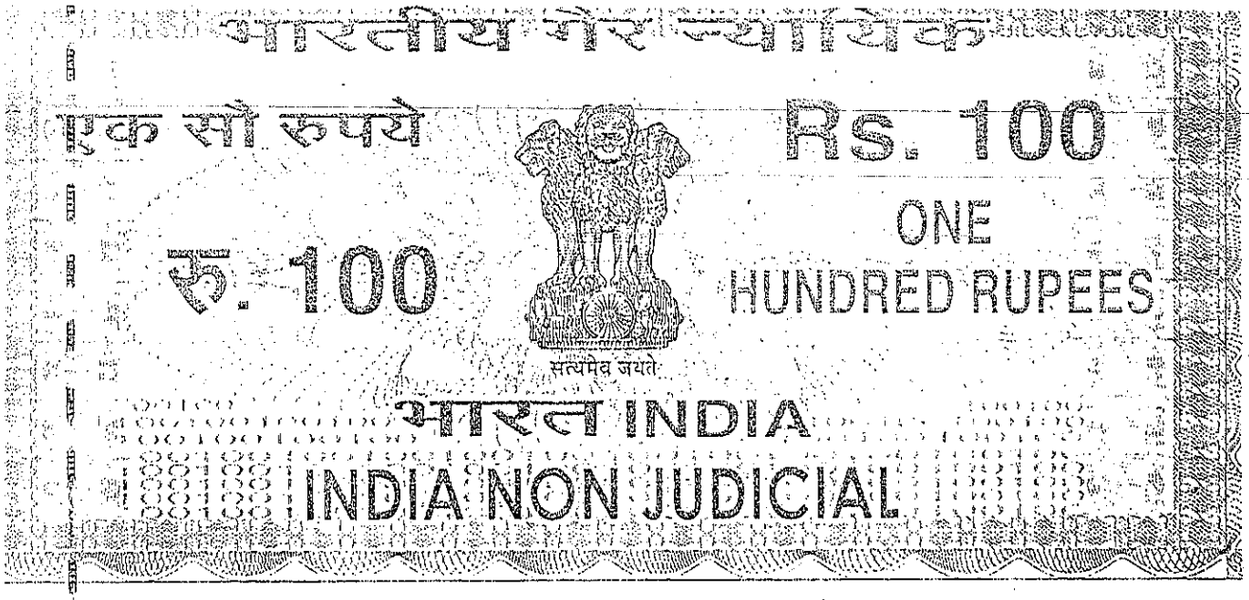

ગુજરાત GUJARAT G 085450

This Power Purchase Agreement is made and entered into at Vadodara on this 29th day of January 2008 by and between

(i) M/s TARINI Infrastructure Ltd, a private Power Producer with limited liability incorporated in India under the Companies Act 1956 and Generating Company as defined under sub-section 28, of Section 2 of the Electricity Act 2003 to commission, operate and maintain an electricity generating station and having its registered office at D-2, 1st Floor, Amar Colony, Lajpat Nagar, New Delhi 110024, , India (hereinafter referred to as "Power Producer", which expression shall, unless repugnant to the context or meaning thereof, include its successors and assignees), as party of the first part.

TARINI INFRASTRUCTURE LTD. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

AND

Gujarat Urja Vikas Nigam Limited, (hereinafter referred to as "GUVNL") a company incorporated under the provisions of the Companies Act, 1956 and carrying on the business of bulk purchase and bulk supply to distribution licensees and having its registered office at Sardar Patel Vidyut Bhavan, Race Course, Vadodara 390 007, (hereinafter referred to as "Procurer", which expression shall, unless repugnant to the context or meaning thereof, include its successors and assignees) as party of the second part.

WHEREAS the Power Producer desires to set-up a Hydel facility under the Gujarat Electricity Regulatory Commission (Power procurement from renewable sources) Regulations, 2005 (15 of 200) principally by small Hydel Projects generated (2.6 MW Cannel Based SHP-II) by the **M/s TARINI Infrastructure Limited located at Daman Ganga (Madhuban) Dam,Gujarat** The Hydel facility shall consist of small Hydel Projects and Hydel turbine generator complete with step-up transformer(s), switchyard, pipelines, grid paralleling / interfacing equipment and other auxiliary equipment.

AND WHEREAS the "Power Producer" will arrange with Gujarat Energy Transmission Corporation Ltd. (hereinafter referred to as "GETCO") for the construction, ownership, operation and maintenance of an appropriate transmission line and interconnection facilities (up to the Delivery Point,)

AND WHEREAS GUVNL will purchase the "Contracted Capacity" and the Power Producer will supply the "Contracted Capacity" to GUVNL on First Right basis on the terms and subject to the conditions set out in this Agreement.

NOW THEREFORE IN VIEW OF THE FOREGOING PREMISES AND IN CONSIDERATION OF THE MUTUAL COVENANTS AND CONDITIONS HEREINAFTER SET FORTH, GUVNL AND THE POWER PRODUCER, EACH TOGETHER WITH THEIR RESPECTIVE SUCCESSORS AND PERMITTED ASSIGNS, A PARTY AND COLLECTIVELY THE PARTIES, HEREBY AGREE AS FOLLOWS:

TARINI INFRASTRUCTURE LIMITED New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

DEFINITIONS

1.1 For all purposes of this Agreement, the following words and expressions shall have the respective meanings set forth below:. Each defined word or expression when used in this Agreement has been identified by capitalizing the first letter of that word or expression.

a. "Agreement" shall mean this Power Purchase Agreement executed hereof, including the schedules hereto, amendments, modifications and supplements made in writing by the Parties from time to time.

b. "Approvals" means the agreements, permits, clearances, licenses and consents as are listed in Schedule 3 hereto and any other statutory approvals or necessary agreements.

c. **Availability:** shall mean that the Generating Unit is available to its contracted capacity at the delivery point and declared to SLDC as per Grid Code of GERC and Availability Based Tariff Regulation of GERC as amended from time to time.

d. "Billing Date" shall be the first Business Day after the Metering Date of each Billing Period.

e. "Small/small Hydel" means projects upto 100KW station capacity are called Micro Hydel,101 KW to 2000KW (Unit size upto 1000KW) are called Mini Hydel and 2001KW to 15 MW(Unit size upto 5 MW) are called small Hydel power projects.

f. "Billing Period" means (subject to Clause 6.1 of the Agreement) the calendar month ending with the Metering Date. The first Billing Period shall commence from the Commercial Operation Date and end with the Metering Date corresponding to the month in which the Commercial Operation Date occurs.

g. "Business Day" means a day other than Sunday or a statutory holiday, on which the banks remain open for business in Vadodara.

h. "CDM" is defined in Clause 4.1 h

i. "Commercial Operation Date" with respect to the Project shall mean the date on which the Project is available for commercial operation and such

VIKAS NIGAM LIMITED GUJARAT URJA VADODARA

the Power Producer to GUVNL and in any case, shall not be beyond the Scheduled Commercial Operation Date. GUVNL have right to refuse to off take power more than three (3) months prior to Schedule Commercial Operation Date.

j. "Commission" means Gujarat Electricity Regulatory Commission.

k. "Construction" means one or more main contractors appointed by the Power Producer to design, engineer and construct the Project.

l. "Contracted Capacity means 2.6 MW.

m. "Construction Default" shall mean failure to begin Commercial Operation by 20 months following execution of this Agreement or failure to commence Construction within 12 months following execution of this Agreement

n. "Contract Year" shall mean, with respect to the "initial Contract Year" the period beginning on the Commercial Operation Date of the Project and ending at 12.00 midnight on 31st March of that Fiscal Year. Each successive Contract Year shall coincide with the succeeding Fiscal Year, except that the final Contract Year shall end on the date of expiry of the Term or on Termination of this Agreement whichever is earlier.

o. "Delivered Energy" means the kilowatt hours of Electricity actually fed and measured by the energy meters at the Delivery Point in a Billing Period and certified in the SEA of Gujarat SLDC. The imported energy supplied by the respective DISCOMs to the Project shall be similarly measured during such Billing Period for which the payment shall be made by the Power Producer to the respective DISCOM at the appropriate tariff.

p. "Delivery Point" shall be the dead end tower in Power Project switchyard of the Power Producer.

q. "Due Date of Payment" means the sixtieth (60th) day after a Monthly Bill is received by GUVNL (or, if such day is not a Business Day, the immediately succeeding day) by which date such bill is payable by GUVNL

r. "Electricity" shall mean the electrical energy in kilowatt-hours.

