REPUBLIC OF INDIA GOVERNMENT OF JHARKHAND, DEPARTMENT OF DRINKING WATER AND SANITATION RANCHI MUNICIPAL CORPORATION

PREPARATORY SURVEY ON RANCHI SEWERAGE PROJECT

FINAL REPORT (APPENDICES)

September 2014

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIPPON KOEI CO., LTD.

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Exchange Rate

1 INR = 1.69 JPN

1 JPN = 0.59 INR

(As of End of June 2014)

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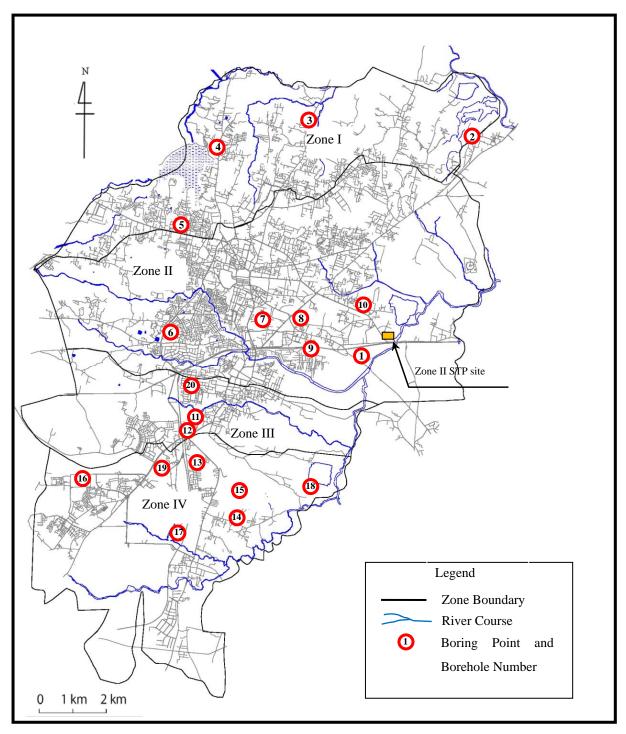
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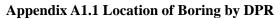
Appendix A1

CHAPTER A1 NATURAL CONDITION OF SURVEY AREA

(1) **Boring by DPR**



Source: DPR for Ranchi Sewerage Project (2013)



State: JHARKHAND Site: KHAJUR TOLA	Client:	MEI	NHARD	T (SINGA	Pore) Pte	LTD.				_	rehole No. mmenced on	
Boring Method		Shell	& Auge	r	Diame	eter of Ho	le	: 150 mm	1	Con	npleted on	: 01/02/07
Termination Depth of B	.H. (m)	9.0	00 m	R.L. of G	Ground : E.G.L.			Water Stud	:k: -	Ground Water:		1.00m
)Г		EPTH)M G.L.	ESS	S.P.T.		SAMPLE A	ND IN-S	ITU 1	TESTS	
DESCRIPTION STRATA	OF	SYMBOL	From (M)	To (M)	THICKNESS	VALUES		DEPTH (M)	TYPE		Ref. No.	REMARKS
Yellowish claye			0.0									
silt/silty clay with traces of kankar				1.00	1.00			0,50	DS		D-1/1	
unces of Raman			1.00			13		1.00	DS SPT		D-1/2 S-1/1	
						15		1.50	SPI		5-1/1	
						-		2.00	UDS	8	U-1/1	
Reddish Yellowi Grey/Yellowish F silty clay/claye	Red					20		3.00	SPT		S-1/2	
silt.Traces of roo fragments were	ck			7.50	6.50	41		4,50	SPT		S-1/3	
observed below 4.50 m.						44		6.00	SPT		S-1/4	
						45		7.50	SPT		S-1/5	
			7.50									
Stiff yellowish gr silty clay / clayey Traces of rock fragments were observed.	silt.			9.00	1.50	51		9.00	SPT		S-1/6	
			9.00									

Appendix A1.2 Boring Log in DPR (No.1)

State: JHARKHAND Site: BAHIR TONGRI		MEIN	HARDT (S	INGAP	ore) pte. I	.TD.				hole No.: menced on	
Boring Method		Shell &	Auger		Diamete	er of Hole	: 150 mm		Com	pleted on	: 01/02/07
Termination Depth of B.	.H. (m)	10.0	0 m RL	of Gro	ound : E.G.	L.	Water Stuck	Water Stuck: - Ground Water:			7.35 M.
		OL.	DEP		ESS	S.P.T.	SAMPLE A	LE AND IN SITU TESTS		ESTS	-
DESCRIPTION STRATA	OF	SWBOL	From (M)	To (M)	THICKNESS (n)	AALUBS	DEPTH (M)	т	PE	Ref. No.	REMARKS
Yellowish clay silt/silty clay w traces of kanka	ith		0.0	1.00	1.00	-	0,50 1.00	D	-	D-2/I D-2/2	
Reddish Yellowi Yellowish Grey Red silty clay/cla silt with traces kankar.	ish iyey			4.50	3.50	14	1.50 2.00 3.00	SP UE SP	S	S-2/1 U-2/1 S-2/2	
			4.50			23	4.50	SP	т	8-2/3	ĺ
Yellowish Grey						25	6.00	SP	т	S-2/4	
clay/ clayey silt traces of fine sa and mica.	ind			10.00	5.50	25	7.50	SP	т	8-2/5	
Fragments of ro were observed be 6.00 m.						27 29	9.00 10.00	SP SP		S-2/6 S-2/7	
			10.00								

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.3 Boring Log in DPR (No.2)

State: JHARKHAND Site: CHIRANDI BAS		MEIN	HARD	T (SINGA	Pore) Pte	LTD.			Borehole No Commenced or		
Boring Method		Shell	& Auger		Diame	ter of Ho	le : 150 mm	n	Completed on : 02/02/07		
Termination Depth of B.	.H. (m)	1.3	85 m	RL of G	round : E.(G.L.	Water Stud	ck: -	Ground Water:	NIL	
		L.	DEPTH		883	S.P.T.	SAMPLE A	ND IN-S	ITU TESTS		
DESCRIPTION STRATA	OF	SYMBOL	From (M)	M G.L. To (M)	THICKNESS	VALUES	DEPTH (M)	тур	E Ref. No.	REMARKS	
Yellowish claye silt/silty clay wit traces of kanka	th		0.0	1.00	1.00	-	0.50	DS DS	D-3/1 D-3/2		
Reddish Yellow Yellowish red sil clay/clayey silt w gravels. Fragments of roc were observed bel 1.25 m	ith :k			1.35	0.35	58	1.25	SPT	S-3/1	58 blows < 10 cm penetratio n.	
			1.35								

Appendix A1.4 Boring Log in DPR (No.3)

State: JHARKHAND	Client:	MEIN	HARD	T (SINGA	Pore) Pte	LTD.			Borehole No	.: 04	
Site: KANKA ROAD									Commenced o	n:04/02/07	
Boring Method	1	Shell	& Auger	r	Diame	eter of Ho	le : 150 m	n	Completed on : 04/02/07		
Termination Depth of B.	H. (m)	8.5	50 m	R.L. of G	round : E.(G.L.	Water Stu	ck: -	Ground Water:	1.50 M.	
		L	DEPTH FROM G.L.		88	S.P.T.	SAMPLEA	ND IN-S	ITU TESTS		
DESCRIPTION OF STRATA		SYMBOL	From (M)	To (M)	THICKNESS	W VALUES	DEPTH (M)	туі	PE Ref. No.	REMARKS	
Reddish Yellow Yellowish Red sil clay/clayey silt wi traces of kankai (observed upto 6.00m) Fragments of roc were observed bel	ity ith		0.00	8.50	8.50	7 9 13 29	0.50 1.00 2.00 2.50 4.00 5.50 6.00 7.00	DS DS UDS SPT SPT UDS SPT	D-4/2 S U-4/1 S -4/1 S -4/2 S -4/2 S -4/3 S U-4/2 S -4/4		
6.00 m			8,50			41	8.50	SPT	S-4/5		

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.5 Boring Log in DPR (No.4)

State: JHARKHAND	Client:	MEI	NHARD	T (SINGA	PORE) PTE	LTD.			Borel	hole No.	: 05
Site: PANDRA									Comm	enced on	: 03/02/07
Boring Method		Shell	& Auge	r	Diame	eter of Ho	le : 150 mm	n	Completed on : 03/02/07		
Termination Depth of B	.H. (m)	8.2	20 m	RL of 0	Ground : E.(G.L.	Water Stu	ck: -	Groun	d Water:	2.70 M.
)L	DEPTH FROM G.L.		8	S.P.T.	SAMPLE AND IN-SITU TESTS				
DESCRIPTION STRATA	OF	SYMBOL	From (M)		THICKNESS	W. ALUES	DEPTH (M)	ту	Æ	Ref. No.	REMARKS
			0.00					DS	1	D-5/1	
Yellowish gray	1						0,50	DS	1	D-5/2	
reddish yellowis							1.00	DS	1	D-5/3	
gray silty clay/cla	yey			4.00	4.00		1.50	DS	1	D-5/4	
silt with traces of	of					5	3.00	SPT		S-5/1	
kankar.							4.00	UDS	8 1	U-5/1	
			4.00								
Grayish silty						20	4,50	SPT	. .	S-5/2	
clay/clayey silt w				8.20	4.20	29	6.00	SPT		S-5/3	
traces of fine sar						35	7.50	SPT		S-5/4	
Fragments of ro were observed be						40	8,20	SPT	. .	S-5/5	
6.00 m			8,20								
0.00					i	i		i	i		i

Appendix A1.6 Boring Log in DPR (No.5)

State: JHARKHAND	Client:	MEI	HARD	T (SINGA	PORE) PTE	. LTD.			Borehole N	o.: 06	
Site: DEEPATOLI									Commenced	on : 25/01/07	
Boring Method		Shell	& Auge	r	Diame	eter of Ho	le : 150	mm	Completed or	: 25/01/07	
Termination Depth of B.	.H. (m)	4.50 m RL of			Fround : E.	G.L.	Water	Stuck: -	Ground Water:		
		SYMBOL	DEPTH FROM G.L.		8	S.P.T.	SAMPLE	E AND IN SITU TESTS			
DESCRIPTION STRATA			From (M)	To (M)	THICK NESS	AALUES	DEPTH (M)	TY	PE Ref. No.	REMARKS	
Yellowish red/reddish yello silty clay/clayey s with traces of sa and kankar.	silt		0.00	2.50	2.50		0.50 1.00 2.50	DS DS UD	D-6/2		
Grayish yellowis silt .Traces of Fragments of roc were observed bel 2.50 m	:k		2.50	4.50	2.00	24	4.00	SPI	Г S-6/1		
			4.50							Hard strata was observed below 4.50 m. No further progess of Auger.	

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.7 Boring Log in DPR (No.6)

State: JHARKHAND	Client:	MEIN	NHARD	T (SINGA	Pore) Pte	. LTD.			Boreho		
Site: FULL TOLI				1					Commenced on : 25/01/07		
Boring Method		Shell	& Auge	r	Diame	eter of Ho	de : 150 mm	n	Completed on		: 25/01/07
Termination Depth of B.	H. (m)	5.5	50 m	RL of G	round : E.	G.L.	Water Stud	ck: -	Ground	Water:	3.50 M.
		ж		EPTH M.G.L.	ESS	S.P.T.	SAMPLE A	ND IN-SI	ITU TESTS	8	
DESCRIPTION STRATA	OF	SYMBOL	From (M)	To (M)	THICK NESS (m)	VALUES 'N	DEPTH (M)	түр	E Rei	f, No.	REMARKS
Grayish yellowis silty clay / clayey with traces of sar	silt		0.00	1.00	1.00		0.50 1.00	DS DS	D-3 D-3		
Brownish red / Reddish Brown si clay / clayey silt.Fragments o	lty			5.50	4.50	7	2.50 3.00	SPT UDS			
rock were observe below 4.00 m						10 31	4.00	SPT SPT		7/2 7/3	
			5.50			2.	0.00				

Appendix A1.8 Boring Log in DPR (No.7)

State: JHARKHAND	Client:	MEI	NHARD	T (SINGAF	PORE) PTE	e ltd.				Borehole No	.: 8
Site: LOWAR CHUTIA	A (NEAR	RAIL	WAY RE	CRUTME	NT BOARD)				Commenced o	n : 23/01/07
Boring Method		Shell	& Auger	r	Diam	eter of H	ole	: 150 m	m	Completed on	: 23/01/07
Termination Depth of B.	H. (m)	10	.00 m	RL of G	round : E.	G.L.		Water Stu	ick: -	Ground Water:	3.00 M.
		ы		PTH 4 G.L.	NESS	S.P.T.		SAMPLE A	ND IN-ST	TU TESTS	
DESCRIPTION O STRATA)F	SYMBOL	From (M)	To (M)	THICKNESS (m)	NALUES N'		EPTH (M)	TYPE	Ref. No.	REMARKS
Yellowish Red/ Reddish Yellow sil clay / clayey silt wi traces of sand an kankar.	lty ith		0.00	3,00	3.00	3 4	1	.50 .00 .00	DS SPT SPT UDS	D-8/1 S-8/1 S-8/2 U-8/1	
Stiff Yellowish Re Reddish Yellowis Gray with traces o mica & sand, Few Gravels wer observed below 4.00 m.Fragments rock were observe	h of e of			10.00	7.00	13 14 28 54 69	5 6 7	.00 .00 .00 .00	SPT SPT SPT SPT SPT	S-8/3 S-8/4 S-8/5 S-8/6 S-8/7	
below 7.00 m.			10.00			88		0.00	SPT	S-8/8	

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.9 Boring Log in DPR (No.8)

State: JHARKHAND	Client:	MEI	NHARD	T (SINGA	PORE) PTE	LTD.				Bo	rehole No.	: 09	
Site: LOWAR CHUTIA										Cor	mmenced on	: 24/01/07	
Boring Method		Shell	& Auge	r	Diame	ter of Ho	le	: 150 mm	1	Cor	mpleted on	: 24/01/07	
Termination Depth of B.	.H. (m)	9.5	50 m	R.L. of (f Ground : E.G.L. Water Stuck: -					Gro	und Water:	6.25 M.	
		or		EPTH DM G.L.	ESS	S.P.T.		SAMPLE A	ND IN-S	ITU1	TESTS		
DESCRIPTION STRATA	OF	SYMBOL	From (M)	To (M)	THICKNESS (m)	W NULES	1	DEPTH (M)	TYP	E	Ref. No.	REMARKS	
Yellowish Red			0.00										
Reddish Yellow s clay / clayey silt v								0.50	DS		D-9/1	-	
filling material				2.00	2.00			1.00 1.50	DS		D-9/2 D-9/3		
	-							2.00	DS		D-9/3 D-9/4	-	
			2.00									-	
						2	:	2,50	SPT		S-9/1	-	
Stiff Yellowis reddish / Reddi: Yellowish Brown	sh			5.00	3.00		:	3,50	UDS		U-9/1	-	
clay / clayey silt v traces of grits.	vith					11		5.00	SPT		S-9/2	-	
			5.00			19		6,50	SPT		S-9/3		
Stiff Redish						20	-	8.00	SPT		S-9/4		
Yellowish Gray cl silt/silty clay wi traces of mica	th			9.50	4,50	21		9.50	SPT		S-9/5		
Fragments of ro were observed be 5`.00 m.													

Appendix A1.10 Boring Log in DPR (No.9)

State: JHARKHAND Clier	t: MEI	NHARDI	(SINGA	PORE) PTE.	LTD.			Borehole No.	: 10
Site: LOADI NICHE COAC	HI							Commenced on	: 19/01/07
Boring Method	Shell	& Auger		Diamet	er of Hok	e : 150 mr	n	Completed on	: 19/01/07
Termination Depth of B.H. (m	10	.00 m	RL of G	round : E.G	.L.	Water Stu	ck: -	Ground Water:	5.90 M.
	5		EPTH M.G.L.	S I	S.P.T.	SAMPLEA	ND IN-	SITU TESTS	
DESCRIPTION OF STRATA	TOBINS	From (M)	To (M)	(III)	*N-	DEPTH (M)	TYI	PE Ref. No.	REMARKS
Yellowish Brownish clayey silt / silty clay with traces of kankar and grass roots.		0.00 4.00	4.00	4.00	3 7	0.50 1.00 2.50 4.00	DS SPT SPT UDS	S-10/1 S-10/2	
Stiff Yellowish Gray clayey silt / silty clay with gravels		10.00	10.00	6.00	7 9 19 28	5.50 7.00 8.50 10.00	SPT SPT SPT SPT	S-10/4 S-10/5	

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.11 Boring Log in DPR (No.10)

State: JHARKHAND	Client:	MEINHAR	DT (SING	APORE)	PTE LT	D.		Borehole	No.: 11	
Site: TRIL ASHRAM								Commenc	ed on : 08/02/07	
Boring Method	\$	Shell & Aug	ger		Diameter	of Hoke :	150 mm	Completed on : 08/02/		
Termination Depth of B.H	H (m) 1.50 m R.L of Ground : E.G.L. Water S						ter Stuck: -	Ground W	ater: NIL	
	- 1	DEPT	Ή	8	S.P.T.	SAMPLE	AND IN-SITU	TESTS		
	SYMBOL	FROM	G.L.	E KN					REMARKS	
DESCRIPTION OF STRATA	sw	From (M)	To (M)	THICKNESS (m)	VALUES	DEPTH (M)	TYPE	Ref. No.		
Yellowish silty clay / clayey silt with traces of filling materials and graveler.		0.00	1.00	1.00		0.50 1.00	DS DS	D-11/1 D-11/2		
<yellowish grayish<br="">silty clay / clayey silt with traces Fragments of rock were observed below 1,00 m</yellowish>		1.50			>50	1.35	SPT	S-11/1	Below 1.35 m <10 cm progra Per 50 blow	

Appendix A1.12 Boring Log in DPR (No.11)

tate: JHARKHAND Client: MEINHARDT (SINGAPORE) PTE. LTD. Borehole No.: 12													
Site: FIRE STATION V	VATER	r re	SERVI	OR					Com	menced on	: 08/02/07		
Boring Method		Shell	& Auger	r	Diame	eter of Ho	le : 150 mm	1	Com	pleted on	: 08/02/07		
Termination Depth of B.	rmination Depth of B.H. (m) 10.00 m R.L. of Ground : E.G.L. Water Stuck: -												
DEPTH & C.P.T. SAMPLE AND IN-SITU TESTS													
		OL		EPTH M.G.L.	8	S.P.T.	SAMPLE A	ND IN-S	TUTI	ESTS			
DESCRIPTION OF STRATA		SYMBOL	From To (M) (M)		THICKNESS	VALUES	DEPTH (M)	түр	PE Ref. No.		REMARKS		
Soft Yellowish Gr silty clay/clayey s	-		0.00	1.00	1.00		0.50	DS DS		D-12/1 D-12/2			
Stiff Yellowish Bluish Gray clayey silt / silty clay with gravels. Traces of kankar were observed at upper reach.			10.00	10.00	9.00	7 15 17 22 14 32	1.50 3.00 4.50 6.00 7.50 9.00 10.00	SPT UDS SPT SPT SPT SPT SPT		S-12/1 U-12/1 S-12/3 S-12/4 S-12/5 S-12/6 S-12/7			

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.13 Boring Log in DPR (No.12)

PREPARATORY SURVEY ON RANCHI SEWERAGE PROJECT

State: JHARKHAND Site: KALYAN PUR	Client:	MEI	NHARD	T (SINGA	Pore) Pte	LTD.				ole No.: nœd on	: 13 : 05/02/07
Boring Method		Shell	& Auger		Diame	ter of Ho	le : 150 mm	n	Comple	ted on	: 05/02/07
Termination Depth of B.	H. (m)	10.	00 m	RL of G	round : E.(G.L.	Water Stud	ck: -	Ground	6.25 M.	
		ы		PTH M.G.L.	ESS	S.P.T.	SAMPLE A	ND IN-S	ITU TEST	s	
DESCRIPTION O STRATA	OF	SYMBOL	From (M)	To (M)	THICKNESS	VALUES	DEPTH (M)	түр	ER	ef. No.	REMARKS
Grayish silty clay			0.00				0.50	DS		13/1	
clayey silty with filling materials.			1.00	1.00	1.00		1.00	DS	D	13/2	
			·			7	2,50	SPT		13/1	
						9	4.00	SPT		13/2	
Yellowish/						13	5.00 5.50	UDS SPT		13/1	
Yellowish Grayis silty clay/ clayey s	silt			10,00 0	9.00	15	7.00	SPT	_	13/4	
with traces of kank Fragments of roc were observed belo	k					17	8,50	SPT	S-	13/5	
7.00 m						21	10.00	SPT	S-	13/6	
			10.00								

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.14 Boring Log in DPR (No.13)

State: JHARKHAND	Client	: ME	INHARD	T (SINGA	PORE) PT	e. ltd.			Borehole No	.: 14	
Site: LATMA									Commenced o	n : 05/02/07	
Boring Method		Shel	I & Auge	r	Dian	neter of H	l ole : 150 m	nm	Completed on : 05/02/07		
Termination Depth of B.	.H. (m)	10	0.00 m	RL of G	round : E	.G.L.	Water St	tuck: -	Ground Water:	6.20 m.	
		2	DEI		88	S.P.T.	SAMPLE A	ND IN-SIT	TU TESTS		
DECEMBERON		SYMBOL	FROM	IGL.	- Xi	8				REMARKS	
DESCRIPTION OF STRATA Vallowish silty		SYA	From (M)	To (M)	THICKNESS (m)	NALUES	(M)	TYPE	Ref. No.		
Yellowish silty clay/clayey silt wit	L		0.00	2.50	2.50		0.50	DS	D-14/1		
traces of kankar				2,50	2,50		1.00	DS	D-14/1 D-14/1		
	_		2.50			17	2.50	SPT	S-14/1		
				i	i	25	4.00	SPT	S-14/2		
Reddish Yellow				10.00	7.50	31	5,50	SPT	S-14/3		
clayey silt / silty cla with traces of kanka							6.00	UDS	U-14/1		
with traces of Kalikar,						33	7.00	SPT	S-14/4		
						29	8.50	SPT	S-14/5		
			10,00			32	10.00	SPT	S-14/6		

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.15 Boring Log in DPR (No.14)

State: JHARKHAND	Client:	MEIN	HARD	T (SINGA	PORE) PTE	LTD.				Bor	ehole No.:	: 15	
ite: BIRSHA MUND/	A AIR F	PORT								Соп	nmenced on	: 06/02/07	
Boring Method		Shell	& Auger	r	Diame	ter of Ho	ke :	150 mr	m	Соп	npleted on	: 06/02/07	
Termination Depth of B	.H. (m)	7.5	i0 m	R.L. of G	Ground : E.G.L.			Water Stuck: -			und Water:	3.35 m	
		0L		EPTH)M G.L.	ESS	S.P.T.	SA	MPLEA	ND IN-S	SITU TESTS			
DESCRIPTION STRATA	OF	SYMBOL	From (M)	To (M)	THICKNESS (m)	AALUES	DEI (M		ту	Æ	Ref. No.	REMARKS	
Yellowish silty clay/clayey silt			0.00	1.00	1.00		0.5 1.0	_	DS DS		D-15/1 D-15/2		
Yellowish Gray silty clay / clayey silt with traces of gravels			3.00	3.00	2.00	9 12 19	1.5 2.5 3.0	0	SPT SPT SPT		S-15/1 S-15/2 S-15/3		
Grayish yellow silty clay / clayey silt with gravels. Fragments of rock were observed below			7.50	7.50	4.50	28 29 >50	4.5 6.0 7.5	0	SPT SPT SPT		S-15/4 S-15/5 S-15/6		
4.50 m												Below 7.50m < 10 cm penetratio n >50 blows	

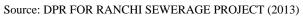
Appendix A1.16 Boring Log in DPR (No.15)

State: JHARKHAND	Client	MEIN	HARDT	(SINGA	PORE) PTE.	LTD.			Borehole No	.: 16	
Site: HARSER BAST	I								Commenced o	n : 07/02/07	
Boring Method		Shell	& Auger		Diame	ter of Ho	le : 150) mm	Completed on : 07/02/0		
Termination Depth of B	.H. (m)	9.5	50 m	R.L. of G	round : E.C	G.L.	Water	Stuck: -	Ground Water:	5.20 m	
		L	DEPTH FROM G.L.		88	S.P.T.	SAMPLE AND I		SITU TESTS		
DESCRIPTION STRATA	OF	SYMBOL	FRO From (M)	M G.L. To (M)	THICKNESS (m)	VALUES	DEPTH (M)	TYI	PE Ref. No.	REMARKS	
Yellowish silty clay/clayey silt w grass roots,			0.00	1.00	1.00		0.50 1.00	DS DS			
Yellowish Reddish silty clay / clayey silt						7	2.00	SPT	S-16/1		
with traces of kan Gravels were observed below				6,50	5.50	9	3.50	SPT			
3.00 m.						11 13	5.00 6.50	SP1 SP1			
Grayish yellow si clay / clayey silt v gravels. Fragme of rock were	vith		6,50			16	8.00	SPT			
observed belov 9,50 m	v		0.05	9.95	3.45	19	9.50	SPT	S-16/6		
			9.95								

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.17 Boring Log in DPR (No.16)

State: JHARKHAND	Client:	MEIN	HARD	T (SINGA	Pore) Pte	LTD.			Borehole N	o.: 17
ite: PUMP HOUSE									Commenced	on : 07/02/07
Boring Method	1	Shell (& Auge	r	Diame	eter of Ho	le : 150 mm	n	Completed or	: 07/02/07
Termination Depth of B.	H. (m)	10.	00 m	R.L. of G	Ground : E.(G.L.	Water Stu	ck: -	Ground Water	r: 3.00 m
		JL.	DEPTH FROM G.L. From To (M) (M		SS	S.P.T.	SAMPLE A			
DESCRIPTION STRATA	OF	SYMBOL			(III)	AALUES	DEPTH (M)	ту	PE Ref. No.	REMARKS
Greyish silty clay/clayey silt.			0.00	1.00	1.00		0.50 1.00	DS DS		
Greyish Yellow/Yellowis						7	1.50	SPT	S-17/1	
Grey clayey silt/s clay .Traces of sa were observed up	nd					10	3.00	SPT	S-17/2	
3.00 m.Gravels w observed below 4.50 m.Fragments	ere			10.00	9.00	11 12	4.50 6.00	SPT SPT		
rock were observ below 9.00 m.						14 18	7.50 9.00	SPT SPT		
			10.00			27	10.00	SPT	S-17/7	



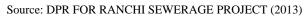
Appendix A1.18 Boring Log in DPR (No.17)

State: JHARKHAND	Client:	MEIN	HARD	T (SINGA	PORE) PTE	LTD.			Borehole No.	: 18	
Site: HETHU									Commenced or	n : 06/02/07	
Boring Method	:	Shell	& Auge	r	Diame	ter of Ho	n	Completed on : 06/02/07			
Termination Depth of B.	H. (m)	10.	00 m	R.L. of G	round : E.C	G.L.	Ground Water:	6.00 m			
		OL.	DEPTH FROM G.L.		ESS	S.P.T.	SAMPLE A	ND IN-S	ITU TESTS		
DESCRIPTION STRATA	OF	TOBIN			THICKNESS	VALUES	DEPTH (M)	түр	E Ref. No.	REMARKS	
Yellowish Grey si clay/clayey silt w traces of sand an kankars.	ith		0.00	1.50	1.50		0.50 1.00	DS DS	D-18/1 D-18/2		
		_	1.50			11	1.50	SPT	S-18/1		
Stiff Yellowish Yellowish Grev si	·					18	3.00	SPT	S-18/2		
Yellowish Grey silty clay/clayey silt with gravels. Traces of grits were observed at upper reach.				10.50	9.00	24 27 29	4.50 6.00 7.50	SPT SPT	S-18/4		
						30	9.00	SPT			
			10.50			31	10.00	SPT	S-18/7		

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.19 Boring Log in DPR (No.18)

State: JHARKHAND Clie Site: BIDHAN SABHA	ent: MB	EINHAR	OT (SINGA	PORE) PTE	LTD.			Borehole No. Commenced or	
Boring Method	She	ell & Auge	ər	Diame	ter of Ho	le : 150 m	m	Completed on	: 08/02/07
Termination Depth of B.H. (r		0.00 m		Ground : E.(Water Stu		Ground Water:	
	,		EPTH OM G.L.	688	S.P.T.	SAMPLEA	ND IN S	ITU TESTS	
DESCRIPTION OF STRATA	10000	From (M)	То	THICKNESS	VALUES	DEPTH (M)	түр	E Ref. No.	REMARKS
Yellowish Grey silty clay/clayey silt with traces of sand and kankars.		0.00	1.00	1.00		0.50 1.00 1.50	DS DS UDS	D-19/1 D-19/2 U-19/1	
Yellowish Grey/Yellowish Bluish Grey silty		1.00			5 7	2.00 3.50	SPT SPT		
clay/clayey silt with traces of kankar, Gravels were observed at lower reach.			10.50	9.00	9 12 16	5.00 6.50 8.00	SPT SPT SPT	S-19/4	
reaut,		10.00	0		21	9.50	SPT	S-19/6	



Appendix A1.20 Boring Log in DPR (No.19)

State: JHARKHAND	Client:	MEI	NHARD	T (SINGA	PORE) PTE	LTD.			Borehole No.	: 20	
Site: MECON STADIU	M								Commenced or	n : 09/02/07	
Boring Method	1	Shell	& Auge	r	Diam	eter of H	ole : 150 m	m	Completed on : 09/02/07		
Termination Depth of B.	H. (m)	10	.00 m	RL of G	round : E.	G.L.	ick: -	Ground Water:	1.60 m		
		T		PTH M.G.L.	8	S.P.T.	SAMPLE A	ND IN-SI	TUTESTS		
DESCRIPTION O)F	SYMBOL	FROM G.L.		THECKNESS (m)	VALUES	DEPTH	тур	Ref. No.	REMARKS	
STRATA		SY	From (M)	To (M)	H	N ²	(M)				
Yellowish Bluish Grey silty	1		0.00	1.00	1.00		0.50	DS	D-20/1		
clay/clayey silt wit traces of fine san				1.00	1.00		1.00	DS	D-20/2		
			1.00			6	1,50	SPT	S-20/1		
Yellowish Grey/Yellowish Bluish Grey silty						8	3.00	SPT	S-20/2		
clay/clayey silt wit gravels, Traces of	th					18	4.50	SPT	S-21/3		
kankars were				10.00	9.00	20	6.00	SPT	S-22/4		
observed at upper reach.	r					21	7.50	SPT	S-23/5		
reach,						24	9.00	SPT	S-24/6		
			10.00			28	10.00	SPT	S-25/7		

Source: DPR FOR RANCHI SEWERAGE PROJECT (2013)

Appendix A1.21 Boring Log in DPR (No.20)

Appendix A1.22 Soil Sampling Test	Result (1/2)
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Envirotech AN ISO 9001:2000 & 14001:2004 COMPANY	LABORATORY TEST RESULTS (SOIL SAMPLES)
Project No: 0407	Date of Testing: 14/02/2006 - 02/03/2007
Client: MEINHARDT (SINGAPORE) PTE. LTD.	
Project Name: Sewerage and Drainage system for t	the capital city of Ranchi,Jharkhand
Site: Ranchi, Iharkhand	