TARINI INFRA P. LTD. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

rules, notifications, and amendments issued there under and all other Laws in effect from time to time and applicable to the development, financing, construction, ownership, operation or maintenance or regulation of electric generating companies and Utilities in India, and the rules, regulations and amendments issued by the Commission from time to time.

t. "Emergency" means a condition or situation of physical damage to the electrical system including the Grid System, which threatens the safe and reliable operation of such system or which is likely to result in disruption of safe, adequate and continuous electric supply by GETCO Grid System or could endanger life or property.

u. "Financing Documents" mean the agreements and documents (including asset leasing arrangements) entered/to be entered into between the Power Producer and the Financing Parties relating to the financing of the Project.

v. "Financial Closure" means the signing of the Financing Documents for financing of the Project and fulfilment of all the conditions precedent to the initial availability of funds there under and the receipt of commitments for such equity as required by the Power Producer in order to satisfy the requirements of the lenders, provided however that the Power Producer has immediate access to funds (subject to giving the required drawdown notices) regarded as adequate by the Power Producer and in any case shall be achieved within 12 (twelve) months from the date of signing of this Agreement.

w. "Financing Parties" means the parties financing the Project, pursuant to the Financing Documents

x. "Fiscal Year" shall mean, with respect to the initial Fiscal Year, the period beginning on the Commercial Operation Date and ending at 12.00 midnight on the following March 31. Each successive Fiscal Year shall begin on April 1 and end on the following March 31, except that the final Fiscal Year shall end on the date of expiry of the Term or on termination of this Agreement, whichever is earlier.

y. "Force Majeure Event" shall have the meaning set forth in Article 8

aa. "GERC" means the Gujarat Electricity Regulatory Commission.

bb. "GoI" means the Government of the Republic of India and any agency, legislative body, department, political subdivision, authority or instrumentality thereof.

cc. "GoG" means the Government of the State of Gujarat and any agency, legislative body, department, political subdivision, authority or instrumentality thereof.

dd. "Government Instrumentality" means the GoI, the GoG and their ministries, inspectorate, departments, agencies, bodies, authorities, legislative bodies.

ee. "Grid System" means GETCO / Distribution network through which Delivered Energy is evacuated and distributed

ff. "GUVNL" means Gujarat Urja Vikas Nigam Limited.

gg. "Installed Capacity" means the capacity of the Project at the generating terminal(s) and shall be equal to 2.6 MW of electrical energy

hh. "Interconnection Facilities" in respect of the Power Producer shall mean all the facilities installed by the Power Producer to enable GETCO to receive the Delivered Energy from the Project at the Delivery Point, including transformers, and associated equipment, relay and switching equipment, protective devices and safety equipment

ii. "KV" means Kilovolts.

jj. "KWH" means Kilowatt-hour.

kk. "Law" means any valid legislation, statute, rule, regulation, notification, directive or order, issued or promulgated by any Governmental Instrumentality.

ll. Letter of Credit" shall mean the letter of credit established pursuant to Article 7.

mm. "Metering Date" for a Billing Period, means the midnight of the last day of the calendar month.

nn. "Metering Point" for purposes of recording of Delivered Energy will be the Delivery Point and shall include two separate sets of electronic meters, main meter and the check meter installed by the GETCO in the Project Switchyard on the Project property and both sealed by the Power

TARINI INFRASTRUCTURE PVT. LTD. NEW DELHI

GUJARAT URJA VIKAS NIGAM LTD. VADODARA

Producer and GETCO, having facilities to record both export and import of electricity to/from the grid.

oo. "Minimum Guaranteed Offtake Energy" means guaranteed offtake by GUVNL of seventy per cent (70%) of the Contracted Capacity during the Fiscal Year excluding force Majeure period , if any.

pp. "Minimum Guaranteed Supply Energy" means guaranteed supply by Power Producer of seventy per cent (70%) of the Contracted Capacity during the Fiscal Year excluding force Majeure period , if any.

qq. "Monthly Charge" shall have the meaning set forth in Article 5.

rr. "MW" means Megawatts.

ss. "O & M Default" shall mean (i) the Project fails to operate because of equipment or maintenance failure for a continuous period of at least ninety (90) consecutive days after commencing Commercial Operations and the Power Producer does not follow Prudent Utility Practices to remedy the operating problem

tt. "Project" means a Small power station to be established by the Power Producer at Daman Ganga (Madhuban) Dam in the State of Gujarat comprising of one (1) Hydel turbine generator (Cannel based) capable of producing 2.6 MW of Electricity and shall include land, buildings, machinery, ancillary equipment, material, switch-gear, transformers, protection equipment, transmission lines and the like necessary to deliver Electricity generated by the Project to GETCO at the Delivery Point.

uu. "Project Site" means any and all parcels of real property, rights-of-way, easements and access roads located at Daman Ganga (Madhuban) Dam in the State of Gujarat, upon which the Project and its related infrastructure will be located, as described in Schedule 1 hereto.

vv. "Prudent Utility Practices" means those practices, methods, techniques and standards, that are generally accepted for use in electric utility industries taking into account conditions in India, and commonly used in prudent electric utility engineering and operations to design, engineer, construct, test, operate and maintain equipment lawfully, safely, efficiently and economically as applicable to power stations of the size, service and type of the Project, and that generally conform to the manufacturers' operation and maintenance guidelines.

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one (1) month maturity as on 1st April of the respective Fiscal Year by the State Bank of India. In the absence of such rate, any other arrangement that substitutes such prime lending rate as mutually agreed to by the Parties.

xx. "Scheduled Commercial Operation Date" means 20 months from signing of this Agreement

yy. "Scheduled Energy "means the quantum of energy to be delivered by the Power Producer at the delivery point as scheduled by the SLDC;

zz. "SEA" means the State Energy Account issued by SLDC, Gujarat on monthly basis and amendments thereto

aaa. "SLDC" means the State Load Despatch Centre as notified by the State Government.

bbb. "Tariff" shall have the meaning set forth in Article 5.

ccc. "Tariff Invoices" shall have the meaning set forth in Article 7.

ddd. "Technical Limits" means the limits and constraints described in Schedule 2, relating to the operations, maintenance and despatch of the Project".

eee. "Term" means the term of the Agreement as defined in Article 9.1."

fff. "Voltage of Delivery" means the voltage at which the Electricity generated by the Project is required to be delivered to GETCO and shall be 66KV or such other KV as is acceptable to GETCO.

Interpretation:

(a) Unless otherwise stated, all references made in this Agreement to "Articles", "Schedules" and Exhibits shall refer, respectively, to Articles of, and Schedules to and Exhibits of this Agreement. The Schedules to this Agreement form part of this Agreement and will be in full force and effect as though they were expressly set out in the body of this Agreement.

(b) In this Agreement, unless the context otherwise requires (i) the singular shall include plural and vice versa; (ii) words denoting persons shall include partnerships, firms, companies (iii) the words "include" and "including" are to be construed without limitation and (iv) a reference to any Party includes that Party's successors and permitted assigns.

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LICENCES, PERMITS

2.1 The Power Producer, at its sole cost and expense, shall acquire and maintain in effect all agreements, clearances, consents, permits, licences and approvals including specified under Schedule-3 required from time to time by all Government Instrumentalities in order to enable it to perform its obligations under the Agreement. GUVNL will render all reasonable assistance to the Power Producer to enable the latter to obtain such clearances without any obligation on part of GUVNL.

Provided, however, non-rendering or partial rendering of assistance shall not in any way absolve the Power Producer of its obligations to obtain such agreements and clearances. Nor shall it mean to confer any right or indicate any intention to waive the need to obtain such agreements or clearances.

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CONSTRUCTION AND OPERATION

3.1 The Power Producer shall complete the Construction of the Project on or before the Scheduled Commercial Operation Date.

3.2 For the purposes of such completion of the Project, the Power Producer and GUVNL shall together endeavour to ensure that all Approvals pursuant to Article 2.1 are cleared within the Scheduled Commercial Operation Date.

3.3 For the purposes of such completion of the Project, the Power Producer shall take all necessary steps for obtaining Approvals pursuant to Article 2.1.

3.4 If the Power Producer commits a Construction Default other than due to Force Majeure Events, GUVNL shall give notice of 90 days in writing to the Power Producer, calling upon the Power Producer to remedy such default and if the Power Producer fails to take steps to remedy such default within the aforesaid period, the Agreement shall stand terminated.

3.5 The Power Producer shall provide to GETCO, SLDC and GUVNL information regarding electrical energy generated during testing, commissioning, synchronization and startup.

3.6 Upon the occurrence of a Force Majeure Event in GETCO's evacuation system for safe operation of its Grid, GUVNL / GETCO has the right to shut down the line and has no obligation to evacuate the Electricity nor to pay any compensation during such period. The Power Producer shall suitably back down their generation. GUVNL / GETCO will, however, make reasonable endeavours to remedy such Emergency, and bring back normalcy at the earliest.