		MENT	/ce	8	2	AT	TERBERG	LIMIT	SHEAR S	STRENGTH	11 01	GRJ	AIN SIZE DI	STRIBUT	ION
BORHOLE NO.	DEPTH(M)	MATURAL MOISTURE CONTENT (%)	BULK DENSITY gms/cc	DRY DENSITY gms/co	SPECIFIC ORAWITY 'G'	полю сими	PLASTIC LIMIT	PLASTI CITY IN DEX	Cohesion °C T/m²	Ricton '¢'	CONSOLDATION Th. (cm ² /%g)	% TAMEL %	% ONVS	SILTS	CLAY'S
1	2.00	23.4	1.91	1.41	2.67	45.4	26.8	18.6	4.3	80	-	9	24	28	39
1	7.50	-	•	1.46	2.71	37.4	20.1	17.3	•	-	0.030	24	36	18	22
2	2.00	27.1	1.89	1.38	2.68	48.2	27.4	20.8	3.8	90	0.041	11	26	30	33
3	1.25	-	-	1.44	2.74	N	Р	-	-	-	-	34	29	19	18
4	2.00	30.8	1.82	1.29	2.65	57.4	32.1	25.3	3.1	00	0.047	-	16	45	39
4	6.00	25.3	1.87	1.36	2.68	42.7	25.6	17.1	4.6	130	0.026	18	21	33	28
5	4.00	29.2	1.82	1.31	2.66	59.2	34.3	24.9	2.7	00	0.038	-	10	49	41
6	2.50	20.6	1.84	1.27	2.65	42.6	29.2	13.4	2.9	110	-	6	21	37	36
7	3.00	22.9	1.89	1.30	2.67	46.4	31.4	15.0	3.2	00	0.040	-	13	47	40
8	3.00	28.7	1.92	1.34	2.69	44.6	28.3	16.3	2.4	4 ⁰	-	-	20	44	36
9	3.50	21.8	1.79	1.25	2.62	39.2	25.0	14.2	2.3	00	0.061	-	12	60	28
10	2.50	-	-	1.29	2.59	47.2	34.4	12.8	-	-	-		15	42	43
10	4.00	18.3	1.90	1.37	2.65	40.1	29.4	10.7	2.7	60	0.048	10	21	39	30
11	1.35	-	-	1.49	2.73	N	Р	-	-	-	-	21	30	33	16
12	3.00	34.6	1.96	1.37	2.67	45.1	30.2	14.9	3.0	70	0.033	8	19	40	33
13	2.00	20.4	1.81	1.32	2.65	47.0	31.4	15.6	2.8	00	0.052	-	10	49	41
13	5.00	18.7	1.87	1.38	2.69	40.2	28.3	11.9	3.4	90	0.028	12	19	36	33
14	6.00	17.4	1.98	1.56	2.71	49.9	34.1	15.8	6.2	00	0.024	6	12	50	32
15	1.50		1.79	1.28	2.60	45.8	24.2	21.6	-	-	-	-	22	48	30

Source: DPR for Ranchi Sewerage Project (2013)

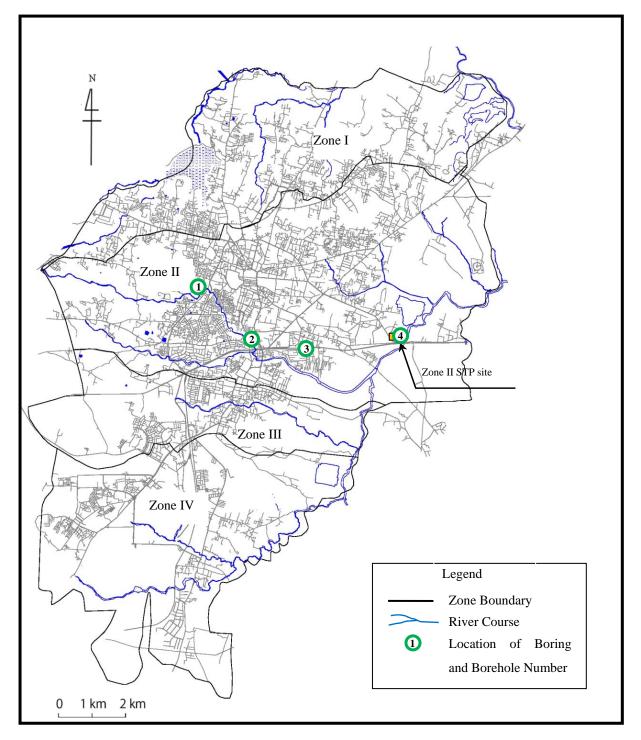
Appendix A1.23.1 Laboratory Test Result (2/2)

Envirotech AN ISO 9001:2000 & 14001:2004 COMPANY	LABORATORY TEST RESULTS (SOIL SAMPLES)										
Project No: 0407 Date of Testing: 14/02/2006 - 02/03/2007											
Client: MEINHARDT (SINGAPORE) PTE. LTD.											
Project Name: Sewerage and Drainage system for t	the capital city of Ranchi, Jharkhand										
Site: Ranchi Iharkhand											

		ONTENT	∕œ	,ce	٢	AT	TERBERG	i limit	SHEAR S	STRENGTH	ATTOM 40	GR/	AIN SIZE DI	STRIBUT	ION
BOREHOLENO	DEFTH(M)	NATURAL MOIST URE CONTENT (%)	BULK DENSITY gns/cc	DRY DENSITY gms/co	S PECIFIC GRAVITY '0'	LIQUID LIMIT	PLASTIC LIMIT	PLA STICITY IN DBX	Cohesion °C' T/m ²	Friction '4'	(cm2/kg) m NORAULIANTION	S TAVEL &	S ON AS	SILT %	CLAYS
16	2.00	-	-	1.27	2.65	53.4	32.9	20.5	-	-	-	3	10	47	40
17	1.50	-	-	1.31	2.67	57.2	37.3	19.9	-	-	-	-	13	42	45
18	1.50	-	-	1.24	2.66	49.5	28.4	21.1	-	-	-	-	17	51	32
19	1.50	21.4	1.80	1.28	2.66	50.7	31.2	19.5	3.8	00	0.041	6	10	43	41
20	1.50	-	-	1.36	2.67	45.4	23.1	22.3	-	-	-	•	19	47	34

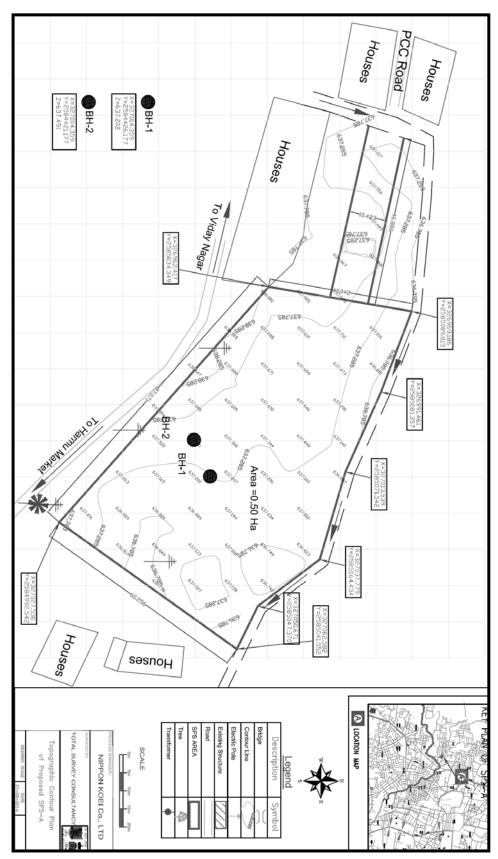
Source: DPR for Ranchi Sewerage Project (2013)

(2) Boring by JICA Study Team



Source: JICA Study Team Note: Location of Boring (JICA) 1: Pumping Station No.1, 2: Pumping Station No.2, 3:Railway Crossing, 4: STP-II Site

Appendix A1.24 Location of Boring by JICA Study Team



Source: JICA Study Team



PREPARATORY SURVEY ON RANCHI SEWERAGE PROJECT

							BORING	LOG									
Proj	ect : R	ANCH	SEW	/ERAG	E PROJE	ст		Boring Date : 13-06	-201	4							
Bore	Hole	; BH-1(PUMPIN	G STATIO	N NO.1/ HARMU)	Scale ; 1;50	Supervisor A : RA	HUL								
		37,202 achine	8					Supervisor B; VIK	ASH	ł							
Elev	atlon	Ground	Wate	r :-not	found			Drilling Method ; CC	RE	DR	ILL	NG U	SING	G BE	NTO	NITE	
	O		-	E	AN N	lo. epth			5	STA	NDA	RD PEI	NETR	NOITA	N TES	т	
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTIO	N OF MATERIAL		low 5 cr		N	6	HAR ⁻	T SD	т	SPT Sampling & Depth SPT
	ŝ			F	õ				15 cm	15 cm	15 cm	N	0		00		001
0.0 -		637.202	0.0			0.0	VERY DENSE YELLOW			-	-	-		+			-
	Ι			1.00		1/UDS (0.60-1.05)	γ = 1,98g/ccC= 0,43kg/cm2	. ,	20	20	20	40					
1,0 -		636.202	1.0				VERY DENSE NON-PLAS SAND WITH GRAVELS		20	20	20	40					SPT-1 1.00-1.45
2.0 -	II			2.00		2/P (2.00-2.45)			14	18	20	38		_	Ц		SPT-2 2.00-2.45
																V	
3.0 -		634,202	3,0			3/P (3.00-3.02)	VERY DENSE COMPLET (TOTAL DEPTH OF BOR	TELY WEATHERED ROCKS. EHOLE 3.00m)	Refu	usa⊫ 1	q) 00	an.2.Ocm)					SPT-3 3.00-3.02
4.0 -	Ш																-
5.0 -													$\left \right $	+	-		-
6,0 -																	
7.0 -														_			-
8.0 -													$\left \right $	+			
9.0 —	Ш																
							SC. Clavey SAND SM- S	ility SAND, CL-Clay of low									
10 -							plasticity, CI-Clay of me High Plasticity	dium plasticity, CH- Clay of low dium plasticity, CH- Clay of e UDS- Undisturbed Sample					\square	_			

Source: JICA Study Team

Appendix A1.26 Boring Log (Pumping Station No.1, BH-1)

PREPARATORY SURVEY ON RANCHI SEWERAGE PROJECT

							BORING	LOG									
Proj	ect : F	RANCH	SEW	/ERAG	E PROJE	ст		Boring Date : 13-06	-201	4							
Bor	e Hole	; BH-2	(PUMPIN	G STATIO	N NO.1/ HARMU)	Scale ; 1;50	Supervisor A: RA	HUL								
		37,491 achine :	8					Supervisor B; VIK	ASF	ł							
Elev	/ation	Ground	Wate	r :-not	found			Drilling Method : CO	DRE	DR	ILL	NG U	SIN	G BE	NTC	NITE	
	No		F	a,a	MN	No. epth				STA	NDA	RD PE	NETF	O TAS	N TE	ST	
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTIO	N OF MATERIAL		low 15 cr			6		T SF	т	SPT Sampling & Depth SPT
	S				ŝ				15 cm	15 cm	15 cm	N		2 8			00
0.0 -		637.491	0.0		()))))))	0.0	VERY DENSE YELLOW	SH CLAVEY SAND		-	-	-				ÌĬ	-
	1			1.00		1/UDS	WITH GRAVELS OF LO	W PLASTICITY (SC).									
						(0.50-0.95)	γ = 1,95g/ccC= 0,39kg/cm2	¢ = 16,00 degree	16		18	36					
1,0 -		636.491	1.0				VERY DENSE NON-PLAS SAND WITH GRAVELS . (10	18	10	30					SPT-1 1.00-1.45
																\mathbb{N}	
2.0 -	. 11			2.00		2/P (2.00-2.45)			20	22	24	48			1	T	SPT-2 2.00-2.45
3.0 -		634,491	3,0			3/P (3.00-3.02)	VERY DENSE COMPLET (TOTAL DEPTH OF BORE	ELY WEATHERED ROCKS.	Ref	usal- 1	100 (p	an.2.0cm)		+	$\left \right $	SPT-3 3.00-3.02
							(TOTAL DEPTH OF BOR	EHOLE 3.00m)									
4.0 -	- 111													_	+	$\left \right $	
5.0 -															_		
6,0 -																	
7.0 –																	
8.0 -																	
	111																
9.0 -													\mid		+	$\left \right $	
							SC- Clayey SAND, SM- S	ity SAND, CL- Clay of low									
10 -							High Plasticity	llum plasticity, CH-Clay of UDS-Undisturbed Sample					\mid		+	$\left \right $	
		1		1	I			•		1		l					

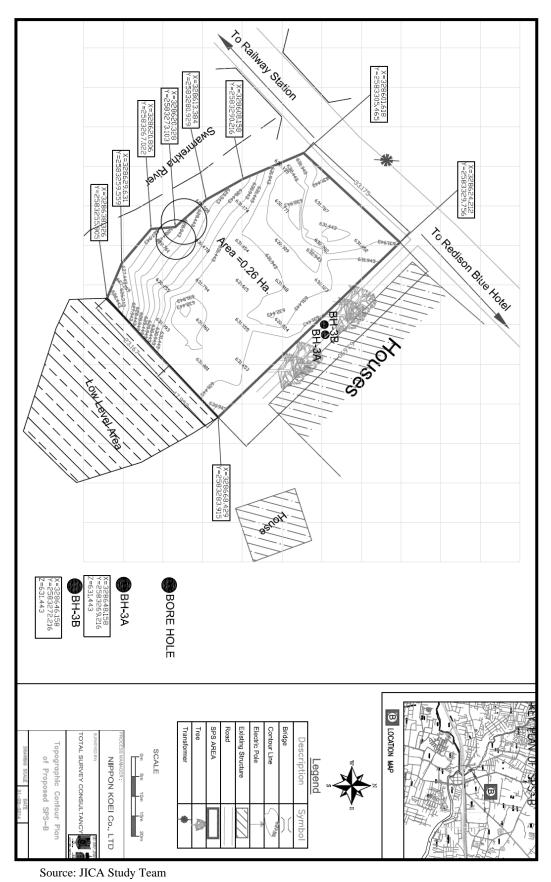
Appendix A1.27 Boring Log (Pumping Station No.1, BH-2)

									BH-	1							
	0	er		Gra	in Size I	Distributi	on	%	%	% 3	n 0)	ıre	٢	ity	Sh	ear Streng	th test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit	Plastic Limit	Plasticity Index	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm ³)	Specific Gravity	Type of test	Cohesion (Kg/cm^2)	Angle of internal Friction (Degree)
Ι	UDS	1/UDS	0.6	1.2	59.42	32.38	7	30.4	13.41	16.9	SC	15.23	1.98	2.63	UUT	0.43	14
п	Р	2/P	2	3.84	83.46	12.7	0	-	NP	-	SM	-	-	2.6	-	-	-
п	Р	3/P	3	1.66	82.18	16.16	0	-	NP	-	SM	-	-	2.62	-	-	-
III						COMP	LETE	LY WE	ATHER	ED RO	CK (3.00	m ONWA	RDS)				

Appendix A1.28 Soil Sampling Test Result (Pumping Station No.1, BH-1)

Appendix A1.29 Soil Sampling Test Result (Pumping Station No.1,	BH-2)
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									BH-2								
		ər		Gra	ain Size D	istributio	n	%	%	%	- 6	re	(g/cm ³)	ty	She	ar Streng	th test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit 9	Plastic Limit	Plasticity Index	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/	Specific Gravity	Type of test	$\begin{array}{c} Cohesion \\ (Kg/cm^2) \end{array}$	Angle of internal Friction (Degree)
Ι	UDS	1/UDS	0.5	0.68	61.35	32.97	5	30.1	14.65	15.45	SC	15.47	1.95	2.62	UUT	0.39	16
	Р	2/P	2	4.77	80.93	14.3	0	-	NP	-	SM	-	-	2.63	-	-	-
II	Р	3/P	3	5.68	81.69	12.43	0	-	NP	-	SM	-	-	-			
III					(COMPLE	TELY	WEAT	HERED	ROCK (3	3.00m O	NWARD	S)				



Appendix A1.30 Boring Location (Pumping Station No.2)

Dee.	t				E 000	CT.	BORING LOG	201	A						
-					E PROJE		Boring Date : 16-06-2		4						
				ING STAT	ION NO.2/KADRI	u)	Scale : 1:50 Supervisor A : RAH								
Altitu	ude: 6	31.443					Supervisor B: VIKA	١SH							
Dr⊪	ng Ma	achine	09				Drilling Method : CO	RF	DR		NG U	SING	BEN.	TON	TE
Elev	ation	Ground	l Wate	r :-8.0	Om										
_	<u>No.</u>		F	a,n	MM	No. epth		5	STA	NDA	RD PEI	IETRA	TION 1	EST	
Scale,m	Statumn No.	Altitude	Depth,m	Thlckness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTION OF MATERIAL		ow 5 cr						TO O
Ň	Stat	A	ŏ	Thlo	STF	Sai		E	E	ε	Ν	СН	ART S	SPT	
								15 cm	15 cm	15 cm		6	30 20	40	20 20
0.0 -		631.443	0.0			0.0	Filled up soll comprising of dust &		-	-	-				H
					4		waste materials. (0.00-6.00m)								
					4 4										
1.0 -								2	4	6	10				1.0
					4 4										
2.0 -								4	6	8	14	\square			2.0
	Т			6.00											
								8	8	12	20		$\left \right $.s
3.0 -					4			0	0	12	20				3,0
					4										
4.0 -								8	15	12	27		+		4.0
														$\langle $	
5.0 -					A			12	18	25	43			X	S
5.0 7					4										5.0
6.0 -		625.443	6.0		4		MEDIUM TO VERY DENSE INORGANIC	12	20	30	50		++	-	6.0
							YELLOWISH CLAYEY SILT WITH SAND AND								
7.0 -							GRAVELS OF LOW PLASTICITY (CL). (6.00-8.50m)								s
/.0	Ш			2.50		1/P (7,00-7.45)		15	30	35	65				77.0
														X	
8.0 -					T	2/P (8.00-8.45)		9	15	20	35	\vdash	+	(8.0
		633,943	8,50				VERY DENSE YELLOWISH INORGANIC CLAYEY								
9,0 -							SAND WITH GRAVELS OF LOW PLASTICITY								s
						3/P (9.00-9.45)	(SC). (8,50-10,50m)	15	20	20	40		$ \top$	\setminus	9.0
	Ш			2.50											
10.0-						4/P (10.00-10.45)		20	30	35	55		+		110.0
							VERY DENSE NON-PLASTIC SILTY SAND.								
11.0_	IV	620.443	11.00				RESIDUAL SOL/ COMPLETELY WEATHERED ROCKS	Refu	sal- '	100 /0	m. 2.0cm)				SI
	P- SPT	-		e UDS-	Undisturbed	Sample	TOTAL DEPTH OF BOREHOLE 11.00m			(p			1 T		11.0



Appendix A1.31 Boring Log (Pumping Station No.2, BH-3A)

								BORING LOG									
Proj	ect : F	ANCH	I SEW	ERAG	E PROJE	ст		Boring Date : 03-07-	201	4							
Bore	e Hole	: BH-3	В(римр	ING STATI	ON NO,2/KADR	u)		Scale : 1:50 Supervisor A : RAH	IUL								
Altit	ude: 6	31,443						Supervisor B: VIKA	١SF	4		·					
		chine															
	-	Ground		<u>r :-8.00</u>	<u>)</u> m			Drilling Method : CO	RE	DR	ILL	ING U	SIN	3 BE	NTC	DNIT	E
	Ċ			E	z		ţ		;	STA	NDA	RD PEN	IETR		N TE	ST	
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No.	Sample Depth	DESCRIPTION OF MATERIAL	в	low	per						SPT bling &
Sca	itatur	Altit	Dep	hick	STRATU LOG	Sam	Samp	DESCRIPTION OF MATERIAL		5 cn	_	N	Cł	HART	SF	т	SPT Sampling &
	0				0)				15 cm	15 cm	5 cm	IN .					
									1	¥	15.		10	20	8 :	1 1	100
0.0 -		631.443	0.0			0.0	0	Filled up soll comprising of dust &	1-	-	-	-				Ħ	
					4			waste materials. (0.00-6.00m)									
1.0 -					4				2	4	5	9				\square	SPT- 1.00-1.
																	1.00-1.
					4									١			
2.0 -					4				4	5	9	14		+		$\left \right $	SPT- 2.00-2.
	T			6.00													
														N			CDT.
3.0 -					4				9	10	10	20				Ħ	SPT- 3.00-3.
					 									\setminus			
4.0 -									8	12	18	30					SPT-4.00-4.
					• • • •										Ι		4.00-4.
															$\left \right $		
5.0 -					••				10	15	21	36	\vdash		Н	$\left \right $	SPT- 5.00-5.
					4 4.										`	\mathbb{N}	
																$\left \right\rangle$	0.07
5.0 -		625.443	6.0					MEDIUM TO VERY DENSE INORGANIC	15	21	33	53				Ħ	SPT-1 6.00-6.
								YELLOWISH CLAYEY SILT WITH SAND AND									
7.0 -								GRAVELS OF LOW PLASTICITY (CL). (6.00-8.50m)									SPT-1 7.00-7.
	Ш			2.50		1/L (7.00	JDS 7.45)	γ = 2.03g/ccC= 0.26kg/cm2 ϕ = 17.00 degree	18	31	34	65				/	7.00-7.
3.0 -					×.	2/F	Þ		15	14	22	36		_	+		SPT- 8.00-8.
		633,943	8,50			(8.00-	8.45)								'		
		555,543	0,00					VERY DENSE YELLOWISH INORGANIC CLAYEY SAND WITH GRAVELS OF LOW PLASTICITY								$\left \right $	
ə.o –						3/F (9.00-9	P).45)	(SC).	17	22	25	47	\vdash	+	+		SPT- 9.00-9.
	10							(8.50-10.50m)									
	Ш			2.50								_					SPT 4
10.0-						4/F (10.00-1	D 10.45)		23	34	39	73	\square	\uparrow		\square	SPT-1 10,00-10
								VERY DENSE NON-PLASTIC SILTY SAND,	{								
11.0	IV	620,443						RESIDUAL SOIL/ COMPLETELY WEATHERED ROCKS. TOTAL DEPTH OF BOREHOLE 11,00m	Ref	usal- 1	00 (p	en. 2.0cm)	Щ	\perp		\square	SPT-1 11,00-11
			d Samp	le UDS-	Undisturbed	Sample	е	TOTAL DEFTH OF BOREHOLE TI.00m	1	1							



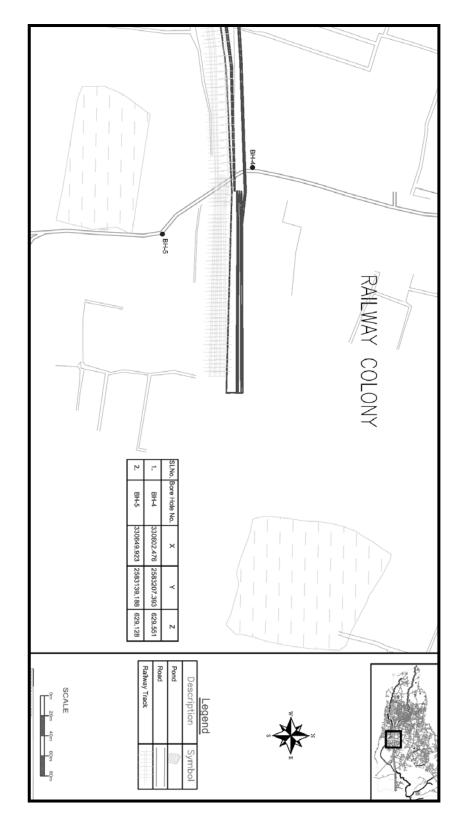
Appendix A1.32 Boring Log (Pumping Station No.2, BH-3B)

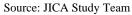
									BH	[-3A							
				Gra	ain Size E	Distributio	n			%		9	n ³)		S	hear Stren	gth test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index 9	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm ³)	Specific Gravity	Type of test	Cohesion (Kg/cm ²)	Angle of internal Friction (Degree)
Ι								FII	LLED UP	SOIL (0.	00-6.00m)					
П	Р	1/P	7	0.62	44.06	43.32	12	31	13.95	17.05	CL	-	-	2.63	-	-	-
11	Р	2/P	8	0.86	49.6	44.54	5	27.8	14.85	12.95	CL	-	-	2.62	-	-	-
Ш	Р	3/P	9	2.82	55.6	31.58	10	31.2	14.64	16.56	SC	-	-	2.64	-	-	-
111	Р	4/P	10	1.88	54.17	34.95	9	29.1	14.6	14.5	SC	-	-	2.62	-	-	-
IV					RESI	DUAL S	OIL/ (COMPL	ETELY V	WEATHE	RED RO	CK (10.5	0m ONW	(ARDS)			

Appendix A1.33 Soil Sampling Test Result (Pumping Station No.2, BH-3A)	Appendix A1	.33 Soil Samplin	g Test Result ()	Pumping Station	No.2, BH-3A)
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Appendix A1.34 Soil Sampling Test Result (Pumping Station No.2, BH-3B)

									BH-3	BB							
				Gr	ain Size E	Distributio	n			%		0	n ³)		Sh	ear Streng	gth test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index 9	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm ³)	Specific Gravity	Type of test	Cohesion (Kg/cm ²)	Angle of internal Friction (Degree)
Ι								FILL	ED UP S	OIL (0.00	0-6.00m)						
п	UDS	1/UDS	7	0.66	42.65	43.69	13	31.0	13.88	17.12	CL	16.85	2.03	2.62	UUT	0.26	17.0
п	Р	2/P	8	1.26	48.21	45.53	5	28.0	14.92	13.08	CL	-	-	2.62	-	-	-
ш	Р	3/P	9	2.95	55.6	31.45	10	31.9	14.75	17.15	SC	-	-	2.66	-	-	-
^{III}	Р	4/P	10	2.05	54.17	33.78	10	32.1	14.29	17.81	SC	-	-	2.64	-	-	-
IV					RESID	UAL SO	IL/ CO	OMPLE	TELY W	EATHER	ED ROC	K (10.50)	n ONWA	ARDS)			





Appendix A1.35 Boring Location (Railway Crossing)

		_				_	BORING LOG		_	_		_		_		
Proj	ect : R	ANCH	SEW	ERAG	E PROJE	ст	Boring Date : 15-06	-201	4							
Bore	e Hole	: BH-4	(RAIL	WAY (CROSSING	G/CHUTI/	A) Scale : 1:50 Supervisor A : RA	HUL								
Altit	ude: 6	29.164					Supervisor B: VIk	ASF	ł							
Drill	ing Ma	chine :	8													
Elev	ation	Ground	Wate	r :-9.60	Om		Drilling Method : Co		DF		NG U	SING	GΒ	ENT	ONIT	E
	ġ		_	Ę	Ę	o. pth			STA	NDA	RD PEI	NETR	ATIO	DN TI	EST	
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTION OF MATERIAL		low 5 or							SPT Sampling &
Sci	Statu	Alti	De	Thick	STR	Sar			5 cn		Ν	C	HAF	RT S	PT	Samp
								15 cm	15 cm	15 cm			0	0	40	8
0.0 -		629.164	0.0			0.0	Etter and the set of t		-		-	Ĺ	Ĩ	Ť	ĨĬ	
				1.00	4		Filled up soil									
					4											
1,0 —		628,164	1,0			1/P (1.00-1.45)	MEDIUM STIFF TO VERY STIFF YELLOWISH	3	3	4	7	H	┥			SPT-1 1.00-1.45
							CLAYEY SILT WITH SAND AND GRAVELS OF MEDIUM PLASTICITY (CI).									
2.0 —						2/P (2.00-2.45)	γ = 1.93g/cc C= 0.43kg/cm2	3	4	5	9	\square	_			SPT-2 2.00-2.4
							$\phi = 14.00 \text{ degree}$									
						2/0							\setminus			
3.0 —						3/P (3.00-3.45)		4	6	10	16	H	\uparrow			SPT-3 3.00-3.4
4.0 —	11			6.00		4/P		4	10	12	22	Ц				SPT-4
						(4.00-4.45)										
						54100										
5.0 -						5/UDS (5.00-5.45)		4	8	10	18	H	1			SPT-5 5.00-5,4
6.0 —						6/P (6.00-6.45)		6	8	12	20	\square		_		SPT-6 6.00-6.4
								0			20					
7,0 —		622.164	7.00				DENSE TO VERY DENSE NON-PLASTIC SILTY SAND, RESIDUAL SOIL/ COMPLETELY WEATHERED	10	12	15	27	H	1	T		SPT-7 7.00-7.4
							ROCKS.							Ν		
8.0 —								10	14	20	34	\square	\downarrow		$\left \right $	SPT-8 8.00-8.4
				3.0												
9,0 —								15	25	40	65	H	╡	+		SPT-9 9.00-9.45
10 —	P- SPT	619.164 Disturbed	10.00 Sample		Indisturbed S	ample	TOTAL DEPTH OF BOREHOLE 10.00m	Ref	usa⊢ '	00 (p	an. 2.0cm)	\square	\downarrow		\parallel	SPT-10
	SC-C	ayey SAI	ND, SM-	SIIty SA	ND, CL-Clay	oflow										

Appendix A1.36 Boring Log (Railway Crossing, BH-4)

							BORING	LOG									
Proje	ect : F	RANCH	SEW	ERAG	E PROJE	ст		Boring Date : 15-06	201	4							
Bore	Hole	: BH-5	(RAIL	WAY (CROSSING	G/CHUTIA	A) Scale : 1:50	Supervisor A: RA	IUL								
Altitu	ude: 6	29.054						Supervisor B: VIK	AS⊦	ł		·					
Drilli	ng Ma	achine :	10														
Elev	ation	Ground	l Wate	r:-9.0	0m		-	Drilling Method : CC	RE	DR	LL	NG U	SIN	G BE	ENT	ON	ΓE
	ď			ε	z	er er			:	STA	NDA	RD PEN	ETR	ATIC	IN TE	ST	
Scale,m	Statumn No.	Altītude	Depth,m	Thlckness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTION	OF MATERIAL		low							SPT pling &
Sca	Statu	Altī	Dep	Thick	STRA	San	DEGORATHOR	OF WATERIAE		5 cn		N	Cł	HAR	ΤS	РТ	SPT Sampling &
	0,			'					15 cm	15 cm	15 cm						
0.0 -		629.054	0.0			0.0			-	-	-		Ę	3	8	40	5 0
			0.0			0.0	Filled up so	11									
	1			4.00													
1.0 -					· · · ·				3	4	5	9		+	+	+	SPT-1 1.00-1.45
					4 4												
2.0 -					· • · •				3	4	4	8					SPT-2
2.0									ľ			0					2.00-2.45
					4												
3.0 -									4	6	8	14		+	+		SPT-3 3.00-3.45
		625.054	4.0		- 4				6	8	10	18					SPT-4
4.0 -						1/P (4.00-4.45)	MEDIUM STIFF TO VER			Ĩ							SPT-4 4.00-4.45
							MEDIUM PLASTICITY (C $\gamma = 2.03g/cc$).									
5.0 -	П			2.50		2/UDS (5.00-5.45)	C= 0.47kg/cm2		7	10	12	22			-		SPT-5 5.00-5.45
						3/P (6.00-6.45)											SPT-6
6,0 -						(6.00-6.45)			10	16	16	32					6.00-6.45
7.0 -		622,054	7,00			4/P (7.00-7.45)	DENSE TO VERY DENSE N		10	16	17	33		_	+		SPT-7 7.00-7.45
					· · · · · ·		SAND, RESIDUAL SOIL/ C										
																	SPT-8
B.O —									14	19	18	37				\backslash	8.00-8.45
				4,50													
9.0 -									20	30	37	67			-		SPT-9 9.00-9.45
																	0007-00
10.0-									22	40	50	90					SPT-10 10.00-10.45
11.0		618.054	11.00				TOTAL DEPTH OF BOREH		Refu	usal- 1	00 (p	an. 1.0cm)					SPT-11 11.00-11.01