3.7 Power Producer shall use commercially reasonable efforts to operate the Project in accordance with the Operating Procedures set forth in Exhibit A and the Interconnection Procedures set forth in Exhibit B.

3.8 The Power Producer shall comply with the provisions of the applicable law including, in particular, GERC Grid Code as amended form time to time regarding operation and maintenance of the Power Project and all matters incidental thereto.

UNDERTAKINGS

4.1. Obligations of the Power Producer

a. The Power Producer shall obtain all statutory approvals, clearances and permits necessary for the Project in addition to those Approvals as listed in Schedule 3.

b. The Power Producer shall construct the Project, including Interconnection Facilities for which prior approval from GETCO shall be obtained.

c. The Power Producer shall undertake at its own cost maintenance of the Interconnection Facilities in accordance with Prudent Utility Practices.

d. The transmission line from the Delivery Point in the Plant Switchyard to the sub-station of GETCO's shall be constructed by GETCO, the cost of which shall be borne by Power Producer. Power Producer is to co-ordinate with GETCO and finalise the evacuation arrangement including the appropriate sub-station which GETCO will decide.

e. The Power Producer shall operate and maintain the Project in accordance with Prudent Utility Practices.

f. The Power Producer shall be responsible for all payments on account of any taxes, cesses, duties or levies imposed by the GoG and GoI or its competent statutory authority on the land, equipment, material or works of the Project or on the Electricity generated or consumed by the Project or by itself or on the income or assets owned by it. The taxes duties, cesses leviable in future on generation of power by GoG and GoI or any other competent authority shall be payable to power producer if approved by GERC.

g. The Power Producer shall make available the Contracted Capacity on First Right basis from the Project to GUVNL and not to sell to any third party. In case GUVNL refuse to off-take power, power producer may sell such power to third party after obtaining the consent from GUVNL.

h. The Power Producer shall pass through to GUVNL, through a reduction of the monthly bills, an amount equal to 25% of Clean Development

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on account of the sale of the Project's Available Capacity to GUVNL.

i. For evacuation facility and maintenance of the transmission, the power producer shall enter into separate agreement with GETCO, if applicable.

j. To procure start up power required for the plant from respective Discom.

k. Fulfilling all other obligations undertaken by power producer under this Agreement.

l. The Power Producer can not inject the power three months earlier to Scheduled Commercial Operation Date from Project

m. Power Producer shall comply with the provisions of the applicable Law including, in particular, Grid Code ABT order as amended form time to time regarding operation and maintenance, Availability declaration, scheduling of the Power from the Project and all other matters incidental thereto.

n. To supply the Minimum Guaranteed power as specified at Article-1(qq) or else pay the compensation for difference between Minimum Guaranteed Supply energy and Actual Energy declared available to SLDC/ GUVNL at the Rs 0.60 per kWh within thirty days to GUVNL

4.2. Obligations of GUVNL:

GUVNL agrees:

a. To pay the Power Producer for the Scheduled Energy as certified in the SEA by SLDC with in due date

b. To offtake the Minimum Guaranteed power as specified at Article-1(pp) or else pay the compensation for difference between Minimum Guaranteed offtake energy and Actual Scheduled Energy subject to the Power Producer has made available the Capacity up to Minimum Guaranteed off take at the Rs. 0.60 per kWh within thirty days to Power Producer.

4.3 Liquidated damages for delay in Commissioning of the Project beyond Scheduled Commercial Operation date

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If the project is not commissioned by its Scheduled Commercial Operation Date other than the reasons mentioned below, the Power Producer shall pay to the GUVNL liquidated damages for delay at the rate of Rs. 3000 per day per MW for a maximum period of 365 days after which GUVNL may terminate this Agreement or give a chance to the Power Producer to complete the construction to get to the Commercial Operation. If GUVNL does not terminate this Agreement the Power Producer has to abide by all the obligations of this Agreement. However, the liquidated damages will not be applicable if:-

1. The project cannot be Commissioned by Scheduled Commercial Operation Date because of Force Majeure event; or

2. The Power Producer is prevented from performing its obligations because of material default on part of GUVNL.

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RATES AND CHARGES

5.1 Monthly Energy Charges: GUVNL shall pay to the Power Producer every month for Scheduled Energy as certified in the monthly SEA by SLDC the amounts (the "Tariff) set forth in Article 5.2 herein.

5.2 GUVNL shall pay the tariff determined by GERC. GERC has determined a tariff of Rs. 3.29 per KWH for the year 2007-08. This rate of 2007-08 will be escalated at 3% per annum till the Commercial Operation Date. The tariff so arrived at the time of Commercial Operation Date (COD) would be applicable for the entire project life as per GERC's order No: 853 of 2005 dated 14th June 2007. It is the responsibility of Power Producer to satisfy the conditions for qualifying as a Small Hydel Projects project as specified by GERC and in case the Project is not so qualified, then the tariff shall be worked out based on GERC's Terms & Conditions of tariff regulations subject to ceiling of Rs.3.29 per Unit.

5.3 For each KVARH drawn from the grid, the Power Producer shall pay at the rate of as determined by the Commission to GETCO from time to time for each KVARH drawn.

5.4 Upon the implementation of the Intra-State ABT (Intra State Availability Based Tariff) in the State, the provisions of the Intra-State ABT Regulations shall become applicable automatically and all the charges including Unscheduled Interchange shall be borne by the Power Producer.

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METERING AND COMMUNICATION

6.1 Reading and Correction of Meters

(i) The Commission has kept Small Hydel Projects in the purview of the settlement mechanism linked with UI rate (which comes into play in case of deviations) under Intra State ABT. Therefore, for the purpose of energy accounting, the power producer shall provide ABT compliant meters at the interface points. Interface metering shall conform to the Central Electricity Authority (Installation and Operation Meters) Regulation, 2006. Commercial settlement of Small Hydel Projects shall be in accordance with the Commission's order No: 3 of 2006 dated 11.8.2006.

(ii) The GETCO and the power producer shall jointly read the Metering System on the first (1st) day of every month at the Delivery Point

(iii) In the event that the Main Metering System is not in service as a result of maintenance, repairs or testing, then the Backup Metering System shall be used during the period the Main Metering System is not in service and the provisions above shall apply to the reading of the Backup Metering System.

(iv) Meter reading taken jointly at the appointed date and time will be signed by the representatives of GETCO and the Power Producer. If Power Producer's representative is not present, then the GETCO shall provide the Power producer with a signed copy of the meter reading of the Main Metering System or Back up Metering System as the case may be. Such meter readings shall be treated as the accurate and final measurement, unless proved otherwise, of the energy supplied to the GUVNL by the Power Producer for the preceding month for the purpose of payment.

6.2 **Sealing and Maintenance of Meters.**

(i) The Main Metering System and the Backup Metering System shall be sealed in the presence of representatives of Power Producer and GETCO.

(ii) When the Main Metering System and/or Backup Metering System and/or any component thereof is found to be outside the acceptable limits of accuracy or otherwise not functioning properly, it shall be repaired, re-calibrated or replaced by the Power Producer and/or the GUVNL/GETCO at Power Producer's cost, as soon as possible.

(iii) Any meter seal(s) shall be broken only by the GETCO's representative in the presence of Power Producer's/GUVNL representative whenever the Main Metering System or the Backup Metering System is to be inspected, tested, adjusted, repaired or replaced.

(iv) All the main and check meters shall be calibrated every six month.

(v) In case, both the main meters and check meter are found to be beyond permissible limit of error, both the meters shall be calibrated immediately and the correction applicable to main meter shall be applied to the energy registered by the main meter at the correct energy for the purpose of energy account/ billing for the actual period during which inaccurate measurements were made, if such period can be determined or, if not readily determinable, shall be the shorter of:

a. the period since the immediately preceding test of the relevant Main meter, or

b. one hundred and eighty (180) days immediately preceding the test at which the relevant Main meter was determined to be defective or inaccurate.

6.3 Records

Each Party shall keep complete and accurate records and all other data required by each of them for the purposes of proper administration of this Agreement and the operation of the Power Plant. Among such other records and data, the Power Producer shall maintain an accurate and up-to-date operating log at the Power Plant with records of:-

a. Fifteen minutes logs of real and reactive power generation, frequency, transformer tap position, bus voltage(s), Main Meter and Back up Meter readings and any other data mutually agreed ; Till the Intra-State ABT is implemented the details under this clause shall be maintained half hourly basis instead of 15 minutes.

b. any unusual conditions found during operation/ inspections;

c. chart and printout of event loggers, if any, for system disturbances/ outages.

All the records will be preserved for a period of 36 months.

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BILLING

7.1 Tariff Invoices.

Power Producer shall prepare invoices on a monthly basis and shall submit the same to GUVNL along with the copy of SEA on the second business day of the following month. The invoice shall show the amount of Scheduled Energy as per SEA, to GUVNL during such month period. The invoice shall also show any adjustments for sharing of CDM benefits. Based upon such information, the amount due to be paid by GUVNL shall be determined and stated.

7.2 Payment:

GUVNL shall make payment of the amounts due in Indian Rupees, on or before the Due Date.

7.3.1 Late Payment:

For payment of monthly bill by GUVNL, if paid after Due Date of Payment, a late payment charge shall be payable by GUVNL to the Power Producer at the rate of two (2) percent in excess of the applicable SBAR rate per annum, on the unpaid amount outstanding calculated on a week or part thereof basis according to the following formula:

$$= \frac{(\text{SBAR} + 2\%)}{52} \quad \text{per week or part thereof.}$$

7.3.2 Rebate:

For payment of Monthly Bill by GUVNL, if paid before Due Date of Payment, a Rebate shall be deducted by GUVNL at the rate of two (2) percent in excess of the applicable SBAR per annum, on the amount paid before due date, calculated on a week or part thereof basis viz.

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= _____ per week or part thereof.
52

7.3.3 Compensation towards Minimum Guaranteed Offtake by GUVNL

In case, GUVNL fails to take "Minimum Guarantee Oftake Energy" on yearly basis as defined at Article-1 (pp). GUVNL will pay the compensation for difference between Minimum Guaranteed Off-take energy and actual scheduled energy subject to power producer has made available the energy upto the minimum guaranteed off take, at the rate of Rs.0.60/KWh within 30 days to Power Producer. However, the minimum guaranteed off-take compensation shall be worked out on cumulative basis and settled on monthly basis.

7.3.4 Compensation towards Minimum Guaranteed Supply by Power Producer

In case, Power Producer fails to make available "Minimum Guaranteed Supply Energy" on yearly basis as defined in Article-1(qq). Power producer shall pay the compensation for difference between minimum guaranteed supply and actual energy declared available to GUVNL/SLDC at the rate of Rs 0.60/KWh within 30 days to GUVNL. However, the Minimum Guaranteed Supply Energy compensation shall be worked out on cumulative basis and settled on monthly basis.

7.4. Letter of Credit:

7.4.1 GUVNL shall establish and maintain irrevocable and unconditional revolving Letter of Credit from the bank where the GUVNL revenue is deposited every month in favour of, and for the sole benefit of, the Power Producer for the said Project for the amount equivalent to one months invoice amount for one year and renewed thereafter on yearly basis during the term of this agreement.

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the Power Producer on the date hereof and made operational thirty (30) days prior to the Commercial Operation Date of the Project and shall be maintained consistent herewith by GUVNL at any and all times during the Term of the Agreement. The cost of the LC shall be borne by the Power Producer.

7.4.3 Such Letter of Credit shall be in form and substance acceptable to both the Parties and shall be issued by any GUVNL Bank and be provided on the basis that:

(i) In the event a Tariff Invoice or any other amount due and undisputed amount payable by GUVNL pursuant to the terms of this Agreement is not paid in full by GUVNL as and when due, the Letter of Credit may be called by the Power Producer for payment in full of the unpaid Tariff Invoice

(ii) The amount of the Letter of Credit shall be equal to one month's projected payments.

(iii) The GUVNL shall replenish the Letter of Credit to bring it to the original amount within 30 days in case of any valid drawdown.

(iv) The Letter of Credit shall be renewed and/or replaced by the GUVNL not less than 60 days prior to its expiration.

7.5 Payment under the Letter of Credit: The draw down under the Letter of Credit in respect of a Tariff Invoice shall require:

1. A copy of the state energy account issued by the SLDC Gujarat
2. A certificate from the Power Producer stating that the amount payable by GUVNL in respect of such Tariff Invoice has not been paid by GUVNL by the Due Date of Payment of the Tariff Invoice and disputed by the GUVNL till due date of payment of the tariff invoice.

7.6 Disputes: In the event of a dispute as to the amount of any Tariff Invoice/other item, GUVNL shall notify the Power Producer of the amount in dispute and GUVNL shall be liable to pay 100% of the undisputed

amount plus 85% of the disputed amount within the due date provided either party shall have the right to approach the GERC to effect a higher or lesser payment on the disputed amount.

The Parties shall discuss within a week from the date on which GUVNL notifies the Power Producer of the amount in dispute and try and settle the dispute amicably. If the dispute is not settled during such discussion then the payment made by GUVNL shall be considered as a payment under protest Upon resolution of the dispute, in case the Power Producer is subsequently found to have overcharged, then it shall return the overcharged amount with an interest of SBAR plus 2 % per annum for the period it retained the additional amount. GUVNL/Power Producer shall not have the right to challenge any Tariff Invoice, or to bring any court or administrative action of any kind questioning/modifying a Tariff Invoice after a period of three years from the date of the Tariff Invoice is due and payable. Where any Dispute arising out of or in connection with this Agreement is not resolved mutually then such Dispute shall be submitted to adjudication by the Appropriate Commission as provided under section 79 or 86 of the Electricity Act, 2003 and the Appropriate Commission may refer the matter to Arbitration as provided in the said provision read with section 158 of the said Act. For disputes beyond the power conferred upon the Appropriate Commission, such disputes shall be subject to the jurisdiction of the High Courts of Gujarat.

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FORCE MAJEURE

8.1 Force Majeure Events:

a. Neither Party shall be responsible or liable for or deemed in breach hereof because of any delay or failure in the performance of its obligations hereunder (except for obligations to pay money due prior to occurrence of Force Majeure Events under this Agreement) or failure to meet milestone dates due to any event or circumstance (a "Force Majeure Event") beyond the reasonable control of the Party experiencing such delay or failure, including the occurrence of any of the following:

(i) acts of God;

(ii) typhoons, floods, lightning, cyclone, hurricane, drought, famine, epidemic, plague or other natural calamities;

(iii) acts of war (whether declared or undeclared), invasion or civil unrest;

(iv) any requirement, action or omission to act pursuant to any judgment or order of any court or judicial authority in India (provided such requirement, action or omission to act is not due to the breach by the Power Producer or GUVNL of any Law or any of their respective obligations under this Agreement);

(v) inability despite complying with all legal requirements to obtain, renew or maintain required licenses or Legal Approvals;

(vi) earthquakes, explosions, accidents, landslides;

(vii) fire;

(viii) expropriation and/or compulsory acquisition of the Project in whole or in part;

(ix) chemical or radioactive contamination or ionising radiation; or

(x) Non availability of transmission network, damage to or breakdown of transmission facilities of GETCO.

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(xi) exceptional adverse weather condition which are in excess of statistical measure of the last hundred (100) years.

8.1 b The availability of Article 8.1 (a) to excuse a Party's obligations under this Agreement due to a Force Majeure Event shall be subject to the following limitations and restrictions:

(i) the affected party gives the other Party written notice describing the particulars of the Force Majeure Event soon as practicable after its occurrence;

(ii) the suspension of performance is of no greater scope and of no longer duration than is required by the Force Majeure Event and the repairs required due to the Force Majeure Event;

(iii) the affected Party is able to resume performance of its obligations under this Agreement, it shall give the other Party written notice to that effect;

(iv) the Force Majeure Event was not caused by the affected Party's negligence or intentional acts, errors or omissions, or by its negligence/failure to comply with any material Law, or by any material breach or default under this Agreement;

(v) in no event shall a Force Majeure Event excuse the obligations of a Party that are required to be compietely performed prior to the occurrence of a Force Majeure Event.

8.2 Available Relief for a Force Majeure Event : No party shall be in breach of its obligations pursuant to this agreement to the extent that the performance of its obligations was prevented, hindered or delayed due to a Force Majeure Event.For avoidance of doubt, GUVNL's obligation to make payments of money already due and payable prior to Force Majeure Event shall not be suspended or excused due to the occurrence of a Force Majeure Event.

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TERM, TERMINATION AND DEFAULT

9.1 Term of the Agreement: This Agreement shall become effective upon the execution and delivery thereof by the Parties hereto and unless terminated pursuant to other provisions of the Agreement, shall continue to be in force till August 2042.