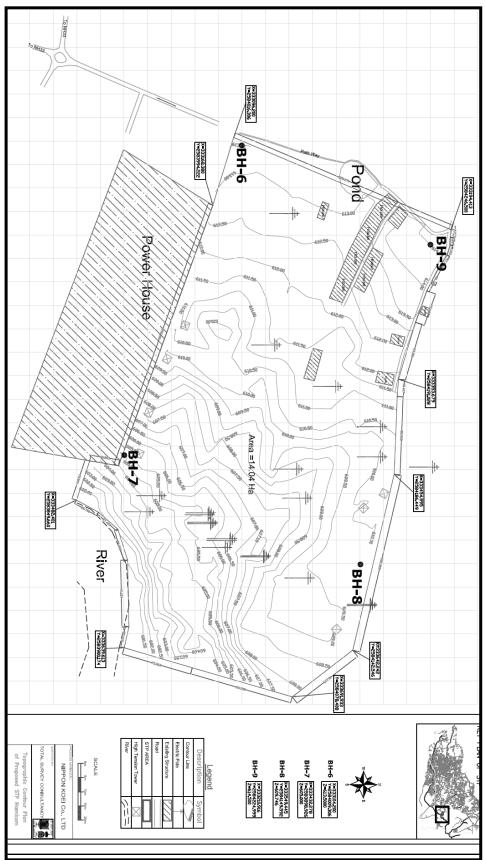
Appendix A1.37 Boring Log (Railway Crossing, BH-5)

									BH-	4							
		er		Gra	in Size I	Distributi	on	%	%	%	1 ((ntent %	(g/cm ³)	ty	She	ear Streng	th test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit	Plasticity Index	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/	Specific Gravity	Type of test	Cohesion (Kg/cm ²)	Angle of internal Friction (Degree)
Ι								FILLI	ED UP S	OIL (0.0	0-1.00m)					
	Р	1/P	1	1.98	41.28	35.74	21	42.2	16.6	25.6	CI	-	-	2.65	-	-	-
	Р	2/P	2	0.8	44.82	32.38	22	36.4	16.21	20.19	CI	-	-	2.66	-	I	-
п	Р	3/P	3	0.52	48.32	31.16	20	39.2	16.29	22.91	CI	-	-	2.66	-	-	-
п	Р	4/P	4	2.72	45.1	37.18	15	38.2	15.92	22.28	CI	-	-	2.67	-	-	-
	UDS	5/UDS	5	1.62	47.64	29.74	21	38.2	16.07	22.13	CI	17.07	1.93	2.67	UUT	0.43	14
	Р	6/P	6	2.42	49.66	30.92	17	38.7	14.43	24.27	CI	-	-	2.67	-	-	-
III						RESI	DUAL	SOIL/	COMPL	ETELY	WEATH	IERED RO	OCK				

Appendix A1.38 Soil Sampling Test Result (River C	Crossing, BH-4)
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Appendix A1.39 Soil Sampling Test Result (River Crossing, BH-5)

									BH	-5							
		_		Gra	in Size I	Distributi	on			%		0	n ³)		She	ear Streng	th test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index 9	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm ³)	Specific Gravity	Type of test	Cohesion (Kg/cm ²)	Angle of internal Friction (Degree)
Ι								FILL	ED UP S	OIL (0.0	0-4.00m)					
	Р	1/P	4	0.58	37.1	36.32	26	39.7	16.59	23.11	CI	-	-	2.67	-	-	-
п	UDS	2/UDS	5	0.00	37.66	39.34	23	40.3	17.49	22.81	CI	17.75	2.03	2.65	UUT	0.47	13
11	Р	3/P	6	0.18	29.98	44.84	25	39.9	17.25	22.65	CI	-	-	2.62	-	-	-
	Р	4/P	7	0.00	30.84	41.16	28	42.7	16.31	26.39	CI	-	-	2.63	-	-	-
III						RESI	DUAL	L SOIL/	COMPL	ETELY	WEATH	HERED RO	OCK				



Source: JICA Study Team

Appendix A1.40 Boring Location (STP-II Site)

							BORING LOG										
Proje	ect:R	ANCH	SEW	ERAG	E PROJE	ст	Boring Date : 27-06	-201	4								
Bore	e Hole	: BH-6	(STP-	II/NAM	IKUM)	S	cale : 1:50 Supervisor A : RA	HUL									
		13.500 ichlne :					Supervisor B: S.B	.PR	ASA	٨D							
Elev	ation	Ground	Wate	er :-not	found		Drilling Method : CO	DRE	DR	ILLI	NG U	SIN	GΒ	EN	FON	TE	
	ö			E	Z	o. Pth			STA	NDA	RD PEN	NETF	RATI	ON 1	EST		
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTION OF MATERIAL		low 5 cr							SPT .	Sampling & Depth SPT
	Ste			Th	ST	s, s		15 cm	15 cm	15 cm	N		HAI ≗ ≅		SPT	200	Sa De
0.0 —		613,500	0.0			0,0	MEDIUM TO VERY STIFF GRAYISH CLAYEY SILT OF HIGH PLASTICITY (CH), INORGANIC SOIL.		-	-	-						
1.0 —						1/P (1.00-1.45)	γ = 1.91g/ccC= 0.93kg/cm2∳ = 4.00 degree	4	5	6	11					SPT 1.00-1	Г-1 1.45
2.0 -	I			4.00		2/P (2.00-2.45)		5	5	6	11					SPT 2.00-2	Г-2 2.45
3.0 —						3/P (3.00-3.45)		8	10	12	22					SPT 3.00-3	ſ-3 3.45
						4/UDS (3.50-3.95)											T 4
4.0 —	II	609,500	4.0			5/P (4.00-4.45)	VERY DENSE COMPLETELY WEATHERED ROCKS. (TOTAL DEPTH OF BOREHOLE 4,00m)	-Refu	isal- 1	00 (pe	n. 10.0cm					4.00-4	4 . 10
5.0 —																	
6.0 —																	
7,0 —																	
8.0 —																	
9.0 —	III																
10 —							SC- Clayey SAND, SM- Silty SAND, CL- Clay of low plasticity, CI- Clay of medium plasticity, CH- Clay of High Plasticity P- SPT Disturbed Sample UDS- Undisturbed Sample										

Appendix A1.41 Boring Log (STP-II Site, BH-6)

							BORING LOG										
Proje	ect:F	RANCH	SEW	ERAG	E PROJE	ст	Boring Date : 27-06	-201	4								
Bore	Hole	: BH-7(STP-	II/NAN	IKUM)	S	cale : 1:50 Supervisor A : RAł	HUL									
		05.000 achlne :	1				Supervisor B: S.B	.PR/	ASA	٨D							
Elev	ation	Ground	Wate	er :-not	found		Drilling Method : CC	RE	DR	ILLI	NG U	SIN	GΒ	EN	ON	TE	
_	O		c	E	Ą	ko. epth			STA	NDA	RD PE	NET	RAT	ON T	EST		
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTION OF MATERIAL		low 5 cn				HAI	от с	тос	SPT	Sampling & Depth SPT
	S			F	ω.			15 cm	15 cm	15 cm	Ν		2 6 8				S
0.0 —		605,000	0.0			0,0	MEDIUM TO VERY STIFF GRAYISH CLAYEY SILT OF MEDIUM TO HIGH PLASTICITY (CI-CH), INORGANIC SOIL.		-	-	-						
1.0 —						1/P (1.00-1.45)	γ = 1.86g/cc,C= 1.07kg/cm2, φ = 2.00 degree	5	8	12	20					SP 1.00	PT-1 ⊨1.45
2.0 —				5.00		2/P (2.00-2.45)		6	9	10	19					SP 2.00	7 - 2 2.45
3.0 —	Ι					3/P (3.00-3.45)		6	10	12	22					SP 3.00	чт-3 -3.45
4.0 —						4/P (4.00-4.45) 5/UDS (4.50-4.95)		8	12	14	26			Í		SP 4.00	r⊤-4 ⊨4.10
5.0 —		600.500	5.0			(4.50-4.95) 6/P (5.00-5.45)	VERY DENSE COMPLETELY WEATHERED ROCKS. (TOTAL DEPTH OF BOREHOLE 5.00m)	Refu	sal- 1	00 (pe	n. 10.0cm					5.00	7T-5 -5.10
6.0 —	II																
r.o —																	
3.0 —																	
9.0 —	Ш																
10 —							SC- Clayey SAND, SM- Silty SAND, CL- Clay of Iow plasticity, CI- Clay of medium plasticity, CH- Clay of High Plasticity P- SPT Disturbed Sample UDS- Undisturbed Sample										

Appendix A1.42 Boring Log (STP-II Site, BH-7)

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							BORING LOG								
Proje	ect : R	ANCH	I SEW	/ERAG	E PROJE	ст	Boring Date : 27-06-	201	4						
Bore	Hole	: BH-8	(STP-	II/NAM	KUM)	S	cale : 1:50 Supervisor A : RAH	IUL							
		09.746 achine					Supervisor B: S.B.	PR/	ASA	D					
Elev	atlon	Ground	d Wate	er :-not	found		DrIIIIng Method : CO	RE	DR	ILL	ING U	SING	BEN	ITO	NIT
_	<u>.</u> 0		Ę	e,m	NM	No. epth		;	STA	NDA	RD PE	NETRAT	TION	TES	т
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTION OF MATERIAL		low 5 cn						_
	St			1	S	0)		15 cm	15 cm	15 cm	Ν	CHA		SP	
0.0 —		609,746	0.0		******	0.0	MEDIUM TO VERY STIFF YELLOWISH CLAYEY SILT OF LOW TO MEDIUM PLASTICITY (CL-CI),	-	-	-	-				
1.0 —						1/P (1.00-1.45)	INORGANIC SOIL. γ = 1.96g/cc,C= 0.36kg/cm2, φ = 18.00 degree	5	12	14	26				
2.0 —				5.00		2/P (2.00-2,45)		5	10	14	24				
3.0 —	Ι					3/P (3.00-3.45)		6	12	15	27				
4.0 —						4/P (4.00-4.45)		8	15	18	33				_
5.0 —		604.746	5.0			5/UDS (4.50-4.95) 6/P (5.00-5.45)	VERY DENSE COMPLETELY WEATHERED ROCKS. (TOTAL DEPTH OF BOREHOLE 5,00m)	-Refu	sa⊨ 1	00 (pe	m. 10.0cm)			
6.0 —	11						1/P								
7.0 —															_
8.0 —															_
9.0 —	III														_
10							SC- Clayey SAND, SM- Silty SAND, CL- Clay of low plasticity, CI- Clay of medium plasticity, CH- Clay of High Plasticity								

Appendix A1.43 Boring Log (STP-II Site, BH-8)

							BORING	LOG									
Proje	ect : F	ANCH	SEW	ERAG	E PROJE	ст		Boring Date : 27-06-	201	4							
Bore	Hole	; BH-9	(STP-	/NAM	IKUM)	S	cale ; 1;50	Supervisor A : RAH	IUL								
		14,500 achine	1					Supervisor B; S.B.	PR/	AS/	٨D						
Eleva	atlon	Ground	Wate	r :-not	found			Drllling Method ; CC	RE	DR		NG U	SIN	GΒ	ENT	ONIT	E
	Ö		_	E	N	pth			\$	STA	NDA	RD PEI	NETF	RATI	ON TE	EST	
Scale,m	Statumn No.	Altitude	Depth,m	Thickness,m	STRATUMN LOG	Sample No. Sample Depth	DESCRIPTION	N OF MATERIAL		low 5 cr		N			RT S	рт	SPT Sampling & Depth SPT
	ß			F	δ				15 cm	15 cm	15 cm	N				9 g	
0.0 -		614.500	0.0			0.0		F YELLOWISH CLAYEY IGH PLASTICITY (CHCH),		-	-	-					
1,0 —						1/P (1.00-1.45)			4	6	10	16					SPT-1 1.00-1.45
2.0 —	I			4.00		2/UDS (1.50-1.95) 3/P (2.00-2.45)			6	10	12	22					SPT-2 2.00-2.45
3.0 —						4/P (3.00-3.45)			8	12	12	24			l		SPT-3 3.00-3.45
4.0 —		610.500	4.0			5/P (4.00-4.45)	VERY DENSE COMPLET (TOTAL DEPTH OF BORE	ELY WEATHERED ROCKS, HOLE 4,00m)	-Refu	sa⊨ 1	00 (pe	n. 10.0cm)				SPT-4 4.00-4.10
5.0 —	II																_
6,0 —																	_
7.0 —																	_
8.0 —																	
9.0 —	111																
10 —							plasticity, CI- Clay of med High Plasticity	ity SAND, CL- Clay of low llum plasticity, CH- Clay of UDS- Undisturbed Sample									

Appendix A1.44 Boring Log (STP-II Site, BH-9)

									BH-6								
				Gra	in Size D	istributio	n						3)		She	ear Stren	gth test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm ³)	Specific Gravity	Type of test	Cohesion (Kg/cm ²)	Angle of internal Friction (Degree)
P 1/P 1 0.00 11.76 31.24 57 55.7 20.59 35.11 CH 2.58															-		
Ţ	Р	2/P	2	0.00	10.48	25.52	64	54.8	21.02	33.78	СН	-	-	2.56	-	-	-
Ι	Р	3/P	3	0.00	6.46	34.54	59	55	21.71	33.29	СН	-	-	2.51	-	-	-
	UPS	4/UDS	3.5	0.00	8.62	34.38	57	54.5	20.42	34.08	CH	15.68	1.91	2.54	UUT	0.93	4
	Р	5/P	4	0.00	2.98	43.02	54	55	21.98	33.02	CH	-	-	2.53	-	-	-
II					VERY	DENSE	WEAT	THERE	D ROCK	S (4.00n	n ONW	ARDS)					

Source: JICA Study Team

Appendix A1.46 Soil Sampling Test Result (STP-II Site, BH-7)

									BH-7								
				Gra	in Size D	istributic	m			%		Ð	n ³)		Sh	ear Streng	gth test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index 9	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm3)	Specific Gravity	Type of test	Cohesion (Kg/cm ²)	Angle of internal Friction (Degree)
	Р	1/P	1	0.00	3.58	35.42	61	43.2	21.81	21.39	CI	-	-	2.56	-	-	-
P 2/P 2 0.00 18.64 39.36 42 55 17.41 37.59 CH 2.59														-			
	Р	3/P	3	0.00	3.64	47.36	49	53.6	20.36	33.24	CH	-	-	2.6	-	-	-
Ι	Р	4/P	4	0.00	19.44	35.56	45	40.5	16.12	24.38	CI	-	-	2.61	-	-	-
	UDS	5/UDS	4.5	0.00	3.52	35.48	61	42.5	20.2	22.3	CI	14.95	1.86	2.6	UUT	1.07	2
	Р	6/P	5	0.00	17.84	37.16	45	55	21.98	33.02	СН	-	-	2.6	-	-	-
Π						VERY D	ENSE	WEAT	HERED	ROCKS	(5.00m	ONWAF	RDS)				

									BH-8								
				Gra	in Size D	istributic	n			%		0	n ³)		She	ar Streng	th test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index 9	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm3)	Specific Gravity	Type of test	Cohesion (Kg/cm^2)	Angle of internal Friction (Degree)
	Р	1/P	1	1.64	40.42	33.94	24	35.9	13.93	21.97	CI	-	-	2.63	-	-	-
	Р	2/P	2	4.26	40.92	31.82	23	35.3	14.24	21.06	CI	-	-	2.62	-	-	-
I	Р	3/P	3	0.00	45.42	33.58	21	34	13.18	20.82	CL	-	-	2.61	-	-	-
1	Р	4/P	4	0.23	38.57	38.2	23	38.7	14.25	24.45	CI	-	-	2.63	-	-	-
	UDS	5/UDS	4.5	0.18	40.12	37.7	22	38.5	14.28	24.22	CI	15.76	1.96	2.62	UUT	0.36	18
	Р	6/P	5	0.00	39.85	37.15	23	37.5	14.52	22.98	CI	-	-	2.62	-	-	-
II					V	ERY DE	ENSE	WEATI	HERED	ROCKS	(5.00m	ONWAR	DS)				

Appendix A1.47 Soil Sampling Test Result (STP-II Site, BH-8)

Source: JICA Study Team

Appendix A1	.48 Soil	Sampling	Test Result	(STP-II	Site, BH-9)
FF · · ·		···· · · ·		(·	, . ,

									BH-9								
				Gra	in Size D	istributic	m			. 0			1 ³)		Sh	ear Stren	gth test
LAYER	Sample Type	Sample Number	Depth (m)	Gravel %	Sand %	Silt %	Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Classification (IS:1498-1970)	Natural Moisture Content %	Bulk Density (g/cm3)	Specific Gravity	Type of test	Cohesion (Kg/cm ²)	Angle of internal Friction (Degree)
P 1/P 1 1.56 40.38 34.06 24 35.8 13.82 21.98 CI 2.6															-		
Ŧ	UDS	2/UDS	1.5	4.12	40.85	32.03	23	35.4	14.28	21.12	CI	15.04	1.9	2.62	UUT	0.39	14
Ι	Р	3/P	2	0.00	37.62	39.38	23	40.4	17.52	22.88	CI	-	-	2.63	-	-	-
	Р	4/P	3	4.54	40.72	32.74	22	36.2	17.24	18.96	CI	-	-	2.61	-	-	-
	Р	5/P	4	0.00	2.87	43.13	54	52	21.85	30.15	СН	-	-	2.61	-	-	-
II					VERY	DENSE V	WEAT	HERE	D ROCK	S (4.00n	n ONW.	ARDS)					

Appendix A2

CHAPTER A2 ECONOMIC AND FINANCISAL CONDITION

Appendix A2.1 Breakdown of Annual Subsidy Granted to Jharkhand State

(unit: Rs. 10 thousand))

		200	0.00	200	0 10	201	0.11	201	1.10	2012 12
No.	Major Items of Subsidy	200	8-09 Expendit	Approve	9-10 Expendit	201 Approve	0-11 Expendit		1-12 Anticipated	2012-13 Approved
110.	Wigor relies of Subsidy	d Outlay	ure	d Outlay	ure	d Outlay	ure	Outlay	Expenditure	Outlay
I	AGRICULTURE & ALLIED ACTIVITIES	37,600	28,349	35,700	25,157	49,849	41,619	58,451	64,938	65,743
	1. Crop Husbandry	10,955	8,825	2,630	2,092	6,430	3,516	10,996	10,996	8,160
	2. Horticulture	725	1,472	1,782	1,646	2,260	205	1,550	1,550	2,130
	3. Soil and Water Conservation (including control of	600	345	1,018	705	3,415	1,522	1,343	1,343	3,600
	shifting cultivation)						-			
	4. Animal Husbandry	3,000	2,317	2,600	2,040	3,092	1,780	3,600	3,600	3,400
	5. Dairy Development	5,100 2,000	4,415	5,900 2,200	4,610 1,430	3,503 2,080	2,323 1,594	4,048	4,048 2,550	4,463 2,300
	6. Fisheries 7. Plantations	2,000	1,702	2,200	1,450	2,080	1,394	2,550	2,550	2,500
	8. Food,Storage & Warehousing		-	_	-					
	9. Agricultural Research & Education	3,100	2,150	2,350	1,670	4,200	2,295	6,000	6,000	5,200
	10. Agricultural Financial Institutions	-	-,	-	-	-		-	-	-
	11. Cooperation	10,000	5,949	5,000	3,801	4,500	13,713	8,451	14,938	5,000
	12. Other Agricultural Programmes :									
	(a) Agiculture marketing	-	-	-	228	3,358	-	-	-	-
	(b) Others	2,120	1,174	12,220	6,935	17,011	14,671	19,913	19,913	31,490
п	RURAL DEVELOPMENT	90,500	102,820	98,800	107,502	143,700	125,171	170,145	173,645	170,769
	1. Special Programme for Rural Development	503	429	703	461	1,500	764	2,700	2,700	3,550
	2. Rural Employment	2 005	0.154	2.402	1.1.40	1.000	2 005	5 500	5 500	7 100
\vdash	(a) Swaranjyanti Gram Swarozgar Yojana (SGSY)	2,905	3,174	3,492	1,140	4,000	3,005	5,500	5,500	7,400
\vdash	(b) Sampoorna Gram Rozgar Yojana (SGRY) (c) National Food for Work Programme/NEGP	15,553	-	15,000	-	10,000	-	10,000	- 10,000	-
\vdash	(d) Others (To be specified)	3,000	- 19,701	6,261	21,194	10,000	35,195	10,000	10,000	28,590
\square	Sub-Total (Rural Employment)	21,458	22,875	24,753	22,334	31,200	38,200	34,500	34,500	35,990
	3. Land Reforms	2,500	2,148	1,500	1,464	1,500	1,022	1,500	1,500	1,500
	4. Other Rural Development Programmes	-,000	2,1.0	1,000	1,101	1,000	1,022	1,000	1,000	1,000
	(a) Community Development & Panchayts	-	4,144	1,500	1,348	1,800	1,501	-	-	10,969
	(b) Other Programmes of Rural Development	66,039	73,224	70,344	81,895	107,700	83,684	131,445	134,945	118,760
	Sub-Total (Other Rural Development)	66,039	77,368	71,844	83,243	109,500	85,185	131,445	134,945	129,729
III	SPECIAL AREAS PROGRAMMES	33,050	52,201	38,886	22,672	46,193	86,171	102,555	109,745	114,744
IV	IRRIGATION & FLOOD CONTROL	60,000	40,231	55,000	29,179	47,500	32,667	155,500	70,500	178,638
	1. Major and Medium Irrigation	34,800	27,994	38,000	23,699	40,800	28,004	142,400	22,300	173,100
	2. Minor Irrigation	10,000	7,716	8,000	4,654	5,000	3,459	11,100	11,100	3,038
	3. Command Area Development	200	12	200	-	200	-	200	200	300
	4. Flood Control (includes flood protection works)	15,000	4,509	8,800	826	1,500	1,204	1,800	36,900	2,200
V	ENERGY	70,000	29,986	72,500	53,190	77,047	35,968	160,000	40,000	117,800
VI	INDUSTRY & MINERALS	20,000 5,651	9,742	11,600	13,508 4,196	13,200	11,815	19,400	17,400	19,400
	Village & Small Enterprises Other Industries (Other than VSE)	9,349	4,764 4,515	6,236 4,764	9,058	6,959 5,841	6,244 5,291	11,291 7,709	10,291 6,709	9,730 9,270
	3. Minerals	5,000	4,515	600	254	400	280	400	400	9,270 400
VII	TRANSPORT	91.000	67,604	80,000	92,443	83,600	98,949	221,500	147,500	217,500
	1. Minor Ports				-					
	2. Civil Aviation	10,000	10,000	10,000	-	100	89	6,000	1,000	9,000
	3. Roads and Bridges	64,000	54,353	64,000	51,352	70,500	68,707	170,000	80,000	165,000
	4. Road Transport	17,000	3,251	6,000	41,091	-	30,153	-	-	43,500
	5. Inland Water Transport	-	-	-	-	-	-	-	-	-
	6. Other Transport Services	-	-	-	-	13,000	-	45,500	66,500	-
VIII	SCIENCE, TECHNOLOGY & ENVIRONMENT	22,140	15,488	17,650	9,016	18,849	13,252	17,400	14,400	19,609
\vdash	1. Scientific Research	640	123	150	150	150	200	100	100	290
\vdash	2. Information Technology & E-Governance	10,000	4,895	6,000	1,120	5,828	2,935	6,100	3,100	6,100
\vdash	3. Ecology & Environment	1,000	- 10.470	10	-	10.07*	-		-	12.010
IX	4. Forestry & Wildlife GENERAL ECONOMIC SERVICES	10,500 34,865	10,470 23,657	11,490 41,865	7,746 22,339	12,871 56,270	10,117 55,245	11,200 86,080	11,200 126,236	13,219 159,763
14	1. Secretariat Economic Services	12,900	23,657	10,900	316	5,305	249	10,299	25,046	61,687
\vdash	2. Tourism	12,900	12,133	3,500	811	2,500	673	2,500	2,500	2,500
	3. Census, Surveys & Statistics									
	4. Civil Supplies	5,965	10,535	27,465	21,212	48,465	54,323	73,281	98,690	95,576
	5. Other General Economic Services :	-	-	-		-		-	-	-
X	SOCIAL SERVICES	305,695	295,998	343,599	263,425	481,642	424,630	653,544	567,442	690,031
	Education	105,860	121,445	99,350	84,169	112,150	111,814	134,900	132,601	154,710
	1. General Education	70,000	62,733	80,000	73,284	98,300	99,163	120,000	120,000	140,000
	2. Technical Education	9,360	7,217	7,850	6,342	7,850	5,363	7,400	7,400	7,210
	3. Sports & Youth Services	23,920	50,437	10,000	3,687	3,405	6,999	4,240	3,941	3,840
	4. Art & Culture	2,580	1,058	1,500	856	2,595	289	3,260	1,260	3,660
\vdash	5. Medical & Public Health	40,000	33,000	40,000		38,500	27,694	64,700	38,000	59,700
\vdash	6. Water Supply & Sanitation	27,000	23,328	27,000	25,582	30,000	22,245	30,000	27,000	35,000
\vdash	7. Housing (incl. Police Housing)	850	1,870	7,300	2,633	800	799	1,000	1,000	2,500
1	8. Urban Development (incl. State Capital Projects & slum	35,000	34,092	37,000	27,675	37,200	18,588	105,000	49,594	99,800
					1,023	1,500	758	1,650		
	Area Development) 0. Information & Publicity	1.000						1 1 650	1,650	2,000
	9. Information & Publicity	1,000	819	2,000						
	9. Information & Publicity 10. Development of SCs, STs & OBCs	14,450	11,083	30,914	24,097	30,807	25,212	46,675	53,277	45,187
	9. Information & Publicity 10. Development of SCs, STs & OBCs 11. Labour & Employment	14,450 13,322	11,083 9,069	30,914 25,482	24,097 17,928	30,807 25,355	25,212 18,298	46,675 47,650	53,277 44,650	45,187 23,155
	9. Information & Publicity 10. Development of SCs, STs & OBCs 11. Labour & Employment 12. Social Security & Social Welfare	14,450 13,322 38,213	11,083 9,069 21,839	30,914 25,482 40,553	24,097 17,928 7,489	30,807 25,355 41,180	25,212 18,298 11,084	46,675 47,650 13,922	53,277 44,650 13,922	45,187
	9. Information & Publicity 10. Development of SCs, STs & OBCs 11. Labour & Employment	14,450 13,322	11,083 9,069	30,914 25,482	24,097 17,928	30,807 25,355	25,212 18,298	46,675 47,650	53,277 44,650	45,187 23,155

Source: Source: Planning Commission of the Government of India, 2014

Appendix A2.2 Past Financial Condition of RMC

(unit: Rs. Lahks (100 thousand))

	2000	2000	2000	2010	2010	2011	2011) mousan	
Capital Receipts (Revenue) (Loans,	2008-	-2009	2009	-2010	2010	-2011	2011	-2012	2012-	-2013	Ave	rage
Grants from State Government)	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Water Supply (State Plan + JNNURM)	46,470	375	58,178	58,663	101,169	523	138,530	0	134,177	41,970	95,705	20,306
Sewage / Drainage	12,000	0	,	0	,	0		1,520	8,000	1,405	10,000	585
Sulabh Shoachalaya	1,898	1,568	1,654	1,747	971	2,239	1,139	1,899	3,000	1,619	1,732	1,814
Road	7,490	5,195	25,528	2,617	26,966	· · · · ·	25,800	7,007	12,000	10,211	19,557	6,401
Street Light/High Masts	1,000	0	/	0		0	,	0	1,000	580	820	116
Drain	8,144	2,695	31,813	1,952	27,037	4,192	23,825	660	8,000	7,282	19,764	3,356
Sanitation (SWM-JNNURM)	2,550	0		10,299	20,556		,	0	30,837	1,307	16,955	2,321
Urinals Market Complex	0	0	-	0	0	-	50	0	0 18,104	0	10 3,621	0
Market Complex	5,540	1,042	4,043	0	1,872	463	10,013	0	300	10,718	4,354	2,445
Buildings Total	85,092	1,042	144,494	75,278	1,872	14,392	226,913	11,086	215,418	75,092	172,518	37,345
Implementation Rate		10,075		52%	-	8%		5%	-	35%	-	22%
		10 / 0		0270		070		070		0070		/0
	2008-	2009	2009	-2010	2010-	-2011	2011	2012	2012-	2013	Ave	rage
Capital Expenditure	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Water Supply			Ŭ		0		Ŭ		0			
Sewage /Drainage												
Sulabh Shoachalaya												
Road												
Street Light/High Masts												
Drain												
Solid water Management												
Ambedkar Awas	178,598	10,631	113,137	16,245	504,742	99,060	169,397	54,335	409,396	66,724	275,054	49,399
Sanitation	170,590	10,031	115,157	10,245	504,742	99,000	109,397	54,555	409,390	00,724	275,054	49,399
Urinals												
Night Shelter												
M.P.Fund												
Market Complex												
Buildings												
Ranchi Lake												
Park												
Total	178,598	10,631	113,137	16,245	504,742	99,060	169,397	54,335	409,396	66,724	275,054	49,399
Implementation Rate	-	6%	-	14%	-	20%	-	32%	-	16%	-	18%
	2000	2000	2000	2010	2010	0011	2011	2012	2012	2012		
Receipt (Revenue)	2008-			-2010	2010-		2011		2012-		Ave	
Markini Tra	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Municipal Tax Registration Tax	14,030	9,614	18,902	9,363	22,739	13,433	29,514	21,095	33,705	29,136	23,778	16,528
Market Recoveries	14,050	9,014	10,902	9,505	22,139	15,455	29,014	21,095	55,705	29,130	23,118	10,526
Govt/Grant/Loan	17,686	7,250	14,484	15,752	17,752	12,265	18,196	11,705	21,528	18,936	17,929	13,182
Misc- Interest	17,000	7,230		13,732					21,528	1,343	0	388
Stamp Duty	2,000	0	-	0		-		0	2,000	1,545	2,000	500
Total	33,716	16,864	_,	25,115	42,491	25,698	49,710		57,233	49,415	43,707	30.098
Implementation Rate	-	50%	-	71%		60%	-	67%	-	86%	-	69%
<u>F</u>												
	2008	2009	2009	-2010	2010	-2011	2011	2012	2012-	2013	Ave	rage
Expenditure		Actual	Budget				Budget		Budget		Budget	0
Establishment											U	
Gratuity	16,581	15,172	18,918	19,251	19,340	21,620	22,014	23,159	31,476	31,087	21,666	22,058
Pension												
Rental charges for Light												
Repairs												
Sanitation Charges												
Petrol	10,520	4,531	9,434	6,090	8,491	6,747	7,263	964	13,450	14,900	9,832	6,646
Misc.												
NCO												
NGO wages	1											
other charges						0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	
other charges	0	0		0					0	0	0	
other charges Refund to RRDA		0	0	0	0	0	0		0	0		0 0
other charges Refund to RRDA Refund to Education Cess	0	0	0	0	0	0	0	0	0	0	0	0 0 28,704