9.2 Events of Default:

9.2.1 Power Producer's Default: The occurrence of any of the following events shall constitute an Event of Default by Power Producer:

a. O&M Default on part of Power Producer.

b. Repeated failure or refusal by Power Producer to operate the Project in accordance with GERC Grid code/ Indian Electricity Grid code and ABT regulation.

c. Power Producer fails to credit GUVNL for the amounts due to GUVNL pursuant to the provisions of Article 4.1(h) within three (3) months after the accrual of such payment by Power Producer.

d. Power Producer (i) assigns or purports to assign all of its assets and rights in violation of this Agreement except as required by Power Producer's lenders or (ii) transfers or novates any of its rights and / or obligations under this Agreement in violation of this Agreement.

e. Due to the gross negligence of Power Producer, the Power Producer becomes voluntarily or involuntarily the subject of a proceeding under any bankruptcy or insolvency laws or goes into liquidation or dissolution or has a receiver appointed over it or a liquidator is appointed, pursuant to Law, except where such dissolution of the Power Producer is for the purpose of a merger, consolidation or reorganization and where the resulting entity has the financial standing to perform its obligations under this Agreement and creditworthiness similar to the Power Producer and expressly assumes all obligations under this Agreement and is in a position to perform them; or

f. The Power Producer repudiates this Agreement by executing a power purchase agreement with another buyer for the same Electric Energy to be

provided to GUVNL hereunder, except in accordance with the terms of this Agreement.

9.2.2 GUVNL's Default: The occurrence of any of the following shall constitute an Event of Default by GUVNL:

(i) Undisputed payment default by the GUVNL for a continuous period of ninety (90) days.

9.3 Termination:

9.3.1 Termination for Power Producer's Default:

Upon the occurrence of an event of default as set out in sub-clause 9.2.1 above, GUVNL may deliver a Default Notice to the Power Producer in writing which shall specify in reasonable detail the Event of Default giving rise to the default notice, and calling upon the Power Producer to remedy the same.

At the expiry of 90 (ninety) days from the delivery of this default notice and unless the Parties have agreed otherwise, or the Event of Default giving rise to the default notice has been remedied, GUVNL may deliver a Termination Notice to the Power Producer. GUVNL may terminate this Agreement by delivering such a Termination Notice to the Power Producer and intimate the same to the Commission. Upon delivery of the Termination Notice this Agreement shall stand terminated and GUVNL shall stand discharged of all its obligations. The Power Producer shall have liability to make payment within 30 days from the date of termination notice toward compensation to GUVNL equivalent to three years billing. The amount of three years billing shall be worked out on 'Minimum Guaranteed off-take energy'.

The Bills towards compensation shall be paid on monthly basis and the provisions of Billing and Payment will apply Mutatis Mutandis in this case also. However, all payment obligations as per the Article 7 prior to the date of termination of the Agreement shall be met by the Parties.

Where a Default Notice has been issued with respect to an Event of Default, which requires the co-operation of both GUVNL and the Power Producer to remedy, GUVNL shall render all reasonable co-operations to enable the Event of Default to be remedied without any legal obligations.

9.3.2 Termination for GUVNL's Default:

Upon the occurrence of an Event of Default as set out in sub-clause 9.2.2 above, the Power Producer may deliver a Default Notice to GUVNL in writing which shall specify in reasonable detail the Event of Default giving rise to the Default Notice, and calling upon GUVNL to remedy the same.

At the expiry of 90 (ninety) days from the delivery of the Default Notice and unless the Parties have agreed otherwise, or the Event of Default giving rise to the Default Notice has been remedied, the Power Producer may serve a "Suspension Notice" to GUVNL for a duration not exceeding one year ("Suspension Period").

During the "Suspension Period" mentioned herein above, GUVNL shall allow the Power Producer to sell power from the project, to any HT consumers of the State, in the open market either by finding the said consumers on its own or through any Central / State power trading utilities. In case of wheeling of power to such third parties, the transmission charges, transmission losses, wheeling charges and losses SLDC charges and cross subsidy surcharge etc. shall be applicable as per GERC's regulation remain force from time to time and paid directly to respective agencies by third party. No banking facility shall be allowed to Power Producer and third parties.

On expiry of the Suspension Period, GUVNL will be entitled to cure its default and buy power from the Power Producer. In the event GUVNL fails to cure the default, the Power Producer may terminate this

Agreement by delivering a Termination Notice to GUVNL / its successor entity and in such an event GUVNL shall have liability to make payment within 30 days from the date of termination notice toward compensation to Power Producer equivalent to three years billing. The amount of three years billing shall be worked out on 'Minimum Guarantee off-take energy' or in such an event, power producer shall be allowed to sale the power from the project to any of the consumers in the State in open market. In case of wheeling of power to such third party, the transmission charges of GETCO and wheeling charges of any of the four subsidiary companies of GUVNL (i.e. DGVCL, MGVCL, PGVCL, UGVCL) which are in excess of 5% of the power purchase rate shall be reimbursed by GUVNL for remaining term of PPA. Moreover, subsidiary companies of GUVNL (i.e. DGVCL, MGVCL, PGVCL, UGVCL) shall also waive their cross subsidy surcharge applicable during the relevant period on the sale of power by power producer to any consumer of these Distribution companies up to the ceiling of power at Minimum Guaranteed Off-take Energy.

The Bills towards reimbursement of transmission and wheeling charges shall be paid on monthly basis and the provisions of Billing and Payment will apply in this case also.

In case of default by GUVNL, the power producer will select any of the option mentioned above for compensation towards termination of the agreement and inform to GUVNL with default notice.

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ARTICLE 10

DISPUTE RESOLUTION

10.1 Disputes or differences between the Parties arising out of or in connection with this Agreement which are not subject to the provisions of Section 7.6 of this Agreement and the Electricity Act of 2003, shall be first tried to be settled through mutual negotiation.

10.2 The Parties hereto agree to attempt to resolve all disputes arising hereunder promptly, equitably and in good faith.

10.3 Each Party shall designate in writing and communicate to the other Party the name of its representative who shall be authorized to resolve any dispute arising under this Agreement in an equitable manner and, unless otherwise expressly provided herein, to exercise the authority of the Parties hereto to make decisions by mutual agreement.

10.4 In the event that such differences or disputes between the Parties are not settled through mutual negotiations within sixty (60) days, after such dispute arises, then the dispute shall be referred to GERC for adjudication as per provisions of Electricity Act 2003.

INDEMNITY

11.1 Power Producer's Indemnity: The Power Producer agrees to defend, indemnify and hold harmless GUVNL, its officers, directors, agents, employees and affiliates (and their respective officers, directors, agents and employees) from and against any and all claims, liabilities, actions, demands, judgements, losses, costs, expenses, suits, actions and damages arising by reason of bodily injury, death or damage to property sustained by third parties that are caused by an act of negligence or the willful misconduct of the Power Producer, or by an officer, director, sub-contractor, agent or employee of the Power Producer except to the extent of such injury, death or damage as is attributable to the willful misconduct or negligence of, or breach of this Agreement by, GUVNL, or by an officer, director, sub-contractor, agent or employee of the GUVNL.

11.2 GUVNL's Indemnity: GUVNL agrees to defend, indemnify and hold harmless the Power Producer, its officers, directors, agents, employees and affiliates (and their respective officers, directors, agents and employees) from and against any and all claims, liabilities, actions, demands, judgements, losses, costs, expenses, suits, actions and damages arising by reason of bodily injury, death or damage to property sustained by third parties that are caused by an act of negligence or the wilful misconduct of GUVNL, or by an officer, director, sub-contractor, agent or employee of GUVNL except to the extent of such injury, death or damage as is attributable to the wilful misconduct or negligence of, or breach of this Agreement by, the Power Producer, or by an officer, director, sub-contractor, agent or employee of the Power Producer.

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Article 12

Representation and Warranties:

a. Power Producer makes to Buyer the representations and warranties set forth in Exhibit C hereto.

b. GUVNL makes to Power Producer the representations and warranties set forth in Exhibit D hereto.

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ARTICLE 13

MISCELLANEOUS PROVISIONS

13.1 Governing Law: This Agreement shall be interpreted, construed and governed by the Laws of India.

13.2 Insurance: The Power Producer shall obtain and maintain necessary insurance during the Term of this Agreement consistent with Prudent Utility Practice and provide the copy of same to GUVNL.

13.3 Books and Records: The Power Producer shall maintain books of account relating to the Project in accordance with Indian generally accepted accounting principles.

13.4. Waivers: Any failure on the part of a Party to exercise, and any delay in exercising, exceeding three years, any right hereunder shall operate as a waiver thereof. No waiver by a Party of any right hereunder with respect to any matter or default arising in connection with this Agreement shall be considered a waiver with respect to any subsequent matter or default.

13.5. Limitation Remedies and Damages: Neither Party shall be liable to the other for any consequential, indirect or special damages to persons or property whether arising in tort, contract or otherwise, by reason of this Agreement or any services performed or undertaken to be performed hereunder.