Source: RMC

		2008-09			2009-10			2010-11			2011-12			2012-13			Average	
Year	Billed	Billed Collected	Collection Rate	Billed Collected	Collected	Collection Rate	Billed (Collected	Collection Rate	Billed	Collected (Collection Rate	Billed	Collected	Collection Rate	Billed	Collected C	Collection Rate
Water TAX (RMC)	18,000	12,776	71.0%	20,000	11,443	57.2%	20,000	12,176	60.9%	20,000	10,693	53.5%	21,500	10,075	46.9%	19,900	11,433	57%
Conservation TAX (RMC)	14,000	12,308	87.9%	16,000	9,737	60.9%	16,000	11,379	71.1%	16,000	9,018	56.4%	21,000	8,703	41.4%	16,600	10,229	62%
Water Charge (RMC)	47,226	5,548	11.7%	39,833	9,535	23.9%	41,000	16,614	40.5%	43,737	12,128	27.7%	45,867	31,161	67.9%	43,533	14,997	34%
Water Charge (DWSD - Hatia Division)	*24,136	*14,916	*61.8%	11,561	16,016	138.5%	11,561	14,750	127.6%	11,561	12,091	104.6%	61,861	16,807	27.2%	24,136	14,916	62%
Water Charge (DWSD - Booty Disttibution Division)	**40,085	36,077	%06**	**20,042	18,038	%06**	**33,811	30,430	%06**	**34,916	31,424	%06**	**71,571	64,414	%06**	**71,571	36,077	**90%
Water Charge (DWSD - Booty Headworks Division)	2,392	2,153	90.0%	2,946	2,651	90.0%	4,199	3,779	%0.06	4,599	4,139	90.0%	4,933	4,440	90.0%	3,814	3,432	90%
Water Charge from Tankers (RMC)	*587	*587	100.0%	*587	*587	100.0%	*587	*587	100.0%	519	519	100.0%	654	654	100.0%	587	587	100%
Latrine Cleaning (RMC)	*1,798	*1,798	100.0%	*1,798	*1,798	100.0%	*1,798	*1,798	100.0%	1,794	1,794	100.0%	1,801	1,801	100.0%	1,798	1,798	100%
Total	148,224	86,161	58.1%	112,766	69,804	61.9%	128,955	91,512	71.0%	71.0% 133,126	81,806	61.5%	229,188	138,055	60.2%	181,938	93,468	51%
Note: * Data is not available and the average figure of available period is used for calcul	ure of availa	hle neriod is	used for calc	ulation														

Appendix A2.3 Past Revenue Data of RMC

Note: * Data is not available, and the average figure of available period is used for calculation Note: ** Collection rate of Booty Head Works Division is assumed by the interview with workers in the division office. The billed amount is estimated by the collected amount and collection rate. Source: RMC, DWSD

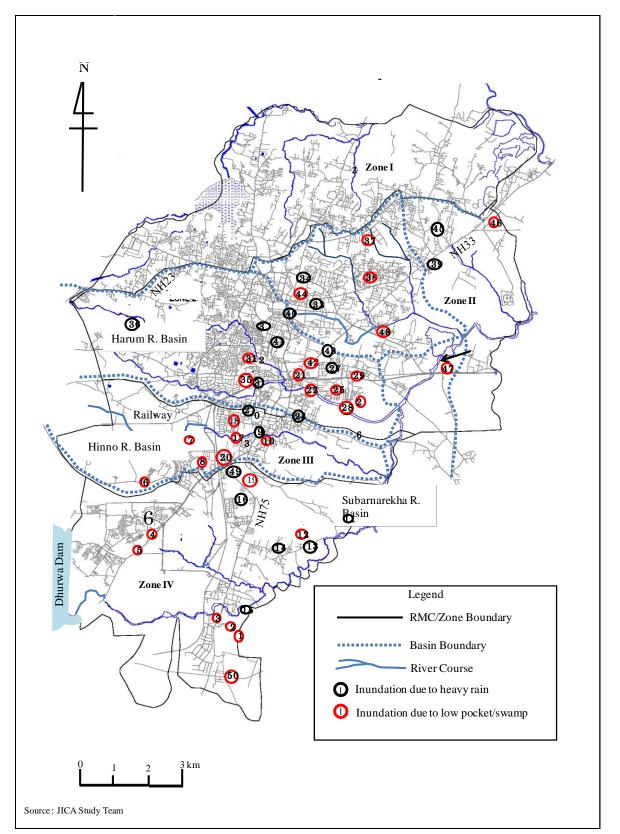
PREPARATORY SURVEY ON RANCHI SEWERAGE PROJECT

Та	riff Category	Number of o	connection	Number of Installed meter	Installation Rate of Meter
	Old (before 2006)	19,443	29,325	4,401	15.0%
	Newer Water connection	9,882	29,323	4,401	15.0%
Domestic	Apartment connection		228	134	58.8%
	Suvidha Sulk project connection		267	5	1.9%
Institutional/Govt.	Institutional/Govt. Building connection	162	218	43	19.7%
	Old (before 2006)	56			
Commercial	Commercial connection		222	131	59.0%
Total			30,260	4,714	15.6%

Appendix A2.4 Number of Connection and Installed Meters of Water Charge by RMC

Source: RMC

Appendix A3



CHAPTER A3 DRAINAGE SYSTEM AND FACILITIES

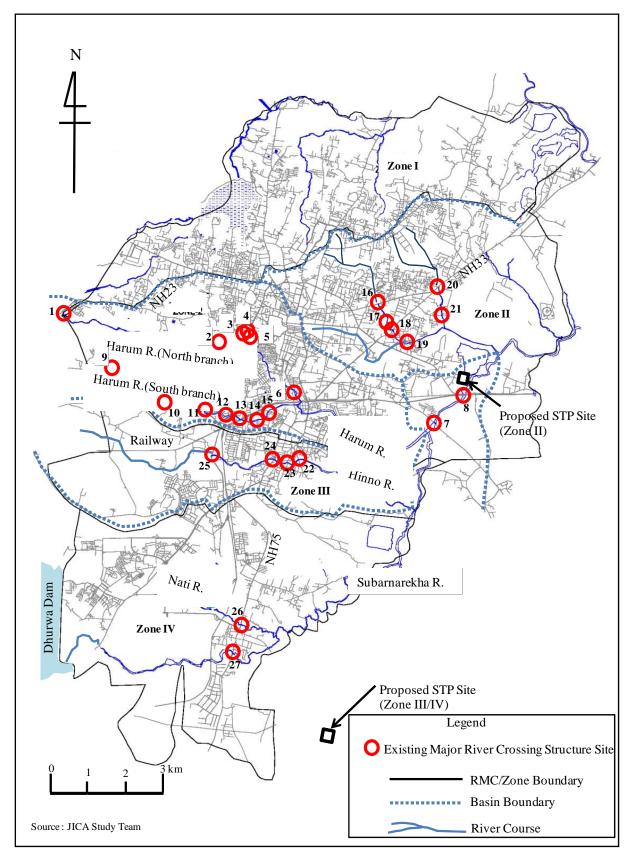
Appendix A3.1 Survey Locations of Current Inundation in the Study Area

Appendix A3.2 Flow Inundation Survey Result (1/2)

				п	nterview	/ee		Features	of Inundatior			Cause	of inunc	ation	~	-	
Sample No.	Name of respondant	Zone - No.	Location	Resident	Vender	Govt. Personnel	Area (m2)	Depth (m)	Frequency (in a year)	Season when problem occurs	Sewerage	Heavy Rain	Moderate Rain	Always	Low pocket/ swamp	Duration of inundation	Remarks
001	Aohab Mirda	IV	Basar Gardh, Opp. Tupudana Industrial Area, Khunti	0			200x20	approx. 2 m	3-4 times	Rainy Season		0			0	2-3 months	
002	Nagendra Ku	IV	RNTI College , Obria Road Hatia, Ranchi	0			30 x 20	1-2 m	1-2 times	Non Rainy Season	0				0	10 Months	
003	Vishal Kuma	IV	Andhara Colony, HEC Railway crossing, Hatia	0			50 x 50	approx. 2 m	7-8 times	Rainy & non Rainy season	0			0	0	12 months	
004	Sachin Kyma	IV	Pani Tanki Side, HEC Golchakkar, Bus Stand Road, Dhurwa	0			100 x 50	1-2 m	7-8 times	Non Rainy Season	0				0	12 months	
005	Indranath Ra	IV	Sharma Road, near maintenance Office, Dhurwa	0			50 x 10	1-2 m	5-6 times	Non Rainy Season	0				0	8-10 months	
006	Jagat Mahli	IV	Mousi Bari, Golchakkar, Jagannathpur mandir, Road	0			50 x 10	1-2 m	3-4 times	Rainy season		0			0	8-9 months	
007	Shalik Singh	IV	Sector-I, Near Sardar Patel Mahila Vidyalaya, Side IV, Ranchi-4	0			80 x 10	0.5 - 1 m	8-10 times	Non Rainy Season	0				0	12 months	
008	Anil Kumar	ш	Sector-II, Market, Dhurwa Ranchi-4		0		45 x 20	1-2 m	2-3 times	Non Rainy Season	0				0	5-6 months	
009	Premi Ekka	Ш	Hinoo Basti, Sukla colony, Ranchi -2	0			40 x 30	1-2 m	3-4 times	Rainy Season		0				2-3 days	
010	Gauri Shanka	Ш	Hinoo United High School, Hinoo, Ranchi -2			0	40 x 10	1 m	4-5 times	Rainy Season		0			0	12 months	water is always is logged in a part of schoo premises
011	Pradip Sahu	IV	Hethu Basti, Airport Area, Ranchi-2	0			20 x 10	1 - 1.5 m	3-4 times	rainy Season		0				2-4 hours	
012	Prakash	IV	Basco Nagar, Nepali colony, Hatia, Ranchi- 3	0			60 x 50 m	1-2 m	2-3 times	rainy season		0			0	6 months	
013	Mahfuj Alam	IV	Tiranga Chowk, Latma Road, Hatia, Ranchi-3	0			20 x 10	0.5 - 1 m	10-20 times	rainy season		0				2-4 hours	
014	Kishore Loha	IV	Hesag Road, Orawan Basti, Near land Akhara, Hatia, Ranchi- 4	0			20x30	1-1.5 m	10-15 times	Rainy Season		0				5-10 days	
015	Rajesh Dyub	IV	Patel Nagar, Hatia, Ranchi-3	0			10 x 5	0.5-1 m	20-25 times	Rainy Season		0				1-2 hours	
016	Mahabir Kas	IV	Gital Pire, Hatia Station Road, Near Railway Station, Hatia, Ranchi-3	0			60 x 30	1-2 m	8-10 times	Rainy Season		0				1-2 Months	Road blocks for 3-4 hours
017	Deepak Karn	IV	Kathar Kocha, Birsa Chowk, Ranchi-3	0			40 x 10	0.5 - 1 m	always	Non Rainy Season	0				0	12 months	
018	Vishwanath	IV	Gandhi Nagar, Birsa Chowk, Hatia Ranchi	0			70 x 10	0.5 m	10-12 times	Non Rainy Season	0				0	10 -12 Months	
019	Birendra Sing	IV	Hawai nagar, Road No, 6, Hatia, Ranchi-3	0			40 x 40	0.5-1 m	10-12 times	Non Rainy Season	0				0	12 months	
020	Binod Kumar	ш	B.S.P High School, Near check Post, Dhurwa, Ranchi-4	0			40 x 30	1-2 m	8-10 times	Rainy Season		0	0		0	8-10 months	
021	Nikolas Minz	П	Minz colony, Kadru, Near Railway Station, Ranchi	0			100 x 5	1-2 m	20-25 times	Non Rainy Season	0				0	10-12 months	Over flow, road blocks
022	Abdul Jafer A	Ш	Bagicha Toli, Argora, Railway crossing, Ranchi			0	50 x 40	1-1.5 m	Always	Rainy and Non rainy Season	0	0			0	12 months	Urgent cleaning is necessary.
023	Bandhan Gar	П	Paras Toli, Oraon Kocha, Doranda, Ranchi-2	0			40 x 10	1-1.5 m	13-14 times	Rainy Season		0				12-14 Hours	
024	MD Mahmad	Ш	Kumhar Toli, Ranchi	0			40 x 10	1-1.5	80-100 times	Rainy Season	0	0				6-7 Hours	Same Probler in Ravidas Colony and Beldar colony
025	Deepak Kum	П	Kusai colony, Doranda	0	-		70 x 40	0.5 - 1 m	always	Non Rainy Season				0	0	12 months	

Appendix A3.2 Flow Inundation Survey Result (2/2)

				In	terview	ee	1	Features	of Inundatior	1	r	Cause	e of inund	lation			
Sample No.	Name of respondant	Zone - No.	Location	Resident	Vender	Govt. Personnel	Area (m2)		Frequency (in a year)	Season when problem occurs	Sewerage	Heavy Rain	Moderate Rain	Always	Low pocket/ swamp	Duration of inundation	Remarks
026	Ram Naresh	п	Dwarika Puri, Chutia, Ranchi	0			100 x 20	1-2 m	always	Non Rainy Season	0	0		0	0	12 months	due to unavailability of drainage system
027	Sanjay Kuma	п	Dumsa Toli, Pragat Path Oxford Road, Chutia	0			12 x 20	1-2 m	10-20 times	Rainy Season		0				4-5 Hours	
028	Bales hwar Si	п	Krishna Puri, Road No. 5, Chutia, Ranchi	0			50 x 10	0.5-1 m	3-4 times	Rainy Season	0	0			0	6-8 months	
029	Prahlad Kum	П	Saraswati Vidya mandir School, Ranchi Railway Colony, Chutia	0			100 x40	0.5 - 1 m	always	Non Rainy Season	0	0		0	0	10-12 Months	
030	Amit Kumar	п	Ashok Kunj, Opp. Ashok Nagar Roas No. 3, Ranchi - 2	0			20 x 30 m	1-2 m	10-12 times	Rainy Day		0				4-6 Hours	
031	Sunny Kuma	п	Vidya nagar Harmu, Ranchi	0			25 x 15 m	0.5 - 1 m	always	Non Rainy Season	0	0			0	12 months	Drain water over flows on road
032	Birbal Sahu	Ш	Kishore Ganj, road no - 9 Near Pahari Mandir, Ranchi	0			100 x 20	0.5 - 1 m	30-40 times	Rainy Day	0	0				10-12 hours	
033	Ramanand Si	п	Midil Market Road, Upper bazar, Ranchi		0		30 x 40 m	0.5 - 1 m	30 - 40 times	Rainy day		0				6-8 Hours	
034	Mobin	П	Akhara chowk, Purani Ranchi	0			30 x 40 m	0.5 - 1 m	30 - 40 times	Rainy day		0				5-6 Hours	
035	Sushil soni	п	Argora Chowk, ranchi		0		70 x 50 m	0.5 - 1 m	4-5 times	Rainy Season		0			0	7-8 months	
036	Garinda Orov	П	Netaji subhash Colony, Itki road, Ranchi	0			20 x 10	0.5 m	30-40 times	Rainy day		0				6-10 Hours	
037	Rahul Kumar	П	Bariyatu Road, Near Rani children Hospital, Ranchi	0			50 x 30 m	0.5 m	always	Non Rainy Season	0	0			0	10-12 months	
038	Sanjay Kuma	п	Prem Nagar, Line Tank Road, Near Central Jail, Ranchi	0			120 x 30	1.2- 1.5 m	always	Non Rainy Season	0	0			0	10-12 months	
039	Santosh Jala	п	Oriental Bank Road, Court Road Ranchi	0	0		30 x 50	0.5 m	30-50 times	Rainy Season		0				4-6 Hours	
040	Mahendra Je	п	Near Marwari Womens College, Upper Bazar		0		40 x 30	0.5 m	40 - 50 times	Rainy Season	0	0				4-8 Hours	
041	Md samim	п	Hindpiri, 2nd Street Road, Ranchi	0			50 x 100	0.5 - 1 m	30-50 times		0	0				8-10 Hours	
042	Kamta Yadav	П	Gossner Womens College, Ranchi	0			40 x 30 m	1 mtrs	always	Non Rainy Season	0				0	12 months	
043	Ali Ahmad	п	Karbala Tank Road, Near Karbala chowk, Ranchi		0		20 x 30 m	0.5 m	40-50 times	Rainy Season	0	0				4-6 hours	traffic blocks for 2-3 hours during rain
044	Sanjay Kuma	П	East Jail Road, Ranchi	0	0		80 x 60	1-1.5 m	always	Non Rainy Season	0	0			0	12 months	
045	Dines wari lal	п	Tril Basti, road, kokar Ranchi	0			40 x 20	0.5 - 1 m	40-50 times	Rainy day		0				2-3 Hours	
046	Aditya Kach	ш	A yodhya Puri, H.B. Road, Near madan Dhaba	0	0		25 x 15 m	0.5 m	always	Non Rainy Season	0	0			0	12 months	
047	Mantosh Ku	ш	Samlong, Near Sushila Enclave	0			80 x 30	1-2 m	always	Non Rainy Season	0				0	12 months	
048	Godwin Kach	ш	Chunwa toli, Old H.B. Road, near Khadgarha Bus stand, Ranchi	0			20 x 10	1-2 m	always	Non Rainy Season	0				0	12 months	
049	Manoj kuma	IV	Ambedkarv Nagar, Birsa Chowk, Ranchi-2	0			10 x 20	0.5 m	20-30 times	Rainy Season		0				4-6 Hours	
050	Praveen Jha	IV	Near Ring road, tupudana, Ranchi - 3	0			30 x 40 m	1 m	2-3 Times	Rainy Season		0	0		0	4-5 Months	
								1	1	1		1					I



Appendix A3.3 Location Map of Existing Major River Crossing Structures

Appendix A3.4 Inventory of Existing Major River Crossing Structures (1/2)

Zone-II

Zoi	ne-II									
No.	Type of Structure	Location	Related Drainage Channel	Structural Features	Major Dimansions	Present Conditions of Structure and The River Course				
1	Road bridge	Zone-II western limt on NH-23	Harum river, north branch	Concrete girder bridge	the girder length of approx. 20m and the sofit level frm approx. 10 m from the river bed. (Flow capacity : approx. 180 m3/s)	This point is located at the most upstream area of the river basin, the sofit level of the bridge is high enough from the river bottom and the river channel is seemed to have enough flow capacity for flood.				
2	Road bridge	Zone-II western suburban road	Harum river, north branch	Concrete slab bridge with 3 piers, total length approx. 12 m	approx dimensions of opening between piers: 2m w x 1.5–1.8 m h, pier width of approx 1.2m, (Flow capacity : approx 15 m3/s)	The bridge sofit level is rather low and the total opening length (approx 8m) is small compared to the river width at US and DS sections of the bridge (approx. 15–20m), a lot of garbage dumping, siltation and weeding are observed at US and DS channel of the bridge, flow capacity at this bridge is seemed to be very limited.				
3	_	Zone-II western suburban road at PS-1 site River Crossing Point (RC-1) proposed by JICA Study Team	Harum river, north branch	Concrete slab bridge with 5 piers, total length approx. 23 m	approx dimensions of opening between piers: 2.5–3m w x2–3 mh, pier width of approx. Im, (Flow capacity : approx. 50 m3/s)	The bridge sofit level is seemed to be enough and the total opening length (approx. 15m) is also seemed to be enough, a lot of garbage dumping, siltation and weeding are observed at US and DS channel of the bridge, flow capacity at this bridge itself is seemed to be enough but the flow capacity of the channel seemed to be insufficient for flood				
4	Road bridge	Zone-II western suburban road near PS-1 site, downstream of No.3 site	Harum river, north branch	Concrete slab bridge with 4 piers, total length approx. 20 m	approx dimensions of opening between piers: 3m w x 1.2 m h, pier width of approx 1m, (Flow capacity : approx 17 m3/s)	The total opening length (approx. 15m) is seemed to be sufficientl compared to the river width at US and DS sections of the bridge but the sofit level seemed to be insufficient, a lot of garbage dumping, siltation and weeding are observed at the river channel, flow capacity at this bridge is seemed to be very limited.				
5	Road bridge	Zone-II, on the Harum Road near PS-1 site, downstream of No.4 site	Harum river, north branch	Concrete girder bridge with 1 pier, total length approx. 20 m	approx dimensions of opening between piers: 10m w 3-4 m h, pier width of approx Im, (Flow capacity : approx 150 m3/s)	The bridge sofit level is seemed to be high enough and the total opening length (approx. 20m) is also seemed to be enough, a lot of garhage dumping, siltation and weeding are observed at US and DS channel of the bridge, flow capacity at this bridge itself is seemed to be enough but the flow capacity of the channel seemed to be insufficient for flood.				
6	Ŭ	Zone-II Kadru road at PS-2 site near Radison Hotel River Crossing Point (RC-2) proposed by JICA Study Team	Harum river, north branch	Concrete girder bridge	the girder length of approx 20m and the sofit level frm approx. 7~8 m from the river bed, (Flow capacity : approx. 140 m3/s).	Sofit level of the bridge is high enough from the river bed and the river channel at bridge site is seemed to have enough flow capacity for flood, but idong the US and DS river sections, a lot of bushes, weeds and dumped garbage, which may be serious obstacles for smooth flow, are observed.				
7	Road Bridge	Zone-II Tata road near Mahuatoli, located eastern suburban area of the city	Subarnarekha river, main river course, just downstream of cofluence with Harumu river		approx dimensions of opening between piers: 5m w x3 m h, pier width of approx Im, (Flow capacity : approx 180 m3/s).	The bridge sofit level is seemed to be high enough and the total opening length (approx. 30m) is also seemed to be enough, no garbage dumping, siltation and weeding are observed at US and DS channel of the bridge, flow capacity at this bridge is seemed to be enough, the river width of the U/S and D/S of the bridge is wider (approx. 50m) than the bridge length.				
8	Road bridge	Zone-II just U/S of STP on Chutia road	Subarnarehka river	Concrete girder bridge	the girder length of more than 30m and the sofit level frm approx. 10 m from the river bed. (Flow capacity : approx. 350 m3/s).	This point is located at the just upstream of the proposed STP site of Zone-II, the sofit level of the bridge is high enough from the river bed and the river channel is seemed to have enough flow capacity for flood.				
9	Road bridge	Zone-II near Dhipatoli on Argora road	Harum river, south branch, near U/S end of the branch	Concrete slab bridge without pier	approx dimensions of opening: 2.5~3m w x 5 m h, (Flow capacity : approx 15 m3/s).	This point is located at the most U/S areas of the river basin, the span length is small but the sofit level is high enough, paddy lands are extended in U/S and D/S area of the bridge and the area is assumed to function as a retention pond during flooding				
10	Road bridge	Zone-II western suburban road to Pundag	Harum river, south branch	Concrete slab bridge with 3 piers, total length approx. 15 m	approx dimensions of opening between piers: 3m w x 1.2 m h, pier width of approx. 0.7m, (Flow capacity : approx. 18 m3/s).	The bridge sofit level is not enough and the total opening length (approx. 15m) is smaller and narrowed compared to the U/S and D/S river sections, dense bushes and weeding are observed in the channel flow capacity at this bridge is seemed to be insufficient for flood. Some houses are being bult up in the adjacent area.				
11	-	Zone-II Dibdhi Basti area, river crossing on the Harum Road By-pass	Harum river, south branch		approx dimensions of opening is 3m w x 2~3 m h, pier width of approx. 1.2m, (Flow capacity : approx. 40 m3/s).	The bridge sofit level is seemed high enough, but the total opening length (approx.7.5m) is smaller and narrowed compared to the U/S and D/S river sections, flow capacity at this bridge is seemed to be insufficient for flood.				
		Zone-II just U/S of railway crossing point	Harum river, south branch	Concrete slab bridge with 1 pier, total length approx. 5.5 m	width of approx. 1.2m, (Flow capacity : approx. 15 m3/s).	The bridge sofit level is seemed high enough, but the total opening length (approx.5.5m) is smaller and narrowed compared to the U/S and DS river sections, a small concrete weir with $1-1.2$ mheight and approx.15m width with small (0.4m x 0.4m) opening is observed just U/S of the bridge, flow capacity at this bridge is seemed to be insufficient for flood.				
		Zone-II railway crossing just D/S of No.12 road bridge site	Harum river, south branch	Concrete box culvert	approx. 3m w x8m h x2 lanes, (flow capacity : approx. 60 m3/s)	The flow capacity of the culvert itself is seemed sufficient for flood, but two water transmission mains (dia. about 700 mm and dia. about 300 mm) run through the culver, the smaller main pipe is located near the channel bed level with some piers and is obstacle for the smooth flood flow.				
14		Zone-II just D/S of railway crossing point	Harum river, south branch	Concrete slab bridge with 1 pier, total length approx. 5.5 m	width of approx. 1.2m, (Flow capacity : approx. 12 m3/s).	The bridge sofit level is seemed high enough, but the total opening length (approx 5.5m) is smaller and narrowed compared to the U/S and D/S river sections, a lot of garbage, siltation and bushes area observed, flow capacity at this bridge is seemed to be insufficient for flood. the land level of the house premises along the channel is lower than the road level.				
15	Road bridge	Zone-II just D/S of the No. 14 bridge, for private use	Harum river, south branch	Concrete slab bridge with 1 pier, total length approx. 7.5 m	approx dimensions of opening between piers: 3.5m w x 3.5 m h, pier width of approx. 0.4m, (Flow capacity : approx. 50 m3/s).	The bridge sofit level is seemed high enough, the total length (approx 7.5m) is almost same as the channel width, garbage, siltation and bushes are observed, flow capacity of the channel is seemed to be sufficient if the obstacles are removed.				
~	TICA	C 1 T								

Appendix A3.4 Inventory of Existing Major River Crossing Structures (2/2)

Zone-II (Cont.)

No.	Type of Structure	Location	Related Drainage Channel	Structural Features	Major Dimansions	Present Conditions of Structure and The River Course
16	Road bridge and Weir		Rivr along the proposed trunk sewer line in north-east area (west branch)	Concrete girder bridge	the girder length of approx. 30m and the sofit level fm approx. 7-8 m from the river bed. (River water flow is regulated by the check dam just upstream of the bridge)	The sofit level of the bridge is high enough from the river bed and the river channel is seemed to have enough flow capacity for flood. At just upstream of the bridge, a weir of brich structure is observed and the flood water is assumed to be regulated by the reservoir. one water supply main (approx dia. 800 mm) is observed at the soffit level of the bridge.
17	Foot bridge	bridge No. 18		Concrete slab bridge without pier	approx dimensions of opening: 2.5-3m w x5 m h, (Flow capacity : approx 30 m3/s).	The span length is small compared to the channel width of U/S and D/S (approx 8-10m), the soft level is high enough, but the river bank level is not high enough for flood. According to the dwellers in the small houses along side of the river, flood level reaches to their house walls.
18	Road bridge	near Kantatoli	Rivr along the trunk sewer line proposed in DPR in north-east area (west branch)	Concrete girder bridge		The sofit level of the bridge is high enough from the river bed and the river channel is seemed to have enough flow capacity for flood. In the river channel at U/S and D/S, a lot of bushes are observed and the flow capacity is seemed to be insufficient for flood.
19	Foot bridge	road bridge on NH-33		Concrete slab bridge without pier	approx dimensions of opening: 7~8 m w x 1.5~1.8 m h (Flow capacity : approx. 30 m3/s).	The opening size is seemed insufficient for flood and narrowed compared to the U/S and D/S river sections (river width of apprx 20m or more), one house is built up in the river side at the river bed level,
20	Road bridge	junction of NH-33 and	Rivr along the trunk sewer line proposed in DPR in north-east area (east branch)	Concrete girder bridge	the sofit level frm approx. 7~8 m from	The sofit level of the bridge is high enough from the river bed and the river channel is seemed to have enough flow capacity for flood. In parallel of of the bridge, two water supply mains (approx. dia. 800 mm and 400 mm) with independent pir structures are observed at the soffit level of the bridge. This water supply structures may be a obstacle for smooth water flow.
21	Road bridge	road bridge		Concrete slab bridge with one pier	approx. 3.5-4m w x 2.5m h, pier width of approx. 1m, (Flow capacity : approx. 30 m3/s).	The total bridge span length is smaller than the river channel width at U/S and D/S section (approx 20–25m), but no major obstacles including garbage dumping, buses and siltation are observed. River water flow with sufficient velocity is observed.
Zoi	не-Ш & I	W (1/1)				
No.	Type of Structure	Location	Related Drainage Channel	Structural Features	Major Dimansions	Present Conditions of Structure and The River Course

No.	Type of Structure	Location	Related Drainage Channel	Structural Features	Major Dimansions	Present Conditions of Structure and The River Course
22	Road bridge	Zone-III on Maudir road	Hinno river, proposed trunk sewer line route in DPR	Concrete slab bridge with 4 piers, total length approx. 12 m	approx dimensions of opening between piers: 2m w x 1.5 m h, pier width of approx 0.7m, (Flow capacity : approx 8 m3/s).	The bridge sofit level is seemed insufficient for flood, the bridge openins at both bank are blocked with siltation, the total opening length (approx 8m) is almost same width as that of U/S and D/S river sections, garbage, siltation and bushes area observed, flow capacity at this bridge is seemed to be insufficient for flood.
23	Ű	Zone-III, on the road where sewer rising main is proposed in DPR.	Hinno river, proposed trunk sewer line route in DPR	Concrete slab bridge with 6 piers, total length approx. 25~30 m	approx dimensions of opening between piers: 3m w x 2.5 m h, pier width of approx. 0.7m, (Flow capacity : approx. 45 m3/s).	The bridge sofit level is seemed high enough, the total bridge length is larger than the river channel width, serious garbage dumping, siltation and bushes are observed at the bridge site. flow capacity of the channel is seemed to be sufficient if the obstacles are removed.
24		Zone-III on main road near Emerald hotel	Hinno river, proposed trunk sewer line route in DPR		the girder length of approx. 30m and the sofit level fm approx. 8–10 m from the river bed. (Flow capacity : approx. 130 m3/s).	The sofit level of the bridge is high enough from the river bed and the river channel is seemed to have enough flow capacity for flood. Water runk main (approx dia. 400MM) with some piers crosses the river in parallel with the bridge at the U/S side. This pipe level is not high enough from the river bed and may be a obstacle for flood.
25	0	Zone-III on Harum Road By- pass		pier, total length approx. 20 m,	the girder length of approx. 20m and the sofit level frm approx. 7~8 m from the river bed. (Flow capacity : approx. 140 m3/s).	The sofit level of the bridge is high enough from the river bed and the river channel is seemed to have enough flow capacity for flood.
26	Ū		Nati River (Branch of Subarnarekha River), proposed trunk sewer line route			The sofit level of the bridge is high enough from the river bed and the river channel at the bridge site is seemed to have enough flow capacity for flood.
27	Ū	Zone-IV on Khuti road (NH75), near Industrial Estate River Crossing Point (RC-3) proposed by JICA Study Team	Subamarekha river near Industrial Estate, proposed trunk sewer line route	0 0	the girder length of approx. 70m and the sofit level frm approx. 7–8 m from the river bed. Theroad width of approx. 10m, (Flow capacity : approx. 100 m $S(s)$).	The sofit level of the bridge is high enough from the river bed and the river channel at the bridge site is seemed to have enough flow capacity for flood.