13.6. Notices: Any notice, communication, demand, or request required or authorized by this Agreement shall be in writing and shall be deemed properly given upon date of receipt if delivered by hand or sent by courier, if mailed by registered or certified mail at the time of receipt, if sent by fax when dispatched (provided if the sender's transmission report shows the entire fax to have been received by the recipient and only if the transmission was received in legible form), to :

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GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

Name- Gangadutt Kuberdutt Joshi
Designation Regional Director
Address: C-1, Saket housing society, Susan-Tarsali Road,
Vadodara-390010

In case of GUVNL:

Designation : General Manager (Commerce)
Address : Gujarat Urja Vikas Nigam Ltd, Sardar Patel Vidyut Bhavan
Race Cource Vadodara - 390007
Ph. Nos.: 0265 - 2340504 Fax No.: 0265 – 2344543

With a copy to : Managing Director on above address

13.7. Severability: Any provision of this Agreement, which is prohibited or unenforceable in any jurisdiction, shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions hereof and without affecting the validity, enforceability or legality of such provision in any other jurisdiction.

13.8. Amendments: This Agreement shall not be amended, changed, altered, or modified except by a written instrument duly executed by an authorized representative of each Party. However, GUVNL at the request of power producer, may consider any amendment(s) or change(s), that the Lenders may require to be made to this Agreement, provided the same are appropriate in opinion of GUVNL.

JARJNI INFRASTRU... New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

13.9. Assignment:

(i) Neither Party shall assign this Agreement or any portion hereof without the prior written consent of the other Party, provided further that any assignee shall expressly assume the assignor's obligations thereafter arising under this Agreement pursuant to documentation satisfactory to such other Party. However GUVNL shall not unreasonably withhold any of Power Producer's request for consent to transfer to any successor all of its right and obligation under this agreement and such successor shall be bound by all the obligations under this agreement.

In furtherance of the foregoing, GUVNL acknowledges that the Financing Documents may provide that upon an event of default by the Power Producer under the Financing Documents, the Financing Parties may cause the Power Producer to assign to a third party the interests, rights and obligations of the Power Producer thereafter arising under this Agreement. GUVNL further acknowledges that the Financing Parties, may, in addition to the exercise of their rights as set forth in this Section, cause the Power Producer to sell or lease the Project and cause any new lessee or purchaser of the Project to assume all of the interests, rights and obligations of the Power Producer thereafter arising under this Agreement.

13.10. Entire Agreement, Appendices: This Agreement constitutes the entire agreement between GUVNL and the Power Producer, concerning the subject matter hereof. All previous documents, undertakings, and agreements, whether oral, written, or otherwise, between the Parties concerning the subject matter hereof are hereby cancelled and shall be of no further force or effect and shall not affect or modify any of the terms or obligations set forth in this Agreement, except as the same may be made part of this Agreement in accordance with its terms, including the terms of any of the appendices, attachments or exhibits. The appendices, attachments and exhibits are hereby made an integral part of this Agreement and shall be fully binding upon the Parties.

In the event of any inconsistency between the text of the Articles of this Agreement and the appendices, attachments or exhibits hereto or in the event of

any inconsistency between the provisions and particulars of the appendix, attachment or exhibit and those of any other appendix, attachment or exhibit GUVNL and the Power Producer shall consult to resolve the inconsistency. In case, explicit provisions are not made under this Agreement, the provisions of Electricity Act 2003, Grid Code, Availability Based Tariff order etc. shall be appropriately applicable.

13.11. Further Acts and Assurances: Each of the Parties after convincing itself agrees to execute and deliver all such further agreements, documents and instruments, and to do and perform all such further acts and things, as shall be necessary or convenient to carry out the provisions of this Agreement and to consummate the transactions contemplated hereby.

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed by their fully authorised officers, and copies delivered to each Party, as of the day and year first above stated.

For and on behalf of

Gujarat Urja Vikas Nigam Ltd

(S. B. KHYALIA)
General Manager (Comm)
GUVNL, BARODA.

GUJARAT URJA VIKAS NIGAM LIMITED ★ VADODARA

Signature with Seal

Witness:

1 **(J. M. VACHHANI)**
EXECUTIVE ENGINEER (Tariff)
GUVNL, VADODARA.

2 **A. N. KHAMBATTA**
Deputy Engineer (T)
Commerce Department
GUVNL
VADODARA.

For and on behalf of

TARINI Infrastructure Limited

For Tarini Infrastructure Ltd.

Authorised Signatory

TARINI INFRASTRUCTURE P. LTD. New Delhi

Signature with Seal

Witness:

1 M. U. Rathava
Mukhidhara Society
Tarsali, Baroda

2 (Jitendra Sura)
MD, Canara Engg Ltd
B'bay Shopping Centre
Baroda.

SCHEDULE-1

PARAMETERS AND TECHNICAL LIMITS OF SUPPLY

- Three phase alternating current
- Nominal declared frequency : 50.0 Hz
- Final Voltage at Delivery Point 66 kV
- Short circuit rating: As a part of the detailed design process, the Power Producer shall calculate the short circuit rating (minimum and maximum), and supply this information to the GUVNL
- The Project shall be designed and capable of being synchronized and operated within a frequency range of 48.0 to 51.5 Hertz and voltage of 66 KV and ___ KV and a power factor (at maximum rated power) between 0.9 lagging and 0.95 leading at the generator terminals.
- Power Factor: Generator shall have a power factor rating of 0.90 lagging. The Power Producer shall also provide capacitors of sufficient rating at the power Project itself to compensate for reactive KVA drawn from the system by induction generators and to maintain average monthly power factor of not less than 0.9 lagging at the point of inter-connection. The Power Producer shall provide suitable protection devices, so that the Electric Generators could be isolated automatically when grid supply fails.
- Connectivity criteria like short circuit level (for switchgear), neutral Grounding, fault clearance time, current unbalance (including negative and zero sequence currents), limit of harmonics etc. shall be in accordance with the IEGC, Gujarat Electricity Grid code and the Grid Connectivity standards as may be specified by the Central Electricity Authority.
- The Project Site is located at Daman Ganga (Madhuvan) Dam in the State of Gujarat

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

TECHNICAL LIMITS

1. The nominal steady state electrical characteristics of the system shall be in accordance with the provisions made in the IEGC, Gujarat State Grid Code, Indian Electricity Rules, 1956 and other applicable Standards.

2. Operation of the Project outside the"nominal voltage and frequency "specified above will result in reduction of power output consistent with generator capability curves.

SCHEDULE 3

APPROVALS

1 Consent from GETCO for the evacuation scheme for evacuation of the power generated by the 2.6 MW Small Hydel Projects vide letter _____

2 Permission from State Government and all other statutory and non-statutory bodies required for the Project.

3 Clearance from the Central Water Commission/State Government Department of Irrigation

4 Clearance from the Airport Authority of India, if required.

5 Clearance from the Ministry of Environment & Forests, Department of Forest, Ecology and Environment, State Pollution Control Board, if required.

6 Order of the Commission dated June14,2007

SCHEDULE 4

TESTING PROCEDURES

Power Producer and GUVNL shall evolve suitable testing procedures three (3) months before the Commercial Operation Date of the Project considering relevant standards.

TARINI INFRASTRUCTURE PVT. LTD. New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

EXHIBIT A Operating & Maintenance

1 *OPERATION AND MAINTENANCE*

Power Producer shall comply with the provisions of the applicable Law including, in particular, Grid Code ,ABT order as amended form time to time regarding operation and maintenance Availability, scheduling of the Power Project and all matters incidental thereto.

EXHIBIT B Details of Interconnection Facilities

To be submitted by Power Producer within six months after financial closure

EXHIBIT C Representations and Warranties of Power Producer

1. Power Producer is a corporation duly organized, validly existing and in good standing under the laws of India and is qualified to do business as a foreign owned corporation, and has the power and authority to own, lease or otherwise have a possessory interest in its properties, to carry on its business as now being conducted and as proposed to be conducted and to enter into this Agreement and carry out the transactions contemplated hereby and to perform and carry out all covenants and obligations on its part to be performed under and pursuant to this Agreement.

2. The Project will have a nominal rated capacity of electricity output of 2.6 MW and when constructed will generate approximately11630000 KWH of electric energy annually.

3. Power Producer is in material compliance with all applicable material laws, judicial and administrative orders, and rules and regulations with respect to the ownership and operation of the Project.

4. Power Producer is not prohibited from entering into this Agreement or discharging and performing all covenants and obligations on its part to be performed under and pursuant to this Agreement.

5. The execution and delivery of this Agreement, the consummation of the transactions contemplated hereby and the fulfilment of and compliance with the provisions of this Agreement will not conflict with or constitute a breach of or a default under, any of the terms, conditions or provisions of any applicable law, order of any court or other agency of government, the certificate of incorporation or by-laws of the Power Producer or any contractual limitation, corporate restriction or outstanding trust indenture, deed of trust, mortgage, loan agreement, other evidence of indebtedness or any other Agreement or instrument,

TARINI INFRASTRUCTURE New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

property is bound, or result in a breach of or a default under any of the foregoing.