Appendix A4

CHAPTER A4 REFERENTIAL TABLES AND FIGURES ON EXISTING SEWAGE TREATMENT AND DISPOSAL SYSTEM

	Category	Percent (%)
	Piped sewer system	5.7
Flush/pour flush latrine connected to:	Septic tank	31.0
i lush/pour llush latine connected to.	Other system	1.5
	Subtotal	38.2
	With slab/ventilated improved pit	1.6
Pit latrine	Without slab/open pit	0.5
	Subtotal	2.1
	Night soil diposed into open drain	0.3
Other latrine	Night soil removed by human	0.1
	Night soil serviced by animal	0.3
	Subtotal	0.7
Latrine facility available within pre	mises	41.0
	Public toilet	1.9
Latrine Not available within	Open	57.1
	Subtotal	59.0
	100.0	

Appendix A4.1 Status of Septic Tank and Latrine Use of Households in Ranchi District

Source: Housing Profile of Jharkhand State in the 2011 census of India

Appendix A4.2 Industries and Hotels whose Effluent Water are Monitored by JSPCB and the Water Quality Data

		Frequency of						Water	Quality Dat	a			
SI. No.	Place	collecting sample	Category	Treatment	Date	Number of Sample	Temperature (°C)	pH (mg/L)	BOD (mg/L)	COD (mg/L)	TSS (mg/L)	TDS (mg/L)	Oil & Grease (mg/L)
Industry													
1	Sudha Dairy (a part of HEC area)	Quarterly	Milk products	None	28-Feb-14	1	25.5/20	6.5	34	260	52	478	N/A
2	Foundry Forge Plant (FFP), HEC	Quarterly	Heavy castings and forgings	None	28-Feb-14	3	24/19-20	6.0-6.5	24-30	220-256	52-64	572-590	1.6-3.8
3	Heavy Machine Building Plant (HMBP), HEC	Quarterly	Heavy machine production	None	28-Feb-14	2	25/20,21	6.5/6.8	28/26	244/236	74/54	330/306	N/A
-	O.P Khandelwal Swastik Fruits Product Pvt.	Half Yearly	Fruit processing	None	30-Jul-13	1	30/28	7.5	24	204	68	684	N/A
5	M/S Usha Martin Industry Ltd	Quarterly	Electrical	Chemical	13-Feb-14	1	27/25	8.5	36	260	82	468	N/A
6	Banwari Lal Agrawal Industrial Area	Half yearly	N/A	None	29-Apr-13	1	30/33	6.5	31	252	88	586	N/A
Hotel													
1	Radisson Blu	Yearly	Hotel	Septic Tank	20-Jan-14	1	30/29	7.5	24	260	36	502	8.1
2	BNR Chanakya	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
3	Quality Inn	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
4	Maharaja Inn	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
5	Landmark	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
6	Yuvraj Palace	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
7	Elements	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
8	Konark	Yearly	Hotel	Septic Tank	N/A	-	-	-	-		-	-	-
9	Amrit	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
10	Krishna Inn	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
11	Hotel Rajasthan	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
12	Hotel New Rajasthan	Yearly	Hotel	Septic Tank	N/A	-	-	-	-	-	-	-	-
Standard	Inland Surface Water						40	5.5 - 9.0	<30	<250	<100	<2100	<10
	Public Sewers						-	5.5 - 9.0	<350	-	<600	<2100	<20

Source: JSPCB Central Laboratory

(1) Kanke STP



Aeration Tank (Right side is out of order) in Kanke STP

Source: JICA Study Team

(2) MECON STP



Aeration in the Aeration Tank



Final Polishing Pond

Facilities in MECON Colony STP

Source: JICA Study Team (3) HEC Colony STP



Aeration Tank not in Use

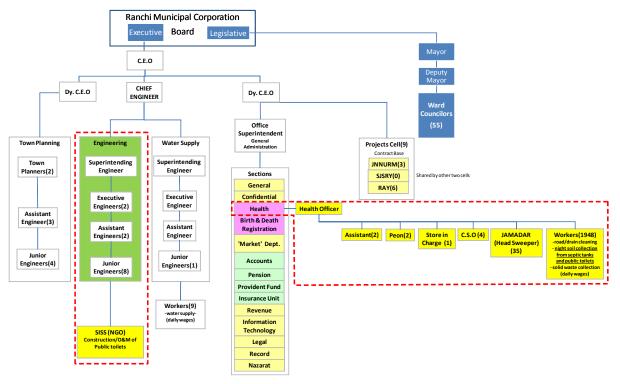


Ruined Final Sedimentation Tank

Facilities in HEC Colony STP (not in use)

Source: JICA Study Team

Appendix A4.3 Photos of Existing STPs and Sewerage System



Source: JICA Study Team

Appendix A4.4 Organization related to Management of Sanitary Facilities in RMC

SI. NO	PARTICULERS	NO. OF EMP.	EMPLOYMENT STATUS	NOTE
1	MOH(Medical Officer Health)	1	Permanent	
2	ASSISTANT	2	Permanent	
3	PEON	2	Permanent	
4	STORE INCHARGE	1	Permanent	
5	C.S.O	4	Permanent	
6	JAMADAR (HEAD SWEEPER)	35	Permanent	
	Total of Permanent Staff	45		
7	ZONAL SUPERVISOR	3	Daily Wage	
8	TRANSPORT SUPERVISOR	2	Daily Wage	
9	C&T SUPERVISOR	55	Daily Wage	
10	COLL.SUPERVISOR	47	Daily Wage	
11	OFFICE STAFF	2	Daily Wage	
12	SECURITY GUARD	9	Daily Wage	
13	DHARMKATA STAFF	2	Daily Wage	
14	MECHANIC / ASSISTANT MECHANIC	7	Daily Wage	
15	COMPACTOR DRIVER	12	Daily Wage	
16	DUMPER DRIVER	12	Daily Wage	
17	TRACTOR DRIVER	11	Daily Wage	
18	JCB DRIVER	1	Daily Wage	
19	DRAIN DICELTING DRIVER	1	Daily Wage	
20	ROAD SWEEPER DRIVER	1	Daily Wage	
21	COMPACTOR / DUMPER HELPER	58	Daily Wage	
22	RICKSAW COOLEE/DRAIN CLEANER/TATA ACE/TRACTOR HELPER	1112	Daily Wage	438 is only for drain cleaning work
23	TATA ACE DRIVER	48	Daily Wage	
24	REJA	498	Daily Wage	
25	LABOUR OF IMPORTANT PLACE	63	Daily Wage	
26	VACUUM TRUCK DRIVER	4	Daily Wage	
	Total of Daily Wage Staff	1948		
	TOTAL	1993		

Appendix A4.5 Manpower Detail of Health Section, RI	MC
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Source: Health Section, RMC

SI No.	Fund	Area	Location	Ward No.	Zone No.
1	RMC	Kanke Dam	Chouri Basti	2	1
2	RMC	Jatra Tad	Sindwaar Toli	3	1
3	RMC	Booty More	Booty Chawk	5	1
4	RMC	Pahari Mamdir	Badgai	5	1
5	RMC	Bandh Gadi	Jatra Place(Khelgaw Chawk)	6	2
6	RMC	Harijan Basti	Kanta Toli	11	2
7	RMC	Laah Kothi	Tetar Toli Hindpidi	26	2
8	RMC	Mantu chawk		27	2
9	RMC	Kathal Gonda	CMPDIL	33	1
10	RMC	Hehal Bazar	Khashi Toli	35	1
11	RMC	Tetengaa Toli		37	2
12	RMC	Jagganathpur	Naya Toli	43	4
13	RMC	Sector-2	Dhurwa Market	44	4
14	RMC	Gosai Tola	Gghaghra Basti	50	3
15	RMC	Hundrow	Niche Toli	52	3
16	RMC	Naya Latma	Sarna Place	54	4
17	' RMC	LatmaBasti	Hatia	54	4

Appendix A4.6 Proposed Public Toilets for Construction by RMC in Fiscal Year 2014-2015

Note: Out of 17 locations above, 11 would be selected in July 2014. Source: RMC

			r	1	r					T						/	1 1111				r	т	r			
							G	ents La	dies				Sta	ff			Та	riff	Operation	Repair		Year of	(Condition	n	1
Sl No.	Sl No.	T a set is a	W	7	A	C				Water		T	W. 1	M	W. 1.		T . 1. (Dette	Interval of		Gutuan			M. 1.		Net
(Rev.)	(Org)	Location	ward No.	Zone No.	Area	Capacity	WC	Bath WC	Bath	Supply	Category	Tariff	0		Working	Total	Toilet	Bath	collecting night	Interval	Category	Construction	Good	Moder	Bad	Note
× · · · /	(- 0/											Collection	Hour	ne	Hour		(Rs/use)	(Rs/use)	soil			(Planned)		ate		1
Zone-II																	1		301							
Zone-m	4	X 11 1	21	2	171 1 1	20	10	2 10		0	CTCC	1	24	2	10	2		2	1	1	D 1 P	2002.02				l
1	4	Madhukam	31	2	Khadgada	20	10		2	G	SISS	1	24	2	12	3	2	3	1year	, , , , , , , , , , , , , , , , , , ,	Public	2002-03	x			l
2	8	Station Road	48	2	Near BSRTC	20	9	2 9	2	G	SISS	1	24	2	24	3	2	3	1year	6months	Public	2002-03	x			l
3	9	RIMS	8	2	Medical College	20	10	2 10	2	G	RMC	1		3		4	2	3	6 months	2 vears	Community	2002-03		x		1
5)	KIND	0	2	Wiedlear College	20	10	2 10	2	U	RNIC	1		5		r	2	5	0 monuis	2 years	Community	2002-03		л		
4	10	Birsa Bus Stand	13	2	Kanta Toli	10	5	1 5	2	G	RMC	1	24	2	24	3	2	3	10 days	-	Public	2002-03	х			
5	10	Birsa Bus Stand	13	2	Kanta Toli	10	5	1 5	2	G	RRDA	1	24	2	24	3	2	3	10 days	-	Public	2010-11	х			
6	11	Firayalal Chawk	19	2	Main Road	9	5	1 4	1	G	SISS	2	24	2	12	4	2	3	1month	1year	Public	2002-03	x			
7	13	Rotary Park	24	2	Nr Ranchi Lake	10	5	1 5	1	G	SISS	1	24	1	24	2	2	3	2year	, , , , , , , , , , , , , , , , , , ,	Public	2002-03	x			(
8	14	Ranchi Women's College	20	2	Hariom tawar	10	5	2 5	1	D	SISS	0	0	0	-	0	Free	Free	N/A	-	Public	2002-03			v	
9			11	2	Kanta Toli	5	3	0 2	0	P		1	÷	0	_	1	1	2	1	-		2002-03			Λ	
	15	Harijan basti				5	3	0 2	0		SISS	1	24	0	-	1	1		6month	-	Community		X			
10	17	Nayak Tola	14	2	Chtia	10	4	1 4	1	G	SISS	1	24	1	12	2	2	3	6month	6month		2003-04	X			l
11	18	Jatra Tod	9	2	Kokar	5	2	1 2	0	G	SISS	1	24	1	12	2	2	3	1yeae	-	Public	2003-04			х	
12	19	Sewa Sadan	24	2	sarjana chawk	10	5	1 5	1	G	SISS	1	15	1	12	2	2	3	1year	6month	Public	2003-04	х			4
13	20	Balmiki Nagar	30	2		10	5	1 5	1	G	SISS	-	-	-	-	-	-	-	-	6month	Community	2003-04			v	When visited site,
15																						2005-04			х	there was no staff.
14	21	Pahari mandir	30	2	Ratu Road	10	5	1 5	1	G	SISS	1	24	1	12	2	2	3	6month	1year	Community	2003-04				
15	23	Kachahri	22	2	D. C. Office	10	4	1 4	1	Р	SISS	1	24	1	12	2	2	3	6 months	-	Public	2004-05	x		1	()
16	24	Tadri basti	22	2	Main Road	10	4	1 4	1	G	RMC	1	24	1	12	2	2	3	1year	_	Public	2004-05			x	
10	24	Bakri Bazar	22	2	Nr Corp Garage	10	7	1 4	1	G	SISS	1	24	1	12	2	2	3	1year	1year	Public	2004-05			X	
					Ni Corp Garage		7	1 5	1			1	1	1		-			i	-					л	H
18	35	Bazar Tad	23	2		10	5	1 5	1	G	SISS	1	24	1	12	2	2	3	1year	1year	Public	2005-06	X			l
19	38	Argoda Chawk	38	2	Harmu	5	2	1 2	1	G	SISS	1	24	1	12	2	2	3	1year	-	Community	2005-06	X			l
20	39	Harijan Basti	38	2	Hatia	5	3	0 2	0	G	SISS	1	12	1	12	2	-	-	1year	1year	Community	2005-06	X			L
21	42	Ramgarh trekker stand	22	2	Jail chawk	10	5	1 5	1	G	SISS	1	24	1	12	2	2	3	1year	-	Community	2006-07			х	
22	43	Gungu Toli	15	2		5	3	- 2	-	G	Local	0	-	3	24	3	Free	Free	1 year	-	Community	2007-08	х			1
	47	Tiril Akhra Kocha	8	2	Kokar	5	2	1 2	0	G	SISS	-	-	-	_	-	-	-	2year	1year	Community					When visited site,
23	••		Ũ	-		5	-		Ů	Ŭ	5155								Lyour	1 your	Community	2008-09			х	there was no staff.
24	48	Bandh Gadi	6	2	Deepa Toli	5	2	1 2	0	G	SISS	1	24	1	24	2	3	Free	1year	1year	Public	2008-09	x			there was no starr.
24		Karbala Chawk	15	2	Ward Office	5	2		-	G	SISS	1	24	1	24		-	Tiee	1 1			2008-09	<u>л</u>			When visited site,
25	50	Karbala Chawk	15	Z	ward Office	5	2	1 2	0	G	2122	-	-	-	-	-	-	-	1year	1year	Community	2008-09				
				_						-																there was no staff.
26	51	Kalibabu Street	18	2	Bhutha Talb	5	3	0 2	0	G	SISS	1	24	0	0	1	3	Free	1year	-	Community	2008-09			X	l
27	52	Tagra Toli	36	2	Hinoo	5	2	1 2	1	Р	Local	1	24	0	0	1	2	3	2year	-	Community	2008-09			Х	ļ
28	36	Karbala Tank	16	2	Karbala Chawk	5	3	0 2	0	Р	SISS	1	24	1	8	2	Free	Free	1year	-	Public	2011			х	1
29	22	Patthal Kudwa	17	2	Sarjana Road	5	3	0 2	0	G	SISS	1		1	24	2	3	Free	1year	1year	Public	2013-14			х	1
20	55	Bada Ghaghra Basti	50	2	Namkum	5	3	0 2	0	G	SISS	-	-	-	-	-	-	-	-	-	Community	2012.11				Appears to be not
30		-							1												.	2013-14				used (closed)
31	60	Harijan Basti	25	2	Hindpidi	5	3	1 2	0	G	Local	1	24	2	12	3	2	3	1year	-	Public	2013-14	x	l	I	
32	61	Haj House	28	2	Kadru	5	3	0 2	0	G	SISS	1	24	0	0	5	Free	Free	3year		Public	2013-14		1	x	
Zone-III				-			5	$+$ $\tilde{-}$	Ť	Ť	2.00					5			e jour					1		I
33		Naya Toli	43	4		20	9	2 9	2	G	SISS		1				Free	Free	5voor	1year	Public	2002-03	v	<u> </u>	1	Under renewal
						1	~					-		-	- 24	-	Free	Free	5year				X			Under renewal
34		Jagganathpur Basti	42	4		20	10				SISS		24	1	24	2	2	3	1year	lyear		2002-03	X		l	├ ────┤
35		Mausi Badi	43	3		20	9		-		SISS	2	24	2	24	4	Free	Free	5year	1year		2002-03			х	↓]
36		Birsa Chawk	45	3		20	9	3 9	3	G	SISS	1	24	2	24	3	2	3	1year	1year		2002-03	x		I	ļ
37		Dhurwa Bus Stand	42	4		20	9	-		G	SISS	1	24	1	24	2	2	3	1year	· ·	Public	2002-03			х	ļ
38	16	Mani Tola	52		Hinoo	5	2			Р	SISS	1	24	1	12	2	2	3	2year		Community	2003-04	x			
39	28	Doranda	46	3	Near Veg Market	10	5	2 5	3	G	SISS	1	24	2	12	3	2	3	6month	1year	Public	2004-05	х			
40	29	Shri Krishna Singh Park	46	3	Doranda	10	6	1 4	1	G	SISS	1	24	1	12	2	2	3	N/A	-	Community	2004-05	х			
41		Khakhma Toli	52	4	Hinoo	5	2			G	Local	1	24	0	0	1	2	3	2year	-	Community	2008-09		l	х	
42	54	Tanki Side	41	4	Gwala Toli	5	2		-	P	Local	1	24	1	12	2	2	3	1year		Public	2013-14	x		<u> </u>	
43	56	Nayak Mohalla	40	4	Riksha Toli	5	3		_	G	SISS	1	12	1	12	2	-	-	1year		Community	2013-14		1	1	
		Urs maidan	-	3	Doranda		5	0 2			5155	1	12	1	12	2	+ -	<u> </u>	Tycal		Public	2013-14				Under construction
44	62	U18 maidan	46	3	Doranda	10	l						1								r ublic	2015-14	I	L	I	Under construction

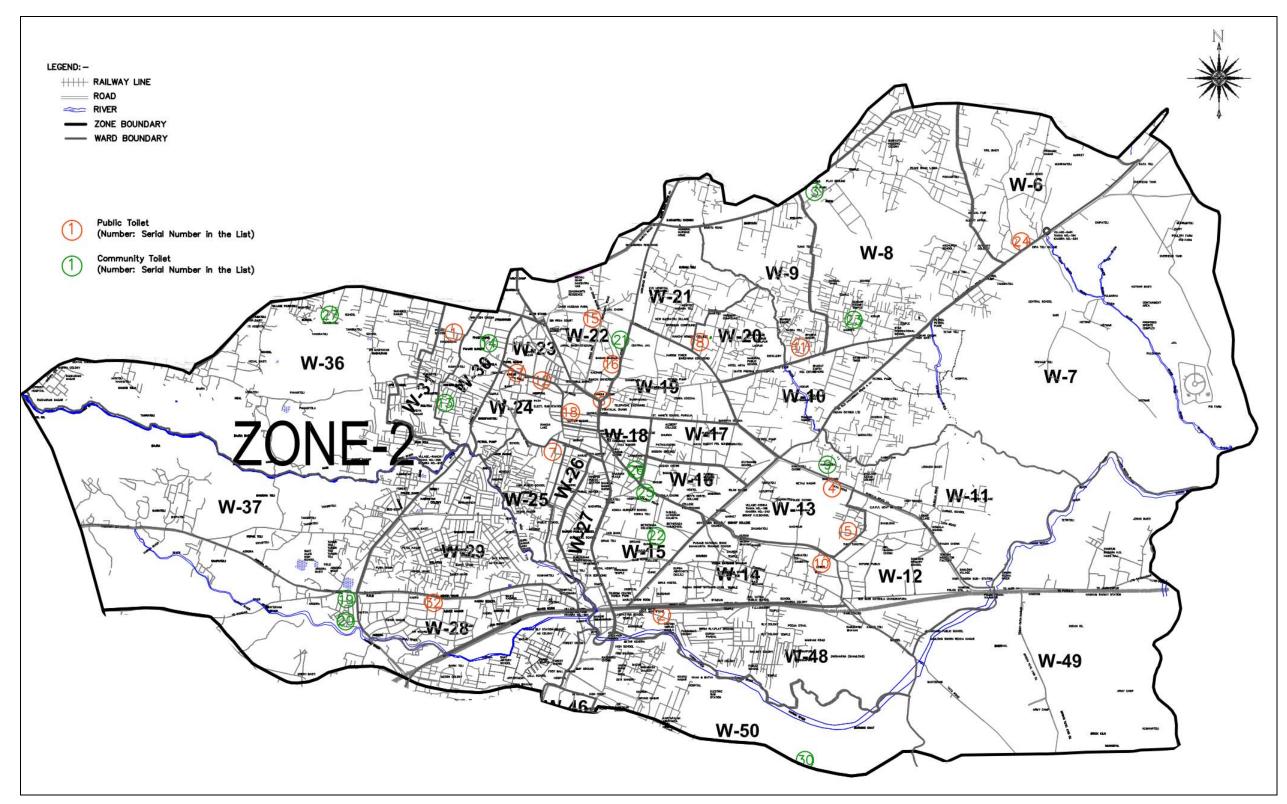
Appendix A4.7 Existing Public and Community Toilets in Zone-II, III&IV in Ranchi City

Note:

Public toilet: Persons from unspecified areas use the toilets Community toilet: Mainly local community people use the toilets

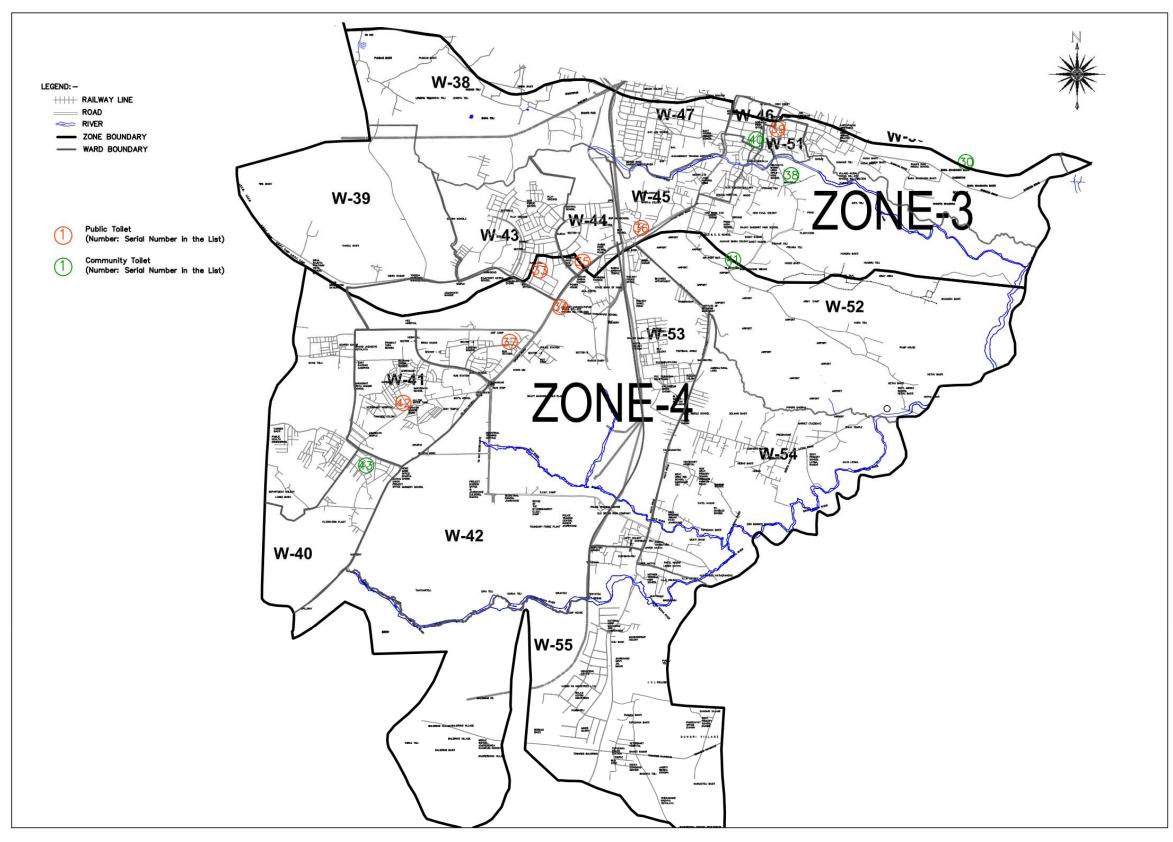
Source: JICA Study Team

P: Piped G: Groundwater APPENDIX A4



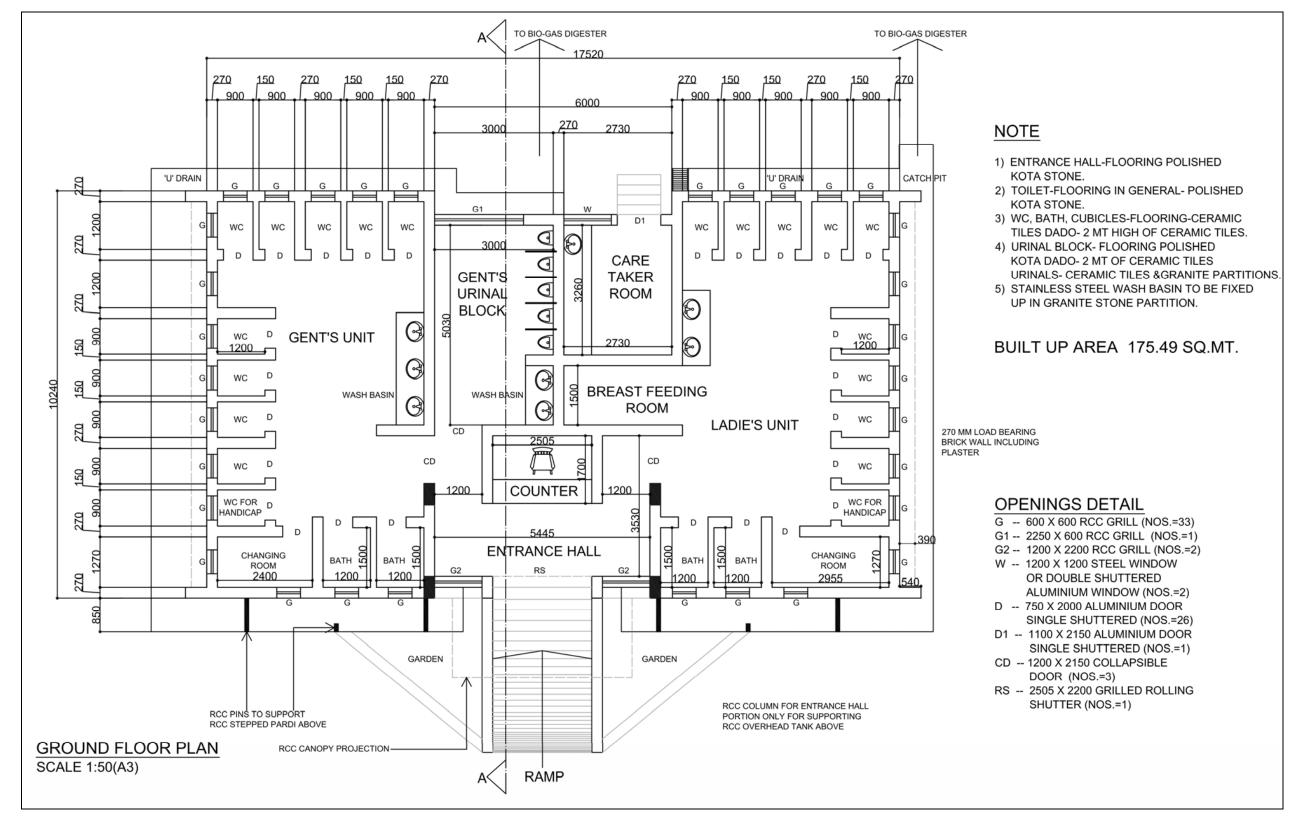
Appendix A4.8 Location Map of Existing Public/Community Toilets in Zone-II of Ranchi City

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APPENDIX A4
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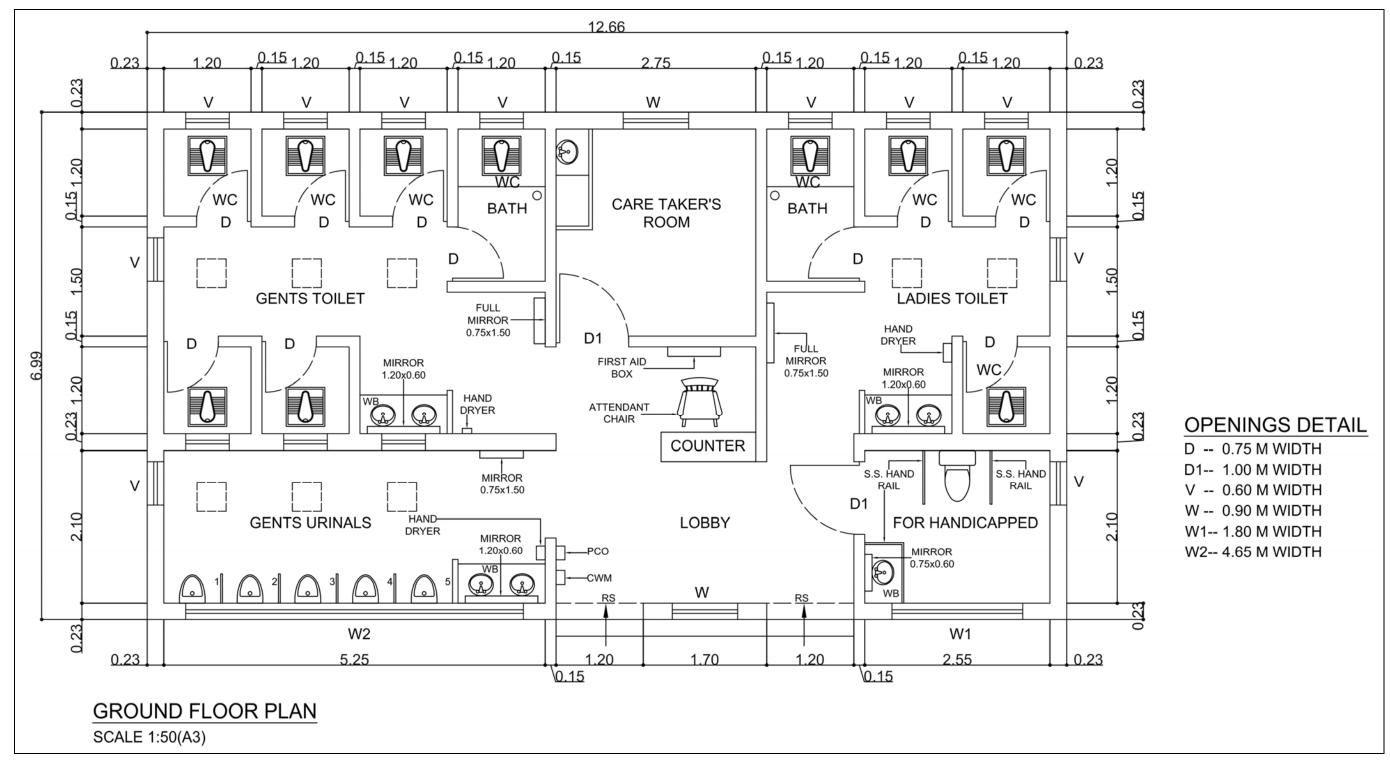