6. This Agreement is the legal, valid and binding obligation of the Power Producer enforceable in accordance with its terms, except as limited by bankruptcy, insolvency, reorganization, moratorium, or other laws of general application relating to or affecting enforcement of creditors' rights, whether such enforcement is sought in a proceeding in equity or at law.

7. Power Producer has taken all such corporate action as may be necessary to authorize this Agreement, the execution and delivery thereof, the consummation of the Transactions and the carrying out of all covenants and obligations on its part to be performed under and pursuant to this Agreement.

TARJNI INFRASTRUCTURE PVT. LTD. NEW DELHI

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

EXHIBIT D Representations and Warranties of GUVNL

1. GUVNL is a Gujarat Government owned utility duly organized, validly existing and qualified to do business under the laws of India ,is in good standing under the laws of India, has the power and authority to own its properties, to carry on its electric utility business as now being conducted and to enter into this Agreement and to carry out the transactions contemplated hereby and to perform and carry out all covenants and obligations on its part to be performed under and pursuant to this Agreement.

2. GUVNL is not prohibited from entering into this Agreement or discharging and performing all covenants and obligations on its part to be performed under and pursuant to this Agreement.

3. The execution and delivery of this Agreement, the consummation of the transactions contemplated hereby and the fulfilment of and compliance with the provisions of this Agreement will not conflict with or constitute a breach of or a default under, any of the terms, conditions or provisions of any applicable law, order of any court or other agency of government, the certificate of incorporation or by-laws of GUVNL, or any contractual limitation, corporate restriction or outstanding trust indenture, deed of trust, mortgage, loan agreement, other evidence of indebtedness or any other agreement or instrument to which GUVNL is a Party or by which it or any of its property is bound or result in a breach of or a default under any of the foregoing.

4. This Agreement is the legal, valid and binding obligation of GUVNL enforceable in accordance with its terms, except as limited by bankruptcy, insolvency, reorganization, moratorium, or other laws of general application relating to or affecting enforcement of creditors' rights, whether such enforcement is sought in a proceeding in equity or at law.

TARINI INFRASTRU New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

5. All consents and authorizations required for GUVNL to execute, deliver and perform this Agreement have been obtained.

6 GUVNL has taken all such corporate action as may be necessary to authorize this Agreement, the execution and delivery thereof, the consummation of the Transactions and the carrying out of all covenants and obligations on its part to be performed under and pursuant to this Agreement.

TARINI INFRASTRUCTURE LIMITED New Delhi

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

ANNEXURE-P-7

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भारतीय गैर न्यायिक

पचास रुपये रु.50

भारत

FIFTY RUPEES Rs.50

सत्यमेव जयते

INDIA

INDIA NON JUDICIAL

ગુજરાત गुजरात GUJARAT

W 821545

Supplemental Power Purchase Agreement

BETWEEN

TARINI INFRASTRUCTURE LIMITED

AND

GUJARAT URJA VIKAS NIGAM LTD

THIS SUPPLEMENTAL POWER PURCHASE AGREEMENT hereinafter called the "Supplemental Agreement" is entered into at Vadodara on the 11th day of July Two Thousand and fourteen (11-7-2014) by and

BETWEEN

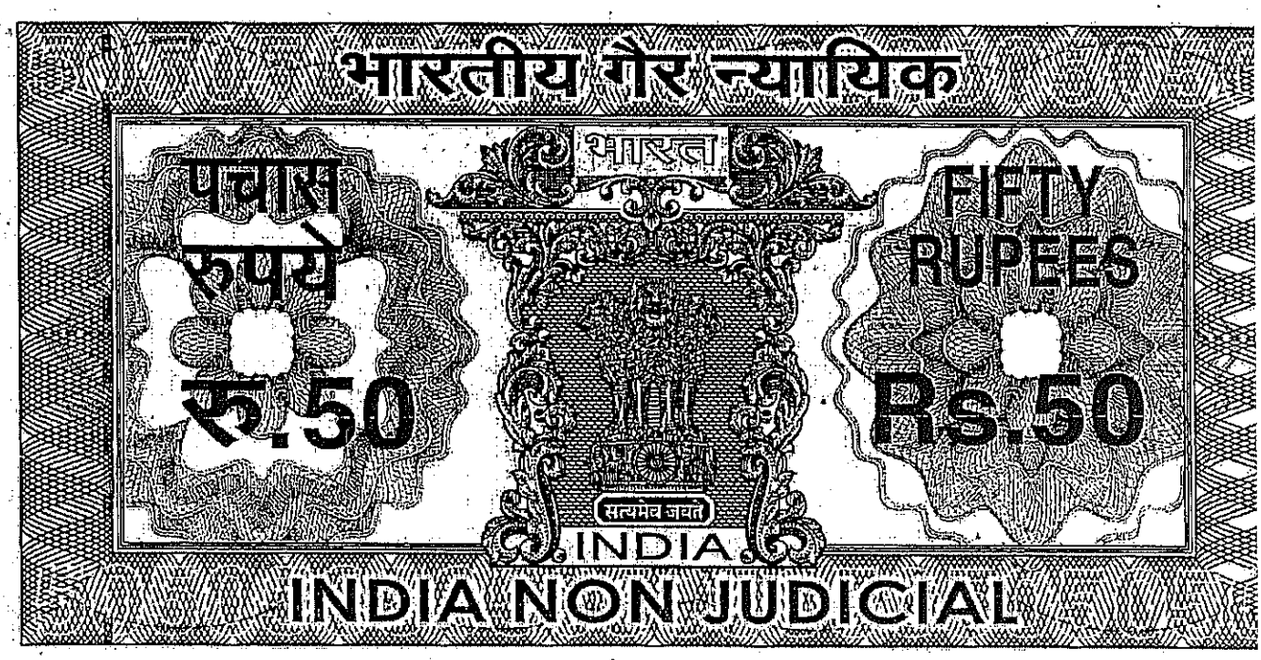
TARINI Infrastructure Ltd, a private Power Producer with limited liability incorporated in India under the Companies Act 1956 and Generating Company as defined under sub-section 28, of Section 2 of the Electricity Act 2003 to commission, operate and maintain an electricity generating station and having its registered office at D-2, 1st Floor, Amar Colony, Lajpat Nagar, New Delhi 110024, , India (hereinafter referred to as "Power Producer" or "Tarini", which expression shall, unless repugnant to the context or meaning thereof, include its successors and assignees), as party of the first part.

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

INFRASTRUCTURE New Delhi

For Tarini Infrastructure

000549



ગુજરાત गुजरात GUJARAT

W 821543

AND

Gujarat Urja Vikas Nigam Limited, a Company incorporated under the Companies Act, 1956 having its registered office at Sardar Patel Vidyut Bhavan, Race Course Circle, Vadodara – 390007 (hereinafter referred to individually, as 'GUVNL' which expression shall unless repugnant to the context or meaning thereof includes its successors and assigns) as party of the second part;

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

INFRASTRU... New Delhi

For Tata Infrastructure

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The "Tarini" and "GUVNL" are individually referred to as "Party" and collectively as the "Parties"

Whereas:

A. The Power Producer has set-up a Hydel project of 3.0 MW (River bed – SHP-I) and 2.6 MW (Canal based SHP-II) under the Gujarat Electricity Regulatory Commission (Power procurement from renewable sources) Regulations, 2005 (15 of 200) principally by small Hydel Projects located at Daman Ganga (Madhuban) Dam,Gujarat

B. M/s. Tarini and GUVNL had signed Power Purchase Agreement on 29th January 2008 for both the projects, hereinafter called the Agreements, setting out the terms and conditions for purchase of energy of "Contracted Capacity" by GUVNL and the Power Producer agreed to supply the energy of "Contracted Capacity" to GUVNL on First Right basis on the terms and subject to the conditions set out in the Power Purchase Agreement. As per the agreements, Scheduled Commercial Operation Date (SCOD) for both the power project was 20 months from signing of this Agreement i.e. 29.9.2009. Accordingly, the tariff of both projects is same i.e Rs. 3.49/Unit for 35 years from the date of commissioning.

C. SHP-I (3 MW) power project commissioned on 6th August 2010 whereas SHP-II (2.6 MW) commissioned on 12th December 2013.

D. M/s. Tarini requested to GUVNL to sign a Supplemental PPA for a common PPA for Small Hydel Power of 5.6 MW capacity with the same terms and conditions by replacing the individual PPA of 3.0 MW (SHP-I) and 2.6 MW (SHP-II) as their both PPAs (i.e. SHP-I & SHP-II) are under one company and on the same Madhuban Dam on Damanganga River having concession agreements and evacuation arrangement.

E. As per generation data of the plant, it was observed that Small Hydel project of 3.0 MW can generate energy more than 3.0 MW subject to availability of head of water.

F. In this regard, on submission and verification of technical data, it is concluded that Small Hydel project having installed capacity of 3.0 MW can generate energy up to 3.6 MW subject to availability of head of water and signed Supplemental Power Purchase Agreement on 22.2.2012. Therefore, both the projects can generate energy of an aggregate capacity up to 6.2 MW subject to availability of head of water

G. The Parties seek to consolidate the terms and conditions of the two Power Purchase Agreements into one Agreement including the recognition of the increased capacity that can be generated subject to availability of head of water and subject to the above all the terms and conditions including the tariff applicable shall remain the same.

NOW THEREFORE, In consideration of the premises, mutual agreements, covenants and conditions set forth in this Supplemental Agreement, IT IS HEREBY AGREED BY AND BETWEEN THE PARTIES AS FOLLOWS:

1.0 All capitalized terms unless specifically defined in this Supplemental Agreement shall have the meanings ascribed to them respectively in the Agreements.

2.0 The Power Purchase Agreements dated 29th January 2008 for SHP-I & SHP-II shall stand modified as under:

2.1. Contracted capacity of Small Hydel Power Project shall be 6.2 MW.

2.2 Installed capacity of both Small Hydel Power Projects shall remain unchanged at 5.6 MW.

GUJARAT URJA VIKAS NIGAM LIMITED VADODARA

TARINI INFRASTRUCTURE LTD. New Delhi

For Tarini Infrastructure Ltd.

Authorised Signatory

2.3 The Minimum Guaranteed Supply / Off-take shall however be worked out based on 5.6 MW installed capacity.

2.4 5.6 MW capacity shall get reduced to 2.6 MW capacity upon expiry of concession agreement for 3.0 MW Riverbed project and the same shall be treated under PPA for all purpose.

2.5 In no case shall any one of the SHPs be assigned / transferred to any other party during agreement period.

2.6 All other terms and conditions including tariff of Power Purchase Agreements dated 29th January 2008 between GUVNL and M/s. Tarini shall remain unchanged shall apply mutatis mutandis.

IN WITNESS WHEREOF THE PARTIES HAVE SIGNED THIS SUPPLEMENTAL AGREEMENT ON THE DAY, MONTH AND YEAR FIRST WRITTEN ABOVE THROUGH THEIR AUTHORISED REPRESENTATIVE(S) AT VADODARA.

FOR AND ON BEHALF OF M/S. TARINI INFRASTRUCTURE LIMITED	FOR AND ON BEHALF OF GUJARAT URJA VIKAS NIGAM LIMITED
For Tarini Infrastructure Ltd. Authorised Signatory	K P JANGID Superintending Engineer (Com) GUJARAT URJA VIKAS NIGAM LTD. Gujarat Urja Vikas Nigam Ltd. Vadodara
Authorised Signatory GANGA DUTT Joshi	
WITNESSES	WITNESSES
1. (Milan A Manchalia) 19-Orchid Bungalows, Old Padra Road Vadodara	1. ( ) A.N. Khambhatta Executive Engineer (Com) Gujarat Urja Vikas Nigam Ltd. Vadodara.
2. V. Manchanda (Vishal Manchanda 19, Orchid Bungalows, Old Padra Road, Vadodara	2. (V. T. Patel) Junior Engineer Gujarat Urja Vikas Nigam Ltd. Vadodara

ANNEXURE-P-8

GETCO

GUJARAT ENERGY TRANSMISSION CORPORATION LIMITED

Regd. Office: Vidyut Bhavan, Race Course, VADODARA - 390 007
Telephone No.(0265) 2353086
Fax No.(0265) 2353086 (GETCO) / (0265) 2337918/2338164 (GUVNL)
Wes site: getcogujarat.com Email:acerl.getco@gebmail.com

000552

No. CE (C&R) /EE(C)/ 385 BY RPAD Date: 5/4/08

To,
M/s Tarini Infrastructure Ltd.
D-2, First floor, Amar Colony,
Lajpat Nagar-IV,
New Delhi.

Subject: System Study Report for evacuation of 5.6 MW (2X1.5 MW) & (1X2.6MW) Hydro power generation from Hydro Power Project site at Madhuban Dam on river Damanganga in Dist. Valsad.

Dear Sir,

The system studies have been carried out for year 2009-2010 condition to evaluate the feasibility of evacuation of Hydro power of 5.6 MW to be generated from your Hydro Power Project site at Madhuban Dam to 66 KV Mota Pondha substation of GETCO.

It is recommended to evacuate the 5.6 MW Hydro Power from your proposed Hydro Power Project at Madhuban Dam to 66 KV Mota Pondha GETCO Substation as under:

1. 66 KV Tarini Generating Station-Mota Pondha D/C lines with Dog conductor, 24.5 RKM.
2. Whenever any contingency occurs at the evacuation lines as well as at the associated transmission network M/s Tarini will have to back down their generation to avoid any overloading on the transmission network.
3. Major portion of the said line is passing through UT (D & NH) and Forest area. Therefore, necessary NOC from irrigation and forest department to erect the aforesaid lines should be obtained by M/s Tarini.

A copy of the report on system study for feasibility of evacuation of Hydro power 5.6 MW generated by M/s Tarini Infrastructure Ltd. at Madhuban Dam, Dist. Valsad is enclosed herewith.

Thanking You,

Yours faithfully,
For Gujarat Energy Transmission Corpn. Ltd.

(M. H. Kshatriya)
CE (SLDC & Commerce)

Encl: As above

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Study Report

on

System Studies for Feasibility of

Evacuation of

Hydro Power of 5.6 MW

[(2 x 1.5 MW) + (1 x 2.6 MW)]

by

M/s. Tarini Infrastructure Limited,

At: Madhuban Dam (Damanganga River),

District: Valsad, Gujarat

TARINI INFRASTRUCTURE LTD.

GETCO

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INDEX

GETCO

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CHAPTER – 1

PREAMBLE

CHAPTER: 1

1 PREAMBLE:

M/s. Tarani Infrastructure Ltd., New Delhi has signed Concession Agreement with Narmada Water Resources, water supply and Kalpsar Department, Gandhinagar, a Statutory body of the Govt. of Gujarat, for setting up small Hydro Power Project at Madhuban Dam on river Damanganga, Via: Silvasa, Dist: Valsad.

M/s. Tarini Infrastructure Ltd. is planning to set up a 5.6 MW [(2 x 1.5 MW) + (1 x 2.6 MW)] Small Hydro Power Project at Madhuban Dam on Damanganga River in Dist: Valsad. M/s. Tarini Infrastructure Ltd. have tentative plans to commission the 5.6 MW power project by July 2009. M/s. Tarani Infrastructure Ltd. is in the process of signing Power Purchase Agreement with GUVNL for the power to be produced from above power plants.

* * * * *

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CHAPTER – 2

METHODOLOGY ADOPTED

FOR

THE STUDIES

CHAPTER: 2

2 METHODOLOGY ADOPTED FOR THE STUDIES:

2.1 The load flow studies for evacuation of the proposed Small Hydro Power Plant generation of 5.6 MW [(2 x 1.5) MW + (1 x 2.6) MW] in 2009-10 condition have been done as indicated below:

2.1.1 BASECASE: To evacuate the proposed Hydro generation of 5.6 MW through proposed grid connectivity to 66 KV Mota Pondha substation i.e.

i) 66 KV Tarini Generating station – Mota Pondha (GETCO) substation D/C lines with Dog conductor (24.5 Kms.)

2.1.2 CASE – 1: Contingency case of outage of one circuit of the proposed 66 KV Tarini Generating station – Mota Pondha (GETCO) substation D/C lines.

2.2 The short circuit studies for determining the maximum three phase symmetrical fault level prior to and after implementation of the generation of 5.6 MW in March-2010 condition are conducted.

* * * * *

CHAPTER – 3

VARIOUS DATA THAT ARE ADDED

TO

THE SYSTEM DATA

CHAPTER: 3

3 VARIOUS DATA THAT ARE ADDED TO THE SYSTEM DATA IN 2009-10 CONDITION:

3.1 BUS DATA:

Bus Name	Bus Voltage
TariniG	3.3 KV
Tarini6	66 KV

(Refer Annexure – 1 for Bus details.)

3.2 GENERATOR TRANSFORMER DATA:

Voltage Ratio	3.3 KV / 66 KV
MVA Rating	6.3 MVA
% Impedance	8.5 %*
No. of Transformer	1

* - Standard value of % Impedance is considered.

3.3 TRANSMISSION LINE DATA:

From Bus	To Bus	Voltage in KV	No. of Circuits	Type of Conductor	Length of Line (RKM)
Tarini Hydro Generating Substation	Mota Pondha (GETCO)	66	2	Dog	24.5