Appendix A4.9 Location Map of Existing Public/Community Toilets in Zone-III&IV of Ranchi City

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APPENDIX A4
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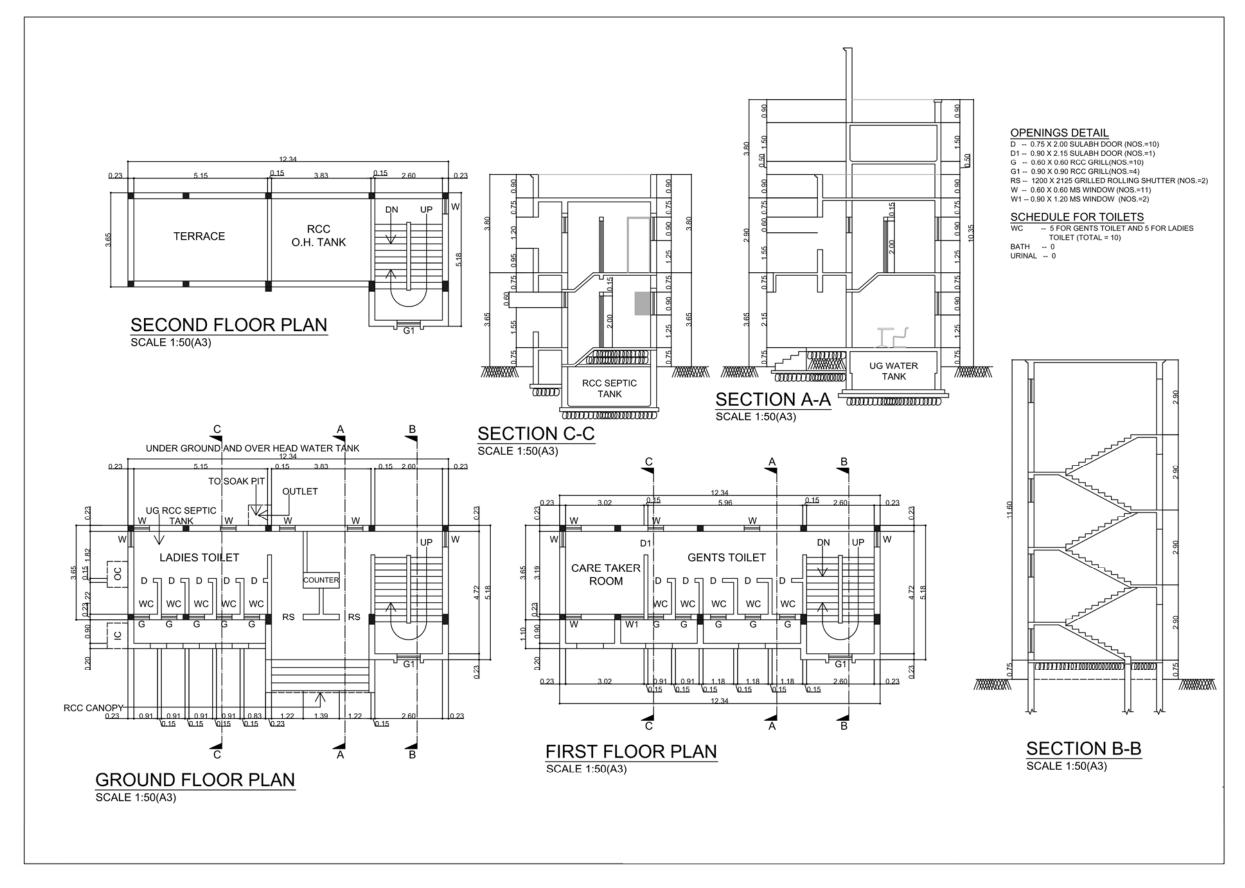


Appendix A4.10 Typical Plan of Existing 20 Seated Public Toilet in Ranchi City

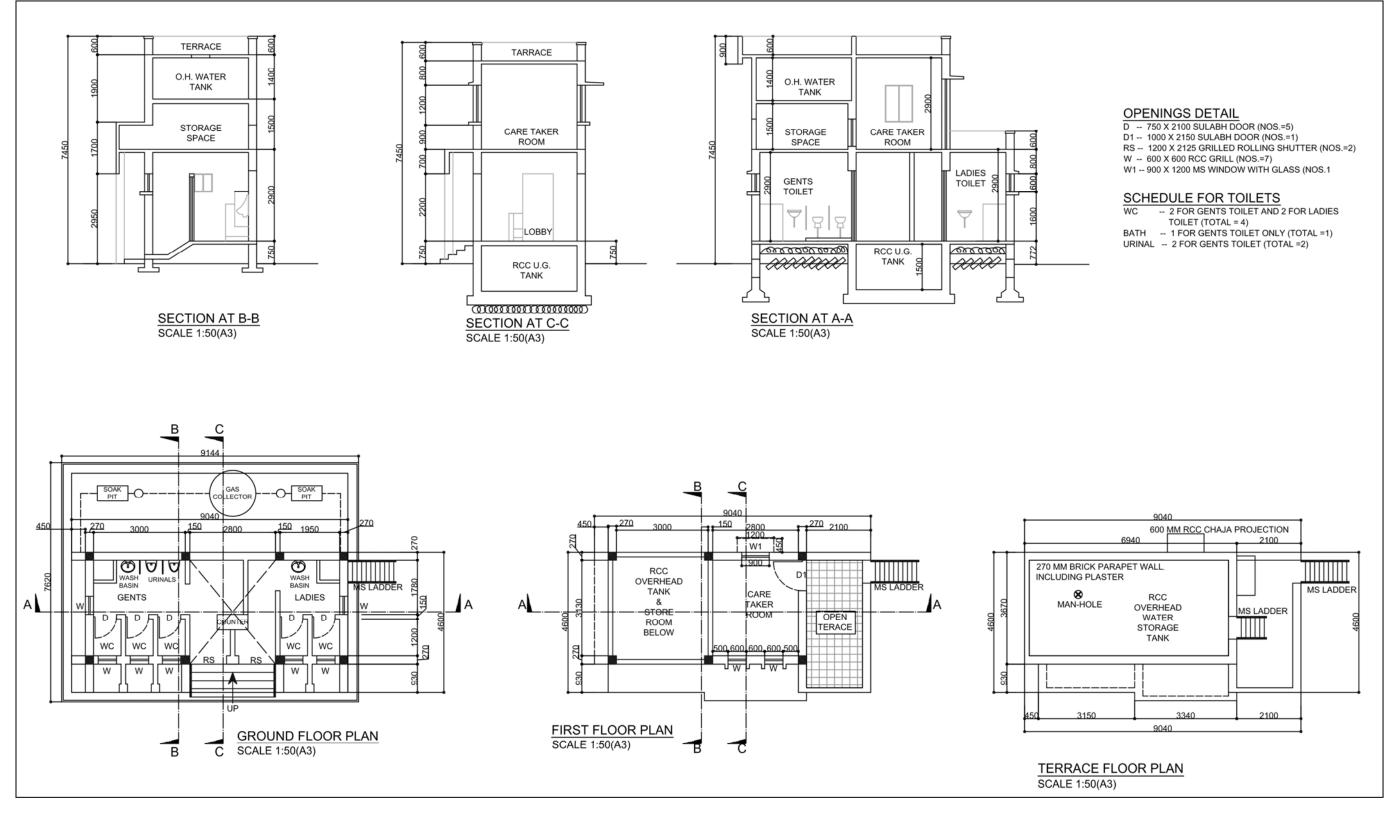


Appendix A4.11 Typical Plan of Existing 10 Seated Public Toilet in Ranchi City (Type of One Floor)

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APPENDIX A4
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Appendix A4.12 Typical Plan and Elevation View of Existing 10 Seated Public Toilet in Ranchi City (Type of Three Floors)



Appendix A4.13 Typical Plan and Elevation View of Existing 5 Seated Public Toilet in Ranchi City

Appendix A5

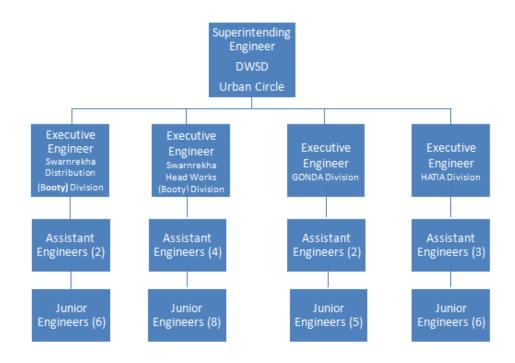
CHAPTER A5 EXISTING ORGANIZATIONS AND INSTITUTIONS

The Twelfth Schedule of the 74th Constitutional Act (Article 243W) has listed the following functions for ULBs:

- Urban Planning including town planning.
- Regulation of land-use and construction of buildings.
- Planning for economic and social development.
- Roads and bridges.
- Water supply for domestic, industrial and commercial purposes.
- Public health, sanitation, conservancy and solid waste management.
- Fire services.
- Urban forestry, protection of the environment and promotion of ecological aspects.
- Safeguarding the interests of weaker sections of society, including the handicapped and mentally retarded.
- Slum improvement and up-gradation.
- Urban poverty alleviation.
- Provision of Urban amenities and facilities such as parks, gardens, playgrounds.
- Promotion of cultural, educational and aesthetic aspects.
- Burials and burial grounds; cremations, cremation grounds and electric crematoriums.
- Cattle pounds; prevention of cruelty to animals.
- Vital statistics including registration of births and deaths.
- Public amenities including street lighting, parking lots, bus stops and public conveniences.
- Regulation of slaughter houses and tanneries.

SI.	Name of Position	Nos.	Qualification	Experience
No.				
1.	Project Director (Technical)	1	Not below the rank of Chief Engineer	Should have managed at least two
			or Equivalent	projects of Rs.100 crores each
2.	Project Director (Economics	1	Not below the rank of Deputy	Minimum 12 yrs
	and Accounts)		Commissioner, Commercial Taxes or	
			equivalent post or MBA for direct	
			Recruitment	
3.	General Manager /Deputy	2	Not below the rank of Chief Engineer/	Should have managed at least two
	General Manager		Superintending Engineer or	projects of Rs. 50 crores each
	(Works/Planning)		Equivalent	
4.	Project Manager	3	Not below the rank of Executive	10 yrs as Assistant Engineer and
	(Works/Planning)		Engineer or equivalent & M.tech /	2yrs for M.tech & 5 years for
			B.tech in Civil Engg for direct	B.tech; Should have managed 5
			recruitment	EPC contracts of at least 100
				crores in total
5.	Officer on Special Duty	1	MBA with 1 st Division	
	(OSD)			
6.	Dy. Project Manager	3	Degree in Civil Engg.	2 Yrs
7.	Structural Engineer	1	M.Tech in Civil Engg	
8.	Water supply Engineer	1	M.Tech in Civil Engg	
9.	Drainage Expert	1	M.Tech in Civil Engg	
10.	Architect	1	M.Arch/B.Arch	3 yrs for B.Arch
11.	IT Officer	1	M.tech in CS/IT or B.Tech in CS/IT	2 yrs/ 5 yrs & 2yrs in GIS/MIS
12.	Asst. Project Manager	6	Degree or Diploma in Civil engg	Minimum 2 yrs for Diploma
				Holder
13.	Private Secretary to the MD	1	Graduation	3 yrs
14.	CAD Operator	2	Diploma in Civil/Mechanical/ITI	3 yrs
15.	Surveyor	2	Diploma in Civil Engg/ITI with 60%	3 yrs
16.	Accountant	1	Graduate in Commerce/ICWA	
			intermediate/CA intermediate	
17.	Manager (HR)	1	MBA	5 yrs
18.	Manager (Economics)	1	Graduate/ Post Graduate in	5 yrs
			Economics	
19.	Legal Executive	1	LL.B (5 yrs course)	
20.	Assistant	1	Graduate with 1 st division	3 yrs

Appendix A5.1 JUIDCO – Proposed Staff



Source: DWSD

Appendix A5.2 URBAN CIRCLE ORGANIZATION IN DWSD

Appendix A5.3 Constitution and Functioning of RMC Board

The "Board of RMC" comprises of Mayor, Deputy Mayor, fifty four councilors, CEO, two Deputy CEO's, Executive Officer and Health Officer.

"Standing Committees" are created to perform specific functions i.e. Budget, Construction Contracts, Procurement, Accounts, etc. The Standing Committee is the policy making body of the Corporation and makes all decisions with respect to the establishment and finances. The Mayor, Deputy Mayor, eleven Ward councillors (one Ward councillor per every five wards), CEO, Deputy CEO's and Health officer form part of the Standing Committee. The members of the Committee are elected by Ward councillors at their first General Body meeting after the municipal elections. "Ward Committees" are

Body/ Committee	Key Roles
General Body	 Taking policy decisions in all RMC matters Giving Administrative approval to project Authorized to appoint specific staff Acquiring authority Sanction of Annual Budget
Standing Committee	 Decision regarding financial matters Award sanctioned to execute tendered work costing more than INR 10,00,000 Preparing Annual Budget
Ward Committee	 Taking policy decisions in all matters pertaining to respective Ward/s under its jurisdiction Giving Administrative approval to projects costing up to INR 5,00,000

constituted with one or more Ward councillors within the territorial area of the Corporation having a population of three hundred thousand or more. Each 'Ward Committee' coordinates with the Standing Committee and assist the Standing Committee in identifying the needs of their respective wards thereby influencing the decision making of the Corporation. The CEO controls and monitors the day to day working of the Corporation and is the implementing authority of the policy decisions

Example: Annual Budgeting process follows seven steps

Step1 Municipal Finance Officer prepares budget papers

Step2 Office Superintendent, RMC, checks the budget papers

Step3 Chief Accounts Officer, RMC, verifies budget papers, puts up to Dy. CEO

Step4 Dy. CEO reviews and puts up for presentation of budget by CEO

Step5 CEO presents budget to 'Standing Committee', who may suggest changes

Step6 CEO presents budget (with changes, if any) to 'Board of RMC' for approval.

S. No.	Department Functions Hierarchy Key Conta									
1.	General	 Key Function of this department include: Issuing of Letter Receiving of Letter Distribution of Letter among Departments Sending Letters by Post 	 Branch Incharge-(1) Assistant-(3) Peon-(5) 	Mr Ramnath Ram Section Incharge						
2.	Confidential	• Basic Function of this department is to carry out all the confidential work under the supervision of Chief Executive Officer i.e. issuance and receipt of letters etc	Clerk-(3)Peon-(4)	Mr. Jai Kumar Prasad Department Head Contact No: 9431576703						
3. A	Health	 Basic Function of this department is to oversee the Sanitation of the city of Ranchi. Key Function of this department include: Disposal of Unclaimed Body Cleaning drains and spraying insecticide through fogging Issuing of Birth and Death Certificates Checking of License of Meat, Flesh Shops Checking of Sanitation Of Schools, Hotels etc Providing Sanitation Certificate 	 Health Officer-(1) Assistant-(2) Midwife-(2) Peon-(4) 	Dr. Ajay Kr. Majhi Health Officer Contact No:9431115817 Mail Id: moh@ranchimunicipal. com						
В	Birth & Death Registration	 Basic Functions of this department is to maintain a record of all birth & death incident under the jurisdiction of RMC Activities of this section are: Receiving of Birth & Death Application. Sending the received application, if required to SDO for the approval of registration. Data entry of received application. Issuance of Birth & Death certificates. 	 Sub – Registrar-(2) Assistant-(1) Computer Operator-(1) Peon-(4) 							
4. A	Engineering	Basic Function of this department is to carry out all the infrastructure	Chief Engineer (1) [Also Heads	Mr N C Chawdhary Chief Engineer						

Appendix A	5.4 Ranchi M	Iunicipal Cori	poration: Sections
	con italicili ita	rumerpur corp	

S. No.	Department	Functions	Hierarchy	Key Contact
		 development activity in the area which comes under RMC. Key Function of this department include: Development and maintenance of road. Development and maintenance of drainage system Facilitate construction of parks, Footpaths, Small Bridges/culverts, pavements 	 Water Board] Superintending Engineers (2) [General - 1; Water Board - 1] Executive Engineer - (3) [General - 2; Water Board - 1] Assistant Engineer - (5) [General - 4; Water Board - 1] Junior Engineer - (9) [General - 7; 	Mr. Vijay kumar Bhagat Superintending Engineer 9431330131
В	Water Supply Section	 Key Function of this department include: Installing Hand Pump, Tap Providing Door to Door Water Connection. Repairing of service connection pipes/ferrules. 	 Water Board – 2] Superintendin g Engineers Executive Engineer Assistant Engineer-1 Junior Engineer – 2 	Mr. Arvind Kr. Sharma Superintending Engineer Mr. Subodh Kr. Sinha Section Incharge
5. A	Jawaharlal Nehru National Urban Renewal Mission (JnNURM)	 The Unit coordinates the activities under this national programme of Min. Of Urban Development, Govt of India. The Team is entrusted with five activities for city up-gradation Basic service to urban poor Ranchi Water Supply Project (<i>Implementation is being done by DWSD</i>) Solid Waste Management City Bus Service Sewerage and Drainage Planning (only of Zone 1). 	 Team Leader Finance officer-(1) Procurement Officer-(1) 	Mr. R. Prashad Team Leader Contact No: 9835167802 Mail Id: ranchi_ramendra@yaho o.co.in
В	Swarna Jayanti Shahari	• This is a Centrally Sponsored Scheme which strives to provide gainful employment to the urban	• Capacity building/ Training Co-ordinator	Ms. Punam Tara Surin Capacity building/ Training Co-ordinator

S. No.	Department	Functions	Hierarchy	Key Contact
	Rozgar	unemployed and	• Assistant-(1)	Contact No:
	Yojana	underemployed poor,		9934583181
		through encouraging the		
	(SJSRY)	setting up of		Mail Id:
		self-employment ventures		punamsurin1@reddiffm
		by the urban poor living below the poverty line.		ail.com
		 Activities of this project 		
		include:		
		 Provide individual and 		
		group loans		
		 Launch Job oriented 		
		training program		
		o Organise community		
		structure for urban poor		
		• 5 components for		
		upliftment of urban		
		poor being:		
		I. USEP: Urban		
		Self		
		employment		
		program II. UWSP: Urban		
		women self help		
		program		
		III. UCDN: Urban		
		community		
		development		
		network		
		IV. STEPUP: Skill		
		training for		
		employment		
		promotion		
		amongst urban		
		v. UWEP: Urban		
		Wage		
		employment		
		Program		
		(presently not		
		running)		
С	RAY	• Rajiv Awas Yojana	Town Planner	Mr. R. Prashad
Ũ		(2013-22) is a scheme of the	(1)	Team Leader
		Government of India for	• Social	
		the benefit of poor in urban	Development	Contact No:
		areas which aims to make	Officer (1)	9835167802
		India slum-free by 2022 by	• MIS Specialist	Mail Id:
		providing people with	(1) Conceitu	ranchi_ramendra@yaho
		shelter or housing free of cost. Basic function of the	• Capacity Building and	-
		team under this	Training	o.co.in
		programme this is to	Co-ordinator	
		provide housing	(1)	
		infrastructure for urban	Project	
		poor	Engineer (1)	

S. No.	Department	Functions	Hierarchy	Key Contact
6.	Town Planning	 This Department is responsible for: Approval of Building Plans. Giving approval for construction of mobile phone signal towers. Demolition of illegal structures Filing cases against Illegal activities Issuing of occupancy certificate for passing of building plans 	 GIS Specialist (1) (NOTE: There is no Hierarchy in RAY) Town Planner-(2) Assistant Engineer-(1) Junior Engineer-(4) Branch Incharge-(1) Assistant-(3) Peon-(4) 	Mr. Gajanand Ram (Town Planner) / Mr. Ghansham Agrawal (Town Planner) Mr. Gajanand Ram's Contact No: 9431929560 Mail Id: gajanandram@gmail.co m
7.	'Market' Department	 Key Function of this department include: Allocation of space for Park etc based on 'Land-Use' map Allotment of shops constructed on RMC Land Lease out Hoarding space to advertisement agencies Allocate space for market on contract e.g. for daily Market Auction out RMC space for Auto Stand, Bus Stand etc Auction out RMC space for Parking Lots Provide permission and space for fairs and exhibitions Provide Municipal Licence to Traders , Lodge / Hotel operators, 	 Assistant Incharge(1) Tax Collector (2) Amin (1) Assistant (2) Peon (2) 	Mr. Manigopal Raha Incharge Contact No:9431592890
8. A	Accounts	 Hostels operators etc Financial functions of this department are Financial advisor to CEO. Preparation of Budget and allocation of funds. Providing financial concurrence for 	 Chief Accountant – cum- Financial Advisor-(1) Accounts Assistant (2) Computer Operator (1) 	Mr. Basant Tiwari Department Head Contact No: 94431176553 Mail Id: accounts@ranchimunic

S. No.	Department	Functions	Hierarchy	Key Contact
		 schemes/ projects. Framing financial policies Internal Audit. Preparation Of Statements: Balance Sheet, Income Expenditure, Cash Flow Statement, Accounting Policy, Receipt Payment, Accounting functions of this department are Passing of bills and making payments Keeping books of accounts and preparing accounts of RMC. Managing Municipal Fund and related bank accounts Managing Provident Fund of RMC employees. All kinds of Final Payments including pensions. Computerized Maintenance of Accounts: Cash Book , Accounting for receipt and Payment, Tax Related functions(service tax, income tax etc),Audit Related Assignment & Compliances. Double accounting based accrual Accounting System It follows JMPG 	• Finance Officer-(1) PIU(JnnURM)	ipal.com
В	Pension	 Key Function of this unit is to: Prepare pension payment documentation of retired staff (including next of kin of those deceased) Sending pension documentation to Bank for release of payment 	 Section Incharge Assistant-(1) 	Mr. Binay Kr. Srivastava Section Incharge
С	Provident Fund	 Key Function of this unit is to: Deduct Money from salary and submit that amount to Bank 	 Section Incharge Assistant-(2) 	Mr. Binay Kr. Srivastava Section Incharge

S. No.	Department	Functions	Hierarchy	Key Contact
		 Preparing Ledger Prepare documentation for staff seeking loan against Provident fund; follow up recovery of loan repayment by staff 		
D	Insurance Unit	 Key Function of this unit is to: Making LIC of employees Make deductions from salary After retirement, to pay group insurance. Run Salary Saving Scheme Makes Group Insurance 	• Assistant-(1)	Mr. Gondiya Oraon Section Incharge
9.	Revenue	 Activities of this section include: Collection of property tax Allotment of 'Holding' numbers Assessment of property Tax Mutation 	 Revenue Officer-(1) Collection In-charge-(1) Supervisor-(8) Assistant-(8) Tax Collector (30) 	Mr. Naresh Sinha Department Head Contact No: 9835345817 Mail Id: ro@ranchimunicipal.co m
10.	Information Technology	 This department is responsible for executing & <i>promoting Ranchi</i> <i>Municipal Corporation.</i> Key Function of this department include: Computerization of all Departments of RMC Customising software Procurement of Software and Hardware Generate MIS reports related to various dept. Of RMC 	 Computer Programmer/ Department Head (1) Computer Operator (15) 	Mr. Rajesh Kumar Department Head Contact No. 9334456161 Mail id:raajjj@ranchimunici pal.com
11.	Legal	Basic Function of this department is to deal with various cases such as Illegal Building case, Holding case etc	 Law Advisor-1 Assistant Law Advisor-1 Section Officer-1 Assistant-4 	Mr. Arvind Kr. Srivastava Law Advisor Contact No:9431115826
12.	Nazarat	 Activities of this section include: Supplying Stationaries Bill Payment Of Petrol Arrangement of Lunch, Function, Meeting etc 	 Assistant(1) Supervisor-(2) Helpers-(5) Driver-(2) Sweeper-(1) 	Mr. Basant Narayan Tiwari Cheif Accountant

S. No.	Department	Functions	Hierarchy	Key Contact
13.	Record	• This Department is responsible for maintaining the Records of all departments of RMC and providing Certified copy of all information	• Record Keeper-(1)	Mr. Ajay Kr. Sahay Record Keeper Contact No:9835323920

Source: JICA Study Team

Salient fact about quantum and type of work of RMC's Engineering Section, Water Supply Section and Health & Sanitation Sections

With focus on water supply, drainage and sewerage, salient facts about the three sections viz. Engineering Section, Water Supply Section and Health & Sanitation Section have been elaborated below.

(1) Engineering section

Basic Function of Engineering section of RMC is to carry out all the infrastructure development activity in the area in its jurisdiction. The key Function of this department include:

- Development and maintenance of roads.
- Development and maintenance of drainage system
- Facilitating construction of Parks, Footpaths, Small Bridges/culverts, Pavements etc.

Maximum value of single work executed in the last three years by this section of RMC is INR 16 Crores (USD 2.6 Million), which was construction of a slaughter house; two other works of similar value are construction of a bus terminus valued at INR 15.5 Crores and two works of construction of a low income group housing buildings valued at INR 10 Crores. The rest of the works are low value works, as low as INR 0.015 Crores (USD 0.0025 Million). The table below indicates the number of works tendered for by the Engineering section during the last two financial years.

Type of works	FY 2011 -2012	2012-2013
Buildings (low income group - Housing)	2	-
Slaughter house	1	-
Bus Terminus	-	1
Roads	170	150
Drains including Culver	169	109
Park renovation	-	6
Total	342	266

Appendix A5.5 Total number of works tendered

The above clearly indicates that the Engineering section is predominantly occupied with outsourcing activity of low value works most part of the year, practically one work per day.

(2) Water Supply Section

As of 2011, with the Jharkhand Municipal Act coming into effect, the nomenclature of the erstwhile 'Water Board' was changed, and hence is referred to as 'Water Supply Section of RMC. The type of works carried out include

- Providing Water Connection
- Revenue collection
- Drilling of wells and installing ground water hand-pumps
- O& M of old ground water hand-pumps

Till date the section has commissioned a total number of 4751 (upto Feb 2014) metered connections. They collect revenue from all individual households in the jurisdiction of RMC and also from bulk users in the Gonda division of DWSD, as mentioned earlier. The other key activity of the section includes installing ground water hand-pumps

	FY 2011 -2012	2012-2013
	(Nos.)	(Nos.)
Ground water hand-pumps installed	321	220
Source: JICA Study Team		

(3) Health & Sanitation Section:

At RMC, the sewerage activity is limited to cleaning of choked drains and cleaning of septic tanks which is carried out by Health & Sanitation Section. The section has four trucks available for removal and disposal of night soil from individual septic tanks; but presently only two are in working condition.

	FY 2011 -2012	2012-2013
Number of septic tanks cleaned	179	329

<u> </u>	Policies And Salient features Organiza			
	Legal Framework	Salent leatures	Organization/ Authority involved	
	"National Urban Sanitation Policy" (2008)	 The salient features of Urban Sanitation Policy are as follows: a) Cities must be open defecation free b) Must eliminate the practice of manual scavenging and provide adequate personnel protection equipment that addresses the safety of sanitation workers c) Municipal sewage and storm water drainage must be safely managed d) Recycle and reuse of treated sewage for non-potable applications should be implemented wherever possible e) Solid waste collected and disposed of fully and safely f) Services to the poor and systems for sustaining results g) Improved public health outcomes and environmental standards 	MoUD / UDD(GoJ)	
2.	74th Constitution al Amendment	74th Constitutional Amendment, enacted by the Parliament in 1993, mandates the State Government to transfer responsibility of water supply and sanitation (WSS) services to the urban local bodies (ULBs) such as Nagar Panchayat (City council), Nagar Palika (Municipality) and Nagar Nigam (Municipal Corporation) in the ascending order of magnitude. This amendment is aimed to strengthen ULBs through devolution of power toward decentralization.	MoUD, UDD(GoJ), RMC	
3.	Jharkhand Municipal Act, 2011	An Act to consolidate and amend the laws relating to the Municipal Governments in the State of Jharkhand in conformity with the provisions of the Constitution of India as amended by the Constitution (Seventy fourth Amendment) Act, 1992, based on the principles of participation in, and decentralization, autonomy and accountability of, urban self-government at various levels, to introduce reforms in financial management and accounting systems, internal resource generation capacity and organizational design of municipalities, to ensure professionalization of the municipal personnel, and to provide for matters connected therewith	UDD(GoJ), RMC	
4.	Water (Prevention And Control Of Pollution) Act, 1974, And its Amendment s	The purpose of this Act is "to provide for the prevention and control of water pollution and the maintenance or restoring wholesomeness of water for the establishment, with a view to carrying out the purpose aforesaid by Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and formatters connected therewith." This is the Act that established the Central and a State Board and also the authority and power to constitute as many committees as it feels essential to carry out specific functions. The Act specifically prohibits 'any poisonous, noxious or polluting matter' into any	CPCB, JSPCB	

Appendix A5.6 Policies and Legal Framework related

with Sewerage and Drainage System

	Policies And Legal Framework	Salient features	Organization/ Authority involved
	Legal Framework	stream or well. Consent from the State Board is required for any type of new discharge into any new stream or well. It also includes consent for "temperature" discharges as done by cooling tower users. In general, this means that a State consent or permit is required for all types of intake and/or discharge of any type of liquid or water either from a running stream or well. Under these rules, "effluent standards to be complied with by persons while causing discharge of sewage or sullage or both" have been specified. Standards for small scale industries have been specified separately. Penalties for non-compliance with the permit or polluting in any way are imprisonment for three months and fine of Rs. 10,000 or fine up to Rs. 5,000 per day of violation or both plus any expenses incurred by the Board for sampling, analysis, inspection etc. Penalties for contravention are specified. Any "director, manager, secretary or other officer of the company may also be deemed to be	involved
		guilty" if proved that the offense occurred with their "consent or connivance." In case of the government, department head could be held liable.	
5.	Water (Prevention And Control Of Pollution) Cess Act, 2003	This law provides for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, with a view to augment the resources of the Central and State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. Industries are specified in Schedule I. They are: 1. Ferrous: Metallurgical industry, 2. Non-Ferrous: Metallurgical industry, 3. Mining industry, 4. Ore processing industry, 5. Petroleum industry, 6. Petro-chemical industry, 7. Chemical industry, 8. Ceramic industry, 9. Cement industry, 10. Textile industry, 11. Paper industry, 12. Fertilizer industry, 13. Coal (including coke) industry, 14. Power (thermal and diesel) generating industry, 15. Processing of animal or vegetable products industry. Collection of cess was based on the quantity of water consumed. The State government had the authority to collect the cess from the industry. The definition of "industry" in the earlier Act of 1997 has been amended to read as "industry includes any operation or process, or treatment and disposal system, which consumes water or gives rise to sewage effluent or trade effluent, but does not include any hydel power unit" and levy of cess for water used for domestic purpose has been duly authorized.	MoEF, CPCB, and JSPCB

	Policies And Legal Framework	Salient features	Organization/ Authority involved
6.	Framework Environment (Protection) Act, 1986	The provisions of this Act, passed in 1986, have strengthened the enforcement of the Water Act1974. The Act was enacted to "provide for the protection and improvement of environment and for matters connected therewith." This act defined environment which includes "water, air, and land and the inter-relationship which exists among and between "water, air and land, and human beings, other living creatures, plants, micro-organisms and property." It also defined a hazardous substance as "any substance or preparation which, by reason of its chemical or physics-chemical properties, or handling, is liable to cause harm to human beings, other living creatures, plants, microorganisms, property or the environment." This law enlists general powers of the central government which included "all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution." The law also included "the standards of quality of air, water, or soil for various areas and purposes, the maximum allowable limits of concentration of various environmental pollutants, procedures and safeguards for the handling of hazardous substances." It empowers the Central Government to establish authorities [under section 3(3)] charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. The Act was last amended in 1991.	MoEF, CPCB
7.	National Environment al Tribunals Act Of 1995	The National Environmental Tribunal Act of 1995 was enacted to provide for strict liability for damages arising out of any accident occurring while handling any hazardous substance and for the establishment of a National Environment Tribunal for effective and expeditious disposal of cases arising from such accidents, with a view to giving relief and compensation for damages to persons, property and the environment and for matters connected therewith or incidental thereto.	MoEF, and State Forest Dept, CPCB, JSPCB,
8.	Hazardous Waste (Managemen t And Handling) Rules, 1989	The Ministry of Environment and Forests came out with Wastes (Management and Handling) Rules, July 1989 under the Environment (Protection) Act, 1986. The main purpose for promulgation of these Rules was for management and handling of hazardous substances. These rules may apply to the conduct of the business of sewerage and sewage treatment if and only if any of its component activities result in hazardous residues as decided by the respective court of law and not arbitrarily by any ULB or other	MoEF, CPCB, and JSPCB

	Policies And Legal Framework	Salient features	Organization/ Authority involved
		statutory agency	
9.	Designated- Best-Use By Central Pollution Control Board, 1981	The Central Pollution Control Board (CPCB) has developed the concept of "designated best use". According to this concept, out of several uses a particular water body is put to, the use which demands the highest quality of water is called its "designated best use", and the water body is designated accordingly. For each of the five defined "designated best uses", the CPCB has identified water quality requirements in terms of few water quality criteria. The "designated best uses" along with respective water quality criteria is given in Table 5.2, Chapter 5, Part A. This classification helps the water quality managers and planners to set water quality targets and identify needs and priority for water quality restoration programmes for various water bodies in the Country.	CPCB, JSPCB
10.	General Standards for Discharge of Environment al Pollutants under the Environment al Protection Rules, 1989 Land Acquisition Act (2013)	 Under the Environment (protection) Rules, the following standards have been stipulated. a) Industry specific standards for emission/effluent discharge (Schedule I) b) General standards for discharge of environmental pollutants (Schedule VI) c) Ambient air quality standards (Schedule III) d) Standards for emission of smoke, vapour, etc., from motor vehicles prescribed in Schedule IV Set out procedures for acquisition of land by government. The act has come to replace The Land Acquisition Act, 1894 covering the R&R and empowering the Gram sabha and PRIs. 	MoEF, CPCB, and JSPCB
12.	National Resettlement and Rehabilitatio n Policy 2007	This policy is prepared by Ministry of Rural Development, Government of India in 2003 and was notified in October 2007 through Gazette of India. The NRRP stipulates the minimum facilities to be ensured for persons displaced due to acquisition of land for public purposes. The basis of the Government's resettlement policy is the NPRR. It provides minimum conditions ensured for persons affected by acquisition of land for public purposes. The objectives of the Policy are: (i) minimize displacement and identify non-displacing or least-displacing alternatives; (ii) plan resettlement and rehabilitation of Project Affected Families (PAFs), considering special needs of tribal and vulnerable sections; (iii) provide a better standard of living for PAFs; (iv) facilitate cooperation between the project proponent	and State Govt MoRD,

	Policies And Legal Framework	Salient features	Organization/ Authority involved
		and PAFs. The Land Acquisition Act, 1894 (LAA) provides the	
		framework for facilitating land acquisition in India. It enables the	
		Government to acquire private lands for public purposes, and helps	
		to ensure that no person is deprived of land except under the Act.4.	
13.	Jharkhand State Resettlement and Rehabilitatio n Policy (2008)	Jharkhand State Resettlement Policy of 2008 recognizes all affected people irrespective of titles and provides provisions for project-assisted resettlement and offers for: (i) resettlement and relocation; (ii) income restoration program; (iii) special attention to vulnerable groups; (iv) time-bound and fair compensation; (v) rebuilding and/or restoration of community resources/facilities.	UDD(GoJ), RMC, Revenue Department
The	following would	d have indirect impact on the project	
14.	The Public Liability Insurance Act, 1991	The purpose of this Act is "to provide for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto. The Act defines an "accident" as involving a fortuitous, sudden or unintentional occurrence while handling any hazardous substance resulting in continuous damage to any property but does not include an accident by reason only of war or radioactivity. Penalty for not taking insurance coverage has also been mentioned in this act. The applicability is contingent on the activity being hazardous.	MoEF, CPCB, and JSPCB
15.	Air (Prevention and Control of Pollution) Act and subsequent amendments (1981)	To provide for the prevention, control and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	CPCB, JSPCB, and Transport Department
16.	The Noise Pollution (Regulation and Control) Rules, and amendments (2000)	Work place noise is covered under Indian factories Act, 1948 but this rule provides safety against noise in ambient condition with generation of noise by certain point and area source.	MoEF, CPCB, and JSPCB
17.	The Factories	The main focus of Factories Act is towards the Health benefits to the workers. Health Chapter of the Act contains specification from Section 11 to 20.	Ministry of Labour and

	Policies And Legal Framework	Salient features	Organization/ Authority involved
	Act (1948)	The Factories Act, 1948 also provides provisions relating to safety measures for the workers employed. The details are discussed between Section 17 to 45	Employment
18.	Building and Other Construction Workers (Regulation of Employment and conditions of Service) Act 1996.	To regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health and welfare measure and for other matter connected therewith or incidental	
19.	The Easements Act, 1882	The Easements Act is perhaps the most important act for public services. Any vacant space of the ULB lying vacant for more than the specified period shall not be alienated by the ULB to any individual unless it is enacted by the state legislature under the act. If such a land has been earmarked for a specific purpose at the time of town planning the same shall not be questioned by the public once the public has set foot over the town planning boundary.	MoUD / UDD(GoJ)
20.	Ranchi Planning Standards & Building Bye-Laws, 2009	The bye-laws called the Ranchi Planning Standards and Building Bye-Laws apply to all building activities in areas within the jurisdiction of Ranchi Municipal Corporation, Ranchi	UDD(GoJ), RMC
21.	National Building Code 2005-Part 9 Plumbing Services (Section 1 Water Supply, Drainage And Sanitation)	This Section covers the basic requirements of water supply for residential, business and other types of buildings, including traffic terminal stations. This Section also deals with general requirements of plumbing connected to public water supply and design of water supply systems. This Section also covers the design, layout, construction and maintenance of drains for foul water, surface water and subsoil water and sewage; together with all ancillary works, such as connections, manholes and inspection chambers used within the building and from building to the connection to a public sewer, private sewer, individual sewage-disposal system, cesspool, soakaway or to other approved point of disposal/ treatment work.	UDD(GoJ), RMC
22.	Manual Scavenging Act 1993	Manual scavenging refers to the removal of animal or human waste/excreta (night soil) using brooms, tin plates and baskets from dry latrine and carrying it to disposal grounds some distance away.	MoUD, UDD(GoJ), RMC

	Policies And Legal Framework	Salient features	Organization/ Authority involved
		Manual scavenging still survives in parts of India without proper sewerage systems. The practice of carrying night-soil on the heads from dry latrines by scavengers has been in existence for centuries in India. The Central Government has formulated the following schemes for the elimination of dry latrines and rehabilitation of manual scavengers in March 2008	
23.	The Notification on Environment al Clearance) (2006)	Notification on Environment Impact Assessment of Development projects - To provide environmental clearance to new development activities following environmental impact assessment.	MoEF, CPCB, JSPCB, and State environmental Impact Appraisal committee
24.	The Municipal Solid Wastes (Managemen t and Handling) Rules (2000)	The rule facilitates and provides methods to manage the Municipal Solid Wastes in an efficient and reusable manner.	MoEF, CPCB, and JSPCB
25.	The Bio-Medical Waste (Management and Handling) Rules, and amendments (1998)		MoEF, CPCB, and JSPCB
26.	E-waste (Managemen t and Handling) Rules (2011)	Due to widespread use of electronic gadgets and equipments for industries and office complexes	MoEF, CPCB, and JSPCB
27.	The Plastics (Manufactur e, Usage and Waste Management	The rule provides the management of plastics waste.	MoEF, CPCB, and JSPCB

	Policies And Legal Framework	Salient features	Organization/ Authority involved
) Rules, (2009)		
28.	The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules (1996)	This rule ensures the preparedness for the emergencies caused by chemical hazards.	MoEF, CPCB, and JSPCB
29.	Forest (Conservatio n) Act (1980)	To protect and manage forests - The Forest Conservation Act 1980 was enacted to help conserve the country's forests. It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government. To this end the Act lays down the pre-requisites for the diversion of forest land for non-forest purposes.	MoEF, and State Forest Dept
30.	Wildlife Protection Act (1972)	The Government of India enacted Wild Life (Protection) Act 1972 with the objective of effectively protecting the wild life of this country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry has proposed further amendments in the law by introducing more rigid measures to strengthen the Act. The objective is to provide protection to the listed endangered flora and fauna and ecologically important protected areas.	MoEF, and State Forest Dept
31.	Fly Ash notification (2007)	Fly ash in construction activities, Responsibilities of Thermal Power Plants and Specifications for use of ash-based products/ responsibility of other agencies,	MoEF, CPCB, and JSPCB
32.	Ancient Monuments and Archaeologi cal sites and Remains Act (1958)	Conservation of Cultural and historical remains found in India.	Archaeological Dept. GOI, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).

Appendix A6

CHAPTER A6 COLLECTED QUESTIONAIRE SHEET FOR SOCIAL BASELINE SURVEY

Appendix A6.1 Questionnaire Sheet for Social Baseline Survey

HOUSEHOLD INTERVIEW ZONE II, III & IV, RANCHI

QUESTIONNAIRE NO.....

This page to be completed by	interviewer
Interviewer	
Supervisor	
Date	

ADDRESS OF HOUSEHOLD (Confidential)

Ward/Commune

Street

Residence Number

Owner Name

1. Please circle the sex of the respondent:

Male.....1 % Female.....2 %

2. How long have you and your family lived in this community or area?

1. Less than 1 year	%
2. Less than 5 years	%
3. Less than 10 years	%
4. Less than 20 years	%
5. More than 21 years	%

Introduction (interviewer should always request the permission to conduct interview prior to conducting the survey).

Hello. My name is _______. This survey is being carried out on behalf of the Sai International Sansthan for the preparatory survey Ranchi sewerage Project. Thank you for taking the time to answer our questions. The information you give us will be confidential and is for the exclusive use of this project. The aim of this interview is to understand existing living conditions, the demand for water and capacity to pay, so that the appropriate Sewerage system and sanitation facilities can be provided in the future.

Α	GENERAL INFORMATION		
Q1.	How many people live in this house:		Percentage
	Total family members of surveyed sample	29	
	Total Number of Male Family members	17	58.6%
	Total Number of Male Family members	12	41.4%
	Total No of Adult population (More than 18 years old)	21	72.4%
	Total No Children (Less than 18 years old)	8	27.6%
	Percentage of Literacy	25	86.2%
	Percentage of Illiteracy	4	13.8%
	Percentage of Male Literacy	16	55.2%
	Percentage of Female Literacy	9	31.0%
Q1-1	Is the head of household:		
		_	05 50
	Male	6	85.7%
	Female	1	14.3%
Q 1-2	How long have the family lived in this community or area?		
Q 1-Z	1. Less than 1 year	1	14.3%
	2. Less than 5 years	6	85.7%
	3. Less than 10 years	0	05.770
	4. Less than 20 years		
	5. More than 21 years		
Q1-3	How much is the total monthly expenditure of the household per month on average	15000	
Q1-4	How much is the average monthly expenditure on the following items, per month		
	Electricity	757.1	5.0%
	Water supply (for household connection)	0.0	0.0%
	Gas	464.3	3.1%
	Fuel (diesel)	1257.2	8.4%
	Sewerage service	0.0	0.0%
	Solid waste collection	0.0	0.0%
	House rent	142.8	1.0%
	Health/treatment	2328.6	15.5%
	Food	5571.4	37.1%
	Others	4478.6	29.9%
Q1-5	What are major news and information sources in the house (Multiple answers are OK.)?		
	1.TV	7	100%
	2. Radio	1	14.3%
	3. Newspapers/magazines	5	71.4%
	4. Pamphlets/posters	0	0.0%
	5. Government announcements	0	0.0%
	6. NGOs/CBOs	0	0.0%
	7. Neighbors	5	71.4%
Q1-6	What are major water sources and monthly consumption by source?		
	1. Household connection	0	00%
	2. Private well (ground water)	7	100%
	3. Public well/tap (water supply)	0	00%
	4. Public well/tap (ground water)	0	00%
	5. River or canal	0	00%
Q1-7.	Where do the family do their laundry?		
	1. Home	7	100%
	2. Public well/tap	0	00%

			3. River c	r canal Others			0% 0%
			4.	UIIEIS			U /0
Q1-8	Please specify the priority for the daily life regarding the improvement of the following sanitation aspects? (Fill all three	1 st F	Priority	2 nd Pri	ority	3 rd I	Priority
	priorities)	7	100%	0	00%	0	00%
	1. Water supply	0	00%	7	100%	0	
	2. Drainage	0	00%	0	00%	7	
	 Sewerage system Public/Community Toilet 	0	00%	0	00%	0	
	5. Solid waste collection and disposal	0	00%	0	00%	0	
	6. Washhouse (wash space)	0	00%	0	00%	0	
	7. Others	0	00%	0	00%	0	
Q1-9	In the last 2 years, has any of the family members had diseases	-	0070	0	0070		007
	, , , , , , , , , , , , , , , , , , ,			1. Yes		1	14.2%
				2. No		6	85.7%
Q 1-10	If the answer is "Yes" in Q1-9, please specify disease(s) (Multip	ole an	swers are	OK.)			
			1. Para		0		0.0%
		-		Cholera	0		0.0%
		3.	Typhoid/		0		0.0%
			,	sentery	1 0		100.09 1009
				Dengue	0		0.09
	7 ()thore	(please s	Malaria	0		0.09
Q 1-11	How do the HHs evaluate the water service which you are mainly			specify)	0		0.07
2 1 11	The double this evaluate the water service which you are mainly		y. Very satis	factory	3		42.9%
	2.		ively satis		3		42.9%
			2	verage	1		14.2%
	4. Re		ly unsatis		0		0.0%
		5. Ve	ry unsatis	factory	0		0.0%
Q 1-12	Is there any problem about the present main water source ? OK.)	<u>(Multi</u>	ole answe	ers are			
			Bad taste		0		00%
	2. Water is				0		0.0%
	3. Frequen				0		0.0%
			int is not e		0		0.0%
			t water pr		0		0.0%
	0.	Takes	s time to p		4 0		100.0%
	8	Othors	s(please s	h Tariff	0		0.0%
Q 1-13	If the above problem is entirely solved, how much are you wi water supply service?				0		0.07
		.ess th	an Rs 20	/month	3		75.0%
	2. More than Rs 20 - L				1		25.0%
	3. More than Rs 40 – L				0		0.0%
	4. More than Rs 60 – L				0		0.0%
	5. More than Rs 80 – Le				0		0.0%
0111			in Rs.100		0		0.0%
Q 1-14	Have the HHs ever heard about the illegal water stealing from the	e exist	• • •		0		0.00
		r		s, often	0		0.09 0.09
		Ζ.	Yes, som	letimes 8. None	0 7		100%
	tions on Sewerage System and Public/Community Toilet		J		1		1007

Sewerage s Q2-2 If t Q2-3 If f Q2-4 If f Q2-4 If f Q2-5 (If f	1. Yes If "Yes", go to Q2-2 2. No If "No", go to Q2-6 system It enswer is 1 "Yes" in Q2-1, what kind of a disposal system do you have? 1. Sewer connection 1. Sewer connection 2. Septic tank (connecting with a soak pit or trench) 3. Pour-flush latrine (using water)/Barapali 4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory 5. Very unsatisfactory	6 1 0 6 0 0 0 0 0 0 0 0 0 0	85.7% 14.2% 0.0% 100.0% 0.0% 0.0% 0.0%
Q2-2 If t Q2-3 If t Se Q2-4 If t an Q2-5 (If	system the answer is 1 "Yes" in Q2-1, what kind of a disposal system do you have? 1. Sewer connection 2. Septic tank (connecting with a soak pit or trench) 3. Pour-flush latrine (using water)/Barapali 4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) the answer is 1 "Sewer Connection" in Q2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	0 6 0 0 0 0 0	0.0% 100.0% 0.0% 0.0% 0.0%
Q2-2 If t Q2-3 If t Q2-3 If t Q2-4 If t Q2-4 If t Q2-5 (If t	ithe answer is 1 "Yes" in Q2-1, what kind of a disposal system do you have? 1. Sewer connection 2. Septic tank (connecting with a soak pit or trench) 3. Pour-flush latrine (using water)/Barapali 4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) ithe answer is 1 "Sewer Connection" in Q2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively unsatisfactory 3. Average 4. Relatively unsatisfactory	6 0 0 0 0 0	100.0% 0.0% 0.0% 0.0%
Q2-3 <u>If</u> se Q2-4 <u>If</u> an	1. Sewer connection 2. Septic tank (connecting with a soak pit or trench) 3. Pour-flush latrine (using water)/Barapali 4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) The answer is 1 "Sewer Connection" in O2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	6 0 0 0 0 0	100.0% 0.0% 0.0% 0.0%
Q2-4 <u>If 1</u> an Q2-5 <u>(If</u>	2. Septic tank (connecting with a soak pit or trench) 3. Pour-flush latrine (using water)/Barapali 4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) the answer is 1 "Sewer Connection" in O2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	6 0 0 0 0 0	100.0% 0.0% 0.0% 0.0%
Q2-4 <u>If 1</u> an Q2-5 <u>(If</u>	2. Septic tank (connecting with a soak pit or trench) 3. Pour-flush latrine (using water)/Barapali 4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) the answer is 1 "Sewer Connection" in O2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	6 0 0 0 0 0	100.0% 0.0% 0.0% 0.0%
Q2-4 <u>If 1</u> an Q2-5 <u>(If</u>	3. Pour-flush latrine (using water)/Barapali 4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) the answer is 1 "Sewer Connection" in Q2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	0 0 0 0	0.0% 0.0% 0.0%
Q2-4 <u>If 1</u> an Q2-5 <u>(If</u>	4. Pit latrine (not using water) 5. Direct discharge into ditch, drain or river 6. Others (please specify) (the answer is 1 "Sewer Connection" in Q2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	0 0 0	0.0%
Q2-4 <u>If 1</u> an Q2-5 <u>(If</u>	6. Others (please specify) <u>the answer is 1 "Sewer Connection" in O2-2, how do HH evaluate the present</u> ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	0	
Q2-4 <u>If 1</u> an Q2-5 <u>(If</u>	the answer is 1 "Sewer Connection" in Q2-2, how do HH evaluate the present ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory	0	0.0%
Q2-4 <u>If 1</u> an Q2-5 <u>(If</u>	ewer connection in your house? 1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory		
Q2-4 <u>If 1</u> an	1. Very satisfactory 2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory		
<u>an</u> Q2-5 <u>(If</u>	2. Relatively satisfactory 3. Average 4. Relatively unsatisfactory		0.00/
<u>an</u> Q2-5 <u>(If</u>	3. Average 4. Relatively unsatisfactory	0	0.0%
<u>an</u> Q2-5 <u>(If</u>	4. Relatively unsatisfactory		0.0%
<u>an</u> Q2-5 <u>(If</u>		0 0	0.0% 0.0%
<u>an</u> Q2-5 <u>(If</u>		0	0.0%
<u>an</u> Q2-5 <u>(If</u>	the answer is not "very satisfactory" in Q2-3 , what are major reasons? (Multiple	0	0.0%
Q2-5 <u>(If</u>	nswers are OK.)		
	1. Offensive odor (bad smell)	0	0.0%
	2. Pipe clogging	0	0.0%
	3. Overflow of wastewater	0	0.0%
	4. User charge is more	0	0.0%
	5. Others (please specify:)	0	0.0%
	f the answer is not "very satisfactory" in Q2-3) If the sewer connection condition is nproved, how much are HH willing to pay for sewer user charge per month?		
	1. Less than Rs 20/month	0	0.0%
	2. More than Rs 20 - Less than Rs 40/month	ů –	0.0%
	3. More than Rs 40 – Less than Rs 60/month	0	0.0%
	4. More than Rs 60 – Less than Rs 80/month	0	0.0%
	5. More than Rs 80 – Less than Rs 100/month	0	0.0%
	6. More than Rs.100/month	0	0.0%
•	<i>(all person <u>except for</u> those who chose 1 "Sewer Connection" in Q2-2)</i> Do the IH want to have a sewer connection in the house?		
	1. Yes	7	100%
	2. No (please specify reason)	0	0.0%
Q2-7 (a	<i>(all person except for those who chose 1 "Sewer Connection" in Q2-2)</i> If the	-	
an	nswer is 1 "Yes" in Q2-6, how much are they willing to pay for <u>connection of sewer</u> b your house (may include set up a toilet at your house)?		
	1. Less than Rs 100	Л	57.1%
	2. More than Rs 100 - Less than Rs 500	4 3	37.1% 42.9%
	3. More than Rs 500 – Less than Rs 1,000	0	42.9%
	4. More than Rs 1,000	0	0.0%
	5. As prescribed by the Government (depending on the distance to the main sewer	0	0.0%
	pipe)	0	0.0%
	6. I do not want to pay (please specify reason)	Ŭ	0.070
Q2-8 (a	<i>(all person except for those who chose 1 "Sewer Connection" in Q2-2)</i> If the		
an <u>pe</u>			

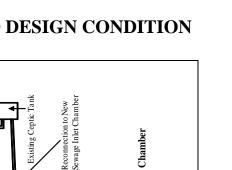
1. Less than Rs 20/month	4	57.1%
2. More than Rs 20 - Less than Rs 40/month	3	42.9%
3. More than Rs 40 – Less than Rs 60/month	0	0.0%
4. More than Rs 60 – Less than Rs 80/month	0	0.0%
5. More than Rs 80 – Less than Rs 100/month	0	0.0%
6. More than Rs.100/month	0	0.0%
Public/Community Toilet		
Q2-9 (only for those who chose 2 "No" in Q2-1), where do HH dispose excreta?		
1. Public/Community toilet	0	0.0%
2. Ditch, drain or river	0	0.0%
3. Open space	1	100%
4. Household backyard	0	0.0%
5. Others (please specify)	0	0.0%
Q2-10 (all person) Are there any public/community toilet(s) in HHs community (near the house)?		
1. Yes (distance to the toilet: aroundm)	0	0.0%
2. No	7	100%
Q2-11 If the answer is 1 "Yes" in Q2-10, how often do HH use the public/community toilet(s) in your community?		
1. Everyday	0	0.0%
2. Sometimes	0	0.0%
3. Rarely	0	0.0%
4. I do not use (please specify reason)	0	0.0%
Q2-12 If the answer is 1 "Yes" in Q2-10, how do HH evaluate the present public/community		
toilet service in your community? 1. Very satisfactory	0	0.0%
2. Relatively satisfactory	0	0.0%
2. Relatively satisfactory 3. Average	0	0.0%
4. Relatively unsatisfactory	0	0.0%
5. Very unsatisfactory	0	0.0%
Q2-13 If the answer is 1 "Yes" in Q2-10 and not "very satisfactory" in Q2-12, what are		
major reasons? (Multiple answers are OK.)		
1. Dirty	0	0.0%
2. Overflow of wastewater	0	0.0%
3. Congestion	0	0.0%
4. Long distance to the toilet	0	0.0%
5. Charge is more	0	0.0%
6. I do not want to pay	0	0.0%
7. Facility wants to use is not installed (please specify:)	0	0.0%
8. Others (please specify:)	0	0.0%
Q2-14. (Only for those who chose 2 "No" in Q2-10) Do HH want to have public/community toile(s) in their community (area) ?		
1. Yes	7	100%
2. No (please specify reason)	0	0.0%
Q2-15 (Only for those who chose 2 "No" in Q2-10) If the answer is 1 "Yes" in Q2-14,		
where public/community toilet(s) should be set up?		0.004
1. Park	0	0.0%

	- 1		
0.0%	0	2. River side	
0.0%	0	3. Major road side	
28.6%	2	4. Open space	
71.4%	5	5. Core area of community	
0.0%	0	6. Near my house	
0.0%	0	7. Others (please specify:)	
		(Only for those who chose 2 "No" in Q2-10) If the answer is 1 "Yes" in Q2-14, in order to set up public/community toilet(s) in your community (area), are HH willing to cooperate?	Q2-16
100%	7	1. Yes	
0.0%	0	2. No (please specify reason)	
		(Only for those who chose 2 "No" in Q2-10) If the answer is 1 "Yes" in Q2-16, how can HH cooperate (Multiple answers are OK.)?	Q2-17
100%	7	1. Provide financial resources	
0.0%	0	2. Provide labor power (for construction)	
0.0%	0	3. Provide labor power (for operation and maintenance, cleaning)	
0.0%	0	4. Provide land	
85.7%	6	5. Provide idea and opinion	
0.0%	0	6. Others (please specify)	
		(all names) they much are the willing to new for using public/community toilet(c) nor	02.10
		(all person) How much are HH willing to pay for using public/community toilet(s) per time?	Q2-18
100%	7	1. Less than Rs 1/time	
0.0%	0	2. More than Rs 1 - Less than Rs 2/time	
0.0%	0	3. More than Rs 2 – Less than Rs 4/time	
0.0%	0	4. More than Rs 4/time	
0.0%	0	5. I do not want to pay (please specify reason)	
0.0%	0	6. Others (please specify)	
		(all person) How do the HH think the present public/community toilet service should	Q2-19
		be improved ? (Multiple answers are OK.)	
85.7%	6	1. More public/community toilets are necessary	
71.4%	5	2. Public/community toilets should be cleaned	
14.3%	1	3. Shower facility should be installed	
0.0%	0	4. Washing space should be installed	
57.1%	4	5. Separated toilet rooms for women should be arranged	
57.1%	4	6. Charging system should be reviewed (ex. Introduction of a family pass or	
0111170		monthly pass)	
0.0%	0	7. Others (please specify:	
		Presently how much expend on sewerage	Q2-20
85.7%	6	1. Less than Rs 20/month	
14.2%	1	2. More than Rs 20 - Less than Rs 40/month	
0.0%	0	3. More than Rs 40 – Less than Rs 60/month	
0.0%	0	4. More than Rs 60 – Less than Rs 80/month	
0.0%	0	5. More than Rs 80 – Less than Rs 100/month	
0.0%	0	6. More than Rs.100/month	

	3. Questions on Public Participation & Public Awareness		
Q3-1	Are there any community-based activities on sanitary programs in your community		
201	(area) ?		
	1. <u>Yes_If "Yes", go to Q3-2</u>	0	0.0%
	2. No <u>If "No", go to Q3-4</u>	7	100%
Q3-2	If the answer is 1 "Yes" in Q3-1, what types of community-based activities are		
	conducted? (Multiple answers are OK)		
	1. Operate (cleaning) public toilets	0	0.0%
	2. Operate water supply system	0	0.0%
	3. Solid waste collection/Cleaning	0	0.0%
	4. Health/hygiene education/training program	0	0.0%
	5. Environmental awareness enhancement campaign	0	$0.0\% \\ 0.0\%$
	 Community meetings regarding sanitation issues Others (please specify) 	0	0.0%
Q3-3	If the answer is 1 "Yes" in Q3-1, have HHs ever participated in or contributed to these	0	0.0%
	community-based activities?		
	1. Yes, I have participated in/contribute to	0	0.0%
	please choose the number/s from Q3-2).	0	0.0%
	2. No		
Q3-4	(all person) Do HH think community-based sanitation improvement activities such as		
	cleaning the community and education program/training on sanitary issues are		
	necessary? 1. Very necessary	7	100%
	2. Somewhat necessary	0	0.0%
	3. Not very necessary	0	0.0%
	4. Not necessary at all (please specify reason)	ů –	0.0%
Q3-5	(all person) If HH have a chance, are you willing to participate in community-based	-	
	sanitation improvement activities? (Multiple answers are OK)		
	1. yes, I am willing to participate in operating (cleaning) public/community toilet	5	71.4%
	2. Yes, I am willing to participate in operating (cleaning) public/community tolet	1	14.3%
	3. Yes, I am willing to participate in campaigns for raising awareness of people	0	0.0%
	4. Yes, I am willing to participate in education program/training on sanitation	2	28.6%
	5. Yes, I am willing to participate in	0	0.0%
	6. No, I do not want to participate in any activities (please specify reason	0	0.0%
Q3-6	(all person) Have HHs ever been taught or informed environmental and hygiene		
200	issues such as the health and environmental impacts caused by polluted water or solid		
	waste?		
	1. Yes	7	100%
	2. No	0	0.0%
Q3-7	If the answer is 1 "Yes" in Q3-6, who taught these to HHs? (Multiple answers are OK)		
	1. Family members	7	100%
	2. Community people/Neighbors	2	28.6%
	3. School	6	85.7%
	4. Municipal Corporation	0	0.0%
	5. Central/State government	0	0.0%
	6. NGO/CBO (please specify)	0	0.0%
	7. Donor agencies (please specify)	0	0.0%
	8. TV program	0	0.0%
	9 Radio program	4	57.1%
	10. Newspaper and magazine	0 3	0.0%
		3	42.9%

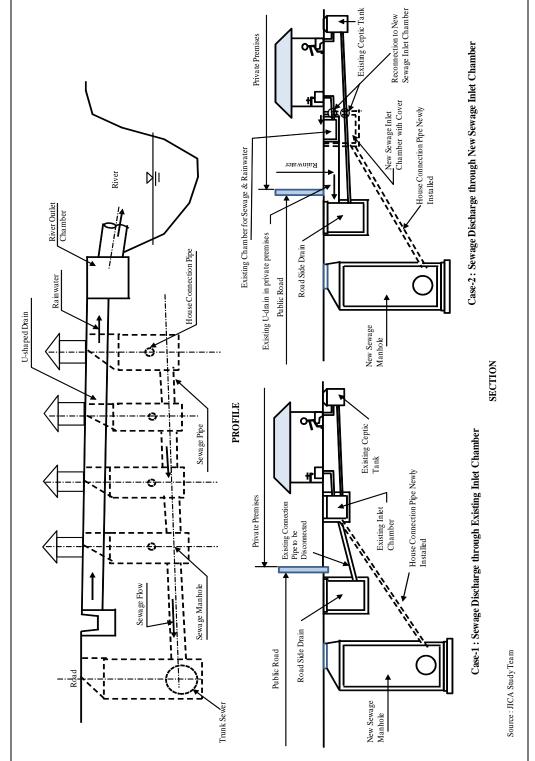
	11. Pamphlet, booklet, posters	0	0.0%
	12. Others (please specify)	0	0.0%
Q3-8	Do HH know about services provided by Ranchi Municipal Corporation		
	1. Yes	6	85.7%
01.0	2. No	1	14.2%
Q3-9	If the answer is 1 "Yes" in Q3-8, do HH use these services?		
	1. House tax	6	100%
	2. Latrine tax	6	100%
	3. Water tax	6	100%
	4. E.P.E. Cess	6	100%
	4. Questions on Solid Waste Collection Services (only for slum areas)		
Q4-1	Are there waste collection services in this community (area)? N=46		
	1. Yes <u>If "Yes", go to Q4-2</u>	0	0.0%
	2. No <u>If "No", go to Q4-6</u>	7	100%
Q4-2	If the answer is 1 "Yes" in Q4-1, do HHs use these services?		
	1. Yes	0	0.0%
	2. No (please specify reasons)	0	0.0%
Q4-3	If the answer is 1 "Yes" in Q4-1, how is the waste collected?		
	1. Collection workers or sweepers collect wastes from door to door	0	0.0%
	2. We carry wastes to a specified collection point	0	0.0%
	3. We directly carry wastes to a collection container/ truck / vehicle.	0	0.0%
	4. Others (please specify)	0	0.0%
Q4-4	If the answer is 1 "Yes" in Q4-1, how often is the waste collected?		
	1. Daily	0	0.0%
	2. Two or three times a week	0	0.0%
	3. Once a week	0	0.0%
	4. Two or three times a month	0	0.0%
	5. Less than once a month	0	0.0%
045	6. Irregular	0	0.0%
Q4-5	If the answer is 1 " Yes " in Q4-1 , how do the HHs evaluate the present collection service? (Multiple answers are OK)		
	1. Waste collection / sweeping is not properly done	0	0.0%
	2. Waste collection / sweeping frequency is too low	0	0.0%
	3. Waste collection / sweeping is irregular	0	0.0%
	4. Waste collection time is too early or too late or irregular	0	0.0%
	5. (ask people who are paying fees) Waste collection / sweeping fee is more	0	0.0%
	6. Waste collection point is too far away	0	0.00/
	7. Other (please specify :)	0	0.0%
	8. Satisfactory	0	0.0%
Q4-6.	(Only for those who chose 2 "No" in Q4-1) Do the HHs want to receive a waste collection service?		
	1. Yes	7	100%
	2. No (please specify reasons:	0	0.0%

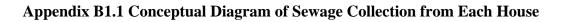
Appendix B1



APPENDIX B1

CHAPTER B1 SET UP PLANNING AND DESIGN CONDITION





Appendix B1.2 Flow Table (1/3)

Sewage Discharge Calculation for Pump and Rising Main (Year 2031) - Separate System 1) Zone-II, Trunk Sewer : TR-1 (West Route)

		uik St we		(west Koute	.)				1				
	Division No.	Flow into	Segment Atea	Accumulated Area	Daily Mean Sewage Generation (m3/day) in 2031 Design Discharge for Trunk Sewer (m3/sec						k Sewer (m3/sec)	Remarks	
Trunk Line	Branch Line		(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated		
1			126	126	715	143	36	895	0.021	0.021	0.021		
2													
			27	153	153	31	13	197	0.005	0.005	0.025	MP-8 flow	
3			27	180	767	153	19	939	0.022	0.022	0.047		
4			109	289	1,456	291	39	1,786	0.041	0.041	0.088		
	5	→6											
		DG 1 0	33	33	1,399	280	21	1,700	0.039	0.039	0.039		
6		\rightarrow PS-1 \rightarrow 9	359	721	3,300	660	105	4,066	0.094	0.094	0.257	PS-1 flow	
	7	$\rightarrow 6$	40	40	1,260	252	21	1,533	0.035	0.035	0.035		
	8	→9	62	62	607	121	18	746	0.017	0.017	0.017		
			02	02	007	121	10	/40	0.017	0.017	0.017		
9			55	838	812	162	23	998	0.023	0.023	0.298		
10			50	888	738	148	22	908	0.021	0.021	0.319		
	11		470	170	2 510	702	102	1226	0.100	0.100	0.100		
			470	470	3,510	702	123	4,336	0.100	0.100	0.100		
	12	→13	129	599	2,317	463	48	2,829	0.065	0.065	0.166		
13		\rightarrow PS-2 \rightarrow 18	52	1,910	893	179	23	1,094	0.025	0.025	0.774	PS-2 flow	
	14	→16											
			56	56	1,169	234	23	1,426	0.033	0.033	0.033		
	15		75	75	1,459	292	29	1,780	0.041	0.041	0.041		
	16	→13	160	291	5,530	1,106	89	6,724	0.156	0.156	0.230		
	17	. 12	100	291	3,330	1,100	89	0,724	0.150	0.130	0.230		
	17	→13	80	80	1,226	245	28	1,499	0.035	0.035	0.035		
18			78	1,988	1,212	242	33	1,488	0.034	0.034	0.809		
19												g	
19			47	2,035	731	146	22	898	0.021	0.021	0.967	flow joining from TR-2	
	20	→22	138	138	3,474	695	63	4,232	0.098	0.098	0.098		
		\rightarrow MP-4 \rightarrow			-,			.,					
	21	22	38	38	904	181	17	1,102	0.025	0.025	0.025	MP-4 flow	
	22	→23	7.		1.000	200		1.242	0.021	0.021	0.4		
			71	247	1,098	220	25	1,343	0.031	0.031	0.155		
23			36	2,318	386	77	13	477	0.011	0.011	1.133		
24		→ Pipe junction	891	3,209	4,379	876	214	5,468	0.127	0.127	1.260		
	24 to Junc	v		.,				-,			1.260	Junction with TR-3	
	unction to											TR-3 Zone II total	
				•		•	1					1	

Appendix B1.2 Flow Table (2/3)

$Sewage \ Discharge \ Calculation \ for \ Pump \ and \ Rising \ Main \ (Year \ 2031) \ - \ Separate \ System$

2) Zone-II, Trunk Sewer : TR-2 (South Route)

	oivision lo.		Segment Atea	Accumulate d Area	Daily N	Aean Sewage C	eneration (m3/da	y) in 2031	Design I	Discharge for T (m3/sec)	runk Sewer	
Trunk Line	Branch Line	Flow into	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	
1												
			34	34	332	66	11	410	0.009	0.009	0.009	
2			48	82	469	94	19	581	0.013	0.013	0.023	
2												
3			66	148	760	152	23	935	0.022	0.022	0.045	
4	R.M.	\rightarrow MP-3 \rightarrow										
7	10.001	6	82	230	463	93	25	581	0.013	0.013	0.058	MP-3 flow
5												
			26	26	376	75	13	463	0.011	0.011	0.011	
6				20.4							0.000	
			38	294	388	78	15	481	0.011	0.011	0.080	
		\rightarrow PS-3 \rightarrow										
7	R.M.	TR-1 18	199	493	2,032	406	63	2,502	0.058	0.058	0.138	PS-3 flow

Source: JICA Study Team

3) Zone-II, Trunk Sewer : TR-3 (North Route - West Line)

		link St we		North Rou		Linc)						
	Division lo.	Flow into	Segment Atea	Accumulate d Area		Aean Sewage C	eneration (m3/da	y) in 2031	Design l	Discharge for 7 (m3/sec)	Frunk Sewer	Remarks
Trunk Line	Branch Line		(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	
1												
1			26	26	330	66	11	407	0.009	0.009	0.009	
2			10	36	154	31	6	192	0.004	0.004	0.014	MP-7 flow =0.023
	3	$\rightarrow 4$	36	36	434	87	11	532	0.012	0.012	0.012	
4												
			60	132	927	185	28	1,140	0.026	0.026	0.053	
5		→PS-4→7	90	222	1,620	324	41	1,985	0.046	0.046	0.419	flow joining from TR-4, PS-4 flow
	6	→7										
	0	~1	35	35	608	122	13	742	0.017	0.017	0.017	
7			21	278	303	61	10	373	0.009	0.009	0.445	
	8											
	Ŭ		112	112	1,351	270	35	1,656	0.038	0.038	0.038	
	9	$\rightarrow 10$	111	223	2,075	415	43	2,533	0.059	0.059	0.097	
10								,				
10			22	523	394	79	12	485	0.011	0.011	0.553	
11			75	598	1,031	206	28	1,265	0.029	0.029	0.610	flow joining from NH33 line(MP-2
			15		1,051	200	20	1,200	0.029	0.02)		
												a
12			53	651	653	131	20	804	0.019	0.019	0.656	flow joining from NH33 line(MP- 6), PS-6 flow
13		\rightarrow Pipe										
		junction	237	888	2,262	452	72	2,787	0.065	0.065	0.720	
1	3 to Junc	tion						<u> </u>			0.720	Junction with TR-1

Appendix B1.2 Flow Table (3/3)

Sewage Discharge Calculation for Pump and Rising Main (Year 2031) - Separate System 4) Zone-II, Trunk Sewer : TR-4 (North Route - East Line)

	/			(North Ko	ate - Last	Linc)						
	Division No.	Flow into	Segment Atea	Accumulate d Area	Daily N	Aean Sewage C	eneration (m3/day	y) in 2046	Design Disc	harge for Trun	k Sewer (m3/sec)	
Trunk Line	Branch Line	Flow into	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	
1			92	92	935	187	31	1,152	0.027	0.027	0.027	
2			70	162	711	142	25	879	0.020	0.020	0.047	
3			60	222	610	122	24	755	0.017	0.017	0.064	
	4	\rightarrow MP-5 \rightarrow 7	90	90	816	163	25	1,005	0.023	0.023	0.023	MP-5 flow
	5	→7						,				
	6	→7	83	83	753	151	23	927	0.021	0.021	0.021	
			78	78	744	149	22	914	0.021	0.021	0.021	
	7	→PS-5→9	915	1,166	3,888	778	208	4,874	0.113	0.113	0.179	
8		\rightarrow PS-5 \rightarrow 9	119	1,507	1,209	242	35	1,486	0.034	0.034	0.278	PS-5 flow
9		→PS-4	133	1,640	1,509	302	45	1,855	0.043	0.043	0.321	flow into PS-4 of TR-3

Source: JICA Study Team

5) Zone-II, Trunk Sewer : TR-5 (North Route - NH33 Line)

	Division Io.		Segment Atea	Accumulate d Area		1ean Sewage C	eneration (m3/da	y) in 2031	Design Disc	harge for Trunl	k Sewer (m3/sec)	
Trunk Line	Branch Line	Flow into	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	
1		\rightarrow MP-1 \rightarrow										
1		2	13	13	179	36	4	219	0.005	0.005	0.005	MP-1 flow
		→MP-2→										
2		TR-3, 11	58	71	798	160	23	981	0.023	0.023	0.028	flow into TR-2 No.11, MP-2 flow
		→MP-6→										
3		TR-3, 12	230	230	928	186	52	1,165	0.027	0.027	0.027	flow into TR-3 No.12, MP-6 flow

Appendix B1.3 Flow Table (1/3)

Sewage Discharge Calculation for Trunk Main (Year 2046) - Separate System 1) Zone-II, Trunk Sewer : TR-1 (West Route)

Area I	Division No.			Accumulated Area		Aean Sewage C	eneration (m3/da	y) in 2046	Design Dis	charge for Trun	k Sewer (m3/sec)	
Trunk Line	Branch Line	Flow into	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	Remarks
1										,		
1			126	126	871	174	37	1,082	0.025	0.025	0.025	
2			27	153	187	37	13	237	0.005	0.005	0.031	
-			21	100	10,	51	15	201	0.005	0.000	0.051	
3			27	180	806	161	18	986	0.023	0.023	0.053	
4			109	289	1,599	320	38	1,956	0.045	0.045	0.099	
	-		105	205	1,000	520	50	1,550	0.045	0.045	0.077	
	5	→6	33	33	1,476	295	20	1,791	0.041	0.041	0.041	
6		\rightarrow PS-1 \rightarrow 9	359	721	3,768	754	104	4,626	0.107	0.107	0.286	
			339	/21	3,708	754	104	4,020	0.107	0.107	0.280	
	7	→6	40	40	1,366	273	20	1,659	0.038	0.038	0.038	
	8	→9	(2)		701	140	10	050	0.020	0.020	0.020	
			62	62	701	140	18	859	0.020	0.020	0.020	
9			55	838	909	182	23	1,114	0.026	0.026	0.331	
10												
			50	888	826	165	22	1,014	0.023	0.023	0.355	
	11		470	470	4,170	834	124	5,127	0.119	0.119	0.119	
	12	→13										
	12	\rightarrow PS-2 \rightarrow	129	599	2,608	522	47	3,177	0.074	0.074	0.192	
13		$\rightarrow PS-2 \rightarrow 18$	52	1,910	1,004	201	22	1,227	0.028	0.028	0.872	
	14	→16										
	14	710	56	56	1,396	279	23	1,699	0.039	0.039	0.039	
	15		75	75	1,698	340	29	2,067	0.048	0.048	0.048	
	16	.12			-,			_,				
	16	→13	160	291	5,995	1,199	84	7,279	0.168	0.168	0.256	
	17	→13	80	80	1,448	290	28	1,766	0.041	0.041	0.041	
10			00		1,440	250	20	1,700	0.041	0.041	0.041	
18			78	1,988	1,389	278	33	1,700	0.039	0.039	0.911	
19			47	2,035	837	167	22	1,026	0.024	0.024	1 000	flow joining from
	20		7/	2,033	007	10/	22	1,020	0.024	0.024	1.098	
	20	→22	138	138	3,983	797	62	4,842	0.112	0.112	0.112	
	21	\rightarrow MP-4 \rightarrow										
		22	38	38	1,037	207	16	1,261	0.029	0.029	0.029	
	22	→23			1 000	07.5		1.550	0.027	0.025		
			71	247	1,282	256	25	1,563	0.036	0.036	0.177	
23			36	2,318	469	94	13	577	0.013	0.013	1.289	
24		\rightarrow Pipe										
		junction	891	3,209	5,706	1,141	219	7,067	0.164	0.164	1.452	
	24 to Junc	tion									1.452	Junction with TR-3
	unction to	STP lv Team									2.3	Zone II total

Appendix B1.3 Flow Table (2/3)

Sewage Discharge Calculation for Trunk Main (Year 2046) - Separate System

2) Zone-II, Trunk Sewer : TR-2 (South Route)

	Division No.		Segment Atea	Accumulated Area	Daily N	/lean Sewage C	eneration (m3/da	y) in 2046	Design Disc	harge for Trun	k Sewer (m3/sec)	
		Flow into							Ľ.	-		Remarks
Trunk Line	Branch Line	110w linto	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	Remarks
1											0.014	
			34	34	398	80	11	489	0.011	0.011	0.011	
2			48	82	562	112	19	693	0.016	0.016	0.027	
2												
3			66	148	892	178	23	1,093	0.025	0.025	0.053	
4	R.M.	\rightarrow MP-3 \rightarrow										
-		6	82	230	572	114	25	712	0.016	0.016	0.069	
5												
-			26	26	434	87	13	534	0.012	0.012	0.012	
6				294	1.50		15		0.012	0.010	0.095	
			38	294	460	92	15	567	0.013	0.013	0.095	
7	R.M.	\rightarrow PS-3 \rightarrow										
,		TR-1, 18	199	493	2,407	481	64	2,952	0.068	0.068	0.163	

Source: JICA Study Team

3) Zone-II, Trunk Sewer : TR-3 (North Route - West Line)

	Division No.	Flow into	Segment Atea	Accumulated Area	Daily N	Aean Sewage C	eneration (m3/da	y) in 2046	Design Disc	charge for Trun	k Sewer (m3/sec)	Remarks
Trunk Line	Branch Line		(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	
1			26	26	399	80	11	490	0.011	0.011	0.011	
2												
_			10	36	184	37	6	226	0.005	0.005	0.017	
	3	$\rightarrow 4$	36	36	524	105	11	641	0.015	0.015	0.015	
4			60	132	1,101	220	28	1,350	0.031	0.031	0.063	
					-,			-,				
5	(R.M.)	→PS-4→7	90	222	1,910	382	41	2,333	0.054	0.054	0.495	flow joining from TR-4
	6	→7	35	35	718	144	13	874	0.020	0.020	0.020	
7												
,			21	278	359	72	10	440	0.010	0.010	0.526	
	8		112	112	1,632	326	35	1,993	0.046	0.046	0.046	
	9	$\rightarrow 10$	111	223	2,377	475	42	2,894	0.067	0.067	0.113	
10												
10			22	523	461	92	12	565	0.013	0.013	0.652	
11			75	598	1,220	244	28	1,492	0.035	0.035	0.720	flow joining from TR-5 line(MP-2)
12				651							0.774	flow joining from
12			53	651	776	155	20	952	0.022	0.022	0.774	TR-5 (MP-6)
13		\rightarrow Pipe junction	237	888	2,722	544	73	3,339	0.077	0.077	0.852	
								-,				
1	13 to Junc	tion									0.852	Junction with West Route

Appendix B1.3 Flow Table (3/3)

$Sewage \ Discharge \ Calculation \ for \ Trunk \ Main \ (Year \ 2046) \ - \ Separate \ System$

	Division No.	Flow into	Segment Atea	Accumulated Area	Daily N	Aean Sewage C	eneration (m3/da	y) in 2046	Design Disc	harge for Trun	k Sewer (m3/sec)	Remarks
Trunk Line	Branch Line	TIOW IIIto	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	ichiliks
1			92	92	1,055	211	30	1,296	0.030	0.030	0.030	
2			70	162	803	161	25	988	0.023	0.023	0.053	
3			60	222	688	138	24	849	0.020	0.020	0.073	
	4	\rightarrow MP-5 \rightarrow 7	90	90	1,000	200	26	1,226	0.028	0.028	0.028	
	5	→7	83	83	922	184	24	1,130	0.026	0.026	0.026	
	6	→7	78	78	878	176	22	1,076	0.025	0.025	0.025	
	7	→PS-5→9	915	1,166	4,723	945	210	5,877	0.136	0.136	0.215	
8		→PS-5→9	119	1,507	1,364	273	34	1,671	0.039	0.039	0.327	
9		→PS-4	133	1,640	1,833	367	45	2,245	0.052	0.052	0.379	flow into PS-4 of TR-3

4) Zone-II, Trunk Sewer : TR-4(North Route - East Line)

Source: JICA Study Team

5) Zone-II, Trunk Sewer : TR-5 (North Route - NH33 Line)

	Division lo.		Segment Atea	Accumulated Area	Daily N	Aean Sewage C	deneration (m3/da	y) in 2046	Design Disc	harge for Trun	k Sewer (m3/sec)	
Trunk Line	Branch Line	Flow into	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	Remarks
1		\rightarrow MP-1 \rightarrow										
1		2	13	13	213	43	4	260	0.006	0.006	0.006	
		\rightarrow MP-2 \rightarrow										
2		TR-3, 11	58	71	952	190	23	1,165	0.027	0.027	0.033	flow into TR-3 No.11
3		→MP-6→										
3		TR-3, 12	230	230	1,135	227	52	1,414	0.033	0.033	0.033	flow into TR-3 No.12

Appendix B1.4 Flow Table

Sewage Discharge Calculation for Pump and Rising Main (Year 2031) - Separate System

Zone-III&IV, Trunk Sewer : TR-1, TR-2 and TR-3 Area Division Segment Accumulated No. Atea Area Daily Mean Sewage Generation (m3/day) in 2046 Design Discharge for Trunk Sewer (m3/sec) Flow into Remarks Trunk Branch Ground Water Comme/Insti Hourly Design Domestic Total (ha) (ha) Accumulated Line Line Discharge Indust. Intrusion max.(Q) 1 PS-1 \rightarrow 3 882 5,175 1,035 6,277 0.145 0.145 882 67 0.145 2 $PS-2\rightarrow 3$ 1,162 8,483 1,697 94 10,274 0.238 0.238 0.238 1.162 3 →PS-5 736 2,780 6,020 1,204 68 7,292 0.169 0.169 0.552 4 R.M 0.000 0.552 0 2,780 0 0.000 0 0 0 5 →PS-4 785 2,648 530 55 3,232 0.075 0.075 3,565 0.627 6 R.M 0 0 0.000 0.000 3,565 0 0 0 0.627 7 707 4,272 4,011 802 58 4,871 0.113 0.113 0.739 8 →9 233 425 21 2,572 0.060 233 2,126 0.060 0.060 9 122 77 0.011 0.011 0.810 4.628 385 472 11 10 245 4,872 769 154 23 946 0.022 0.022 0.832 11 75 155 943 0.022 0.022 0.854 4.947 776 11 →MP-1 12 72 72 490 98 10 598 0.014 0.014 0.014 13 →14, R.M 0 72 0 0 0 0 0.000 0.000 0.014 14 $\rightarrow 18$ 483 97 589 0.014 0.014 0.027 71 143 9 15 →17 75 7 0.022 75 776 155 939 0.022 0.022 16 $\rightarrow 17$ 518 104 0.014 50 626 0.014 0.014 50 5 17 13 138 129 26 3 158 0.004 0.004 0.040 18 270 1,970 394 29 2,394 0.055 0.055 0.123 Flow joining from TR-2 550 →PS-6 19 1,029 1,029 4,072 814 83 4,969 0.115 0.115 0.115 PS-6→21, 20 R.M.. 0.115 Flow joining from TR-3 0 0 0.000 1,029 0 0 0 0.000 21 $\rightarrow PS-3$ 100 6,626 678 136 13 826 0.019 0.019 1.111 22 0 6,626 0 0 0 0 0.000 0.000 1.111 →STP 23 1.111 Flow to STP 0.000 0.000 0 6,626 0 0 8 8

Appendix B1.5 Flow Table

Sewage Discharge Calculation for Trunk Main (Year 2046) - Separate System

Zone-III&IV, Trunk Sewer : TR-1, TR-2 and TR-3

				•1, 1K-2 and	IK U							I
	Division No.	Flow into	Segment Atea	Accumulated Area	Daily N	1ean Sewage C	eneration (m3/da	y) in 2046	Design Dis	charge for Trunl	x Sewer (m3/sec)	Remarks
Trunk Line	Branch Line	. 10 w 1110	(ha)	(ha)	Domestic	Comme/Insti/ Indust.	Ground Water Intrusion	Total	Hourly max.(Q)	Design Discharge	Accumulated	I CHRIRS
1		PS-1 \rightarrow 3	882	882	6,271	1,254	66	7,591	0.176	0.176	0.176	
2		PS-2→3	1,162	1,162	9,994	1,999	93	12,086	0.280	0.280	0.280	
3		→PS-5										
			736	2,780	7,213	1,443	67	8,723	0.202	0.202	0.657	
4		R.M	0	2,780	0	0	0	0	0.000	0.000	0.657	
5		→PS-4	785	3,565	3,582	716	56	4,354	0.101	0.101	0.758	
6		R.M	0	3,565	0	0	0	0	0.000	0.000	0.758	
7			707	4,272	5,026	1,005	58	6,089	0.141	0.141	0.899	
	8	→9										
9			233	233	2,585	517	20	3,122	0.072	0.072	0.072	
9			122	4,628	534	107	11	651	0.015	0.015	0.986	
10			245	4,872	1,067	213	23	1,304	0.030	0.030	1.017	
11			75	4,947	920	184	11	1,114	0.026	0.026	1.042	
	12	→MP-1	72	72	590	118	10	719	0.017	0.017	0.017	
	13	→14, R.M.										
	14	→18	0	72	0	0	0	0	0.000	0.000	0.017	
			71	143	582	116	9	708	0.016	0.016	0.033	
	15	→17	75	75	920	184	7	1,110	0.026	0.026	0.026	
	16	→17	50	50	613	123	5	740	0.017	0.017	0.017	
17			13	138	153	31	3	186	0.004	0.004	0.047	
18			270	550	2,365	473	29	2,867	0.066	0.066	0.147	Flow joining from TR-2
	19	→PS-6										riowjonning riom rit 2
		PS-6→21,	1,029	1,029	5,068	1,014	83	6,164	0.143	0.143	0.143	
	20	R.M	0	1,029	0	0	0	0	0.000	0.000	0.143	Flow joining from TR-3
21		\rightarrow PS-3	100	6,626	817	163	13	993	0.023	0.023	1.355	
22												
		→STP	0	6,626	0	0	0	0	0.000	0.000	1.355	
23		→otr	0	6,626	0	0	8	8	0.000	0.000	1.355	Flow to STP

Appendix B2

CHAPTER B2 REFERENCIAL TABLES AND FIGURES ON PLAN OF SEWAGE TREATMENT PLANT

SI. No.	Parameter	A. Coke Oven	B. Sintering Plant	C. Blast Furnace	D. Steel Making Shop	E. Rolling Mills
1	pН	6.0-8.5	6.0-8.5	6.0-8.5	6.0-8.5	6.0-9.0
2	Suspended Solids (mg/l)	100	100	50	100	100
3	BOD (mg/l)	30	-	-	-	-
4	COD (mg/l)	250	-	-	-	-
5	Oil & Grease (mg/l)	10	10	10	10	10
6	Ammonical nitrogen as N (mg/l)	50	-	50	-	-
7	Cyanide as CN- (mg/l)	0.2	-	-	-	-
8	Phenol (mg/l)	1.0	-	-	-	-

Appendix B2.1 Effluent Standards for Iron and Steel Industries

Source: MOEF Notification as of 31st March, 2012

Appendix B2.2 Cost Comparison of Three Types Treatment Processes (STP Zone-II)

Item		Sequencing batch reactor (SBR) - DPR Proposal	CAS (Conventional Activated Sludge)	UASB+FPU (Upflow Anaerobic Sludge Blanket + Final Polishing Unit)
Flow at target year of 2031	m ³ /d	86,000	86,000	86,000
Unit area required	ha/ m³	0.000057	0.000063	0.000185
(1) Required area for 2031 and ease of purchasing.	ha	4.9	5.4	15.9
Unit land cost	Rs/ha	50,000,000	50,000,000	50,000,000
Unit construction cost of plant	Rs/ m ³	15,900	13,200	11,000
Unit annual O&M cost	Rs/ m ³	1,085	871	717
(2) Land cost	Rs	246,500,000	270,000,000	795,500,000
(3) Cost of STP construction	Rs	1,367,400,000	1,135,200,000	946,000,000
(4) Annual O&M cost	Rs	93,284,403	74,877,493	61,663,319
(5) 30 years cost performance with 0% inflation.	Rs	4,412,432,096	3,651,524,788	3,591,399,559

Note:

1) Unit area, unit construction and O&M costs: "Life cycle cost comparison of different STP processes", NCRPB website (costs were adjusted with price escalation from 2010)

2) Required areas for SBR and CAS: based on layout plans

3) Unit O&M cost of UASB+FPU: adjusted with "Performance Evaluation of Sewage Treatment Plants under NRCD", CPCB 2013
4) Unit land cost: average unit price for farm lands in Ranchi obtained from RMC

Appendix B2.3 Cost Comparison of Three Types Treatment Processes (STP Zone-III&IV)

Item		Sequencing batch reactor (SBR) - DPR Proposal	CAS (Conventional Activated Sludge)	UASB+FPU (Upflow Anaerobic Sludge Blanket + Final Polishing Unit)		
Flow at target year of 2031	m ³ /d	50,000	50,000	50,000		
Unit area required	ha/ m ³	0.000057	0.000064	0.000185		
(1) Required area for 2031 and ease of purchasing.	ha	2.9	3.2	9.3		
Unit land cost	Rs/ha	50,000,000	50,000,000	50,000,000		
Unit construction cost of plant	Rs/ m ³	15,900	13,200	11,000		
Unit Annual O&M cost	Rs/ m ³	1,085	871	717		
(2) Land cost	Rs	143,313,953	159,500,000	462,500,000		
(3) Cost of STP construction	Rs	795,000,000	660,000,000	550,000,000		
(4) Annual O&M cost	Rs	54,235,118	43,533,426	35,850,767		
(5) 30 years cost performance with 0% inflation.	Rs	2,565,367,497	2,125,502,784	2,088,023,000		

Note:

1) Unit area, unit construction and O&M costs: "Life cycle cost comparison of different STP processes", NCRPB website (costs were adjusted with price escalation from 2010)

2) Required areas for SBR and CAS: based on layout plans

3) Unit O&M cost of UASB+FPU: adjusted with "Performance Evaluation of Sewage Treatment Plants under NRCD", CPCB 2013
4) Unit land cost: average unit price for farm lands in Ranchi obtained from RMC

				Process of		Designed				Inlet			Outlet		
SI No.	State	City	STP Name	Sewage Treatment	Year of Commission	capacity (MLD)	Actual Treatment (MLD)	Status operation	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	Sludge Treatment
CAS 1	Delhi	Delhi	Okhla 45	CAS	N/A	204.57	181.84(2003.11) 190.03(2004.9)	Operational	249 206	515 411	480 364	19 8	51 42	27 6	
2	Delhi	Delhi	Keshopur 40	CAS	N/A	181.84	106.46(2003.11) 183.21(2004.9)	Operational	282 257	560 397	404 269	10 20	55 61	21 23	
3	Gujarat	Ahmedabad	Pirana	CAS	N/A	180		Operational							
4	Delhi	Delhi	Okhla 37	CAS	N/A	168.2	159.11(2003.11) 150.93(2004.9)	Operational	249 206	515 411	480 364	12 20	62 48	32 24	
5	Delhi	Delhi	Okhla 30	CAS	N/A	136.38	122.74(2004.9) 131.44(2008.3)	Operational	206 147	411 464	364 491	48 47	138 172	33 73	
6	Maharashtra	Pune	Dr.Naidu Hospital	CAS	N/A	115		Operational							
7	Uttar Pradesh	Kanpur	Jajmau	CAS	1989	130	100 (2011)	Operational	314	672	969	69	211	71	Drying Bed
8	Delhi	Delhi	Keshopur 20	CAS	N/A	90.92	95.1(2003.11) 90.92(2004.9)	Operational	282 246	560 386	404 248	45 94	149 191	78 87	
9	Tamil Nadu	Chennai	Kodungaiyur	CAS	1993	110	90.92(2004.9) 90 (2011)	Operational	138	408	248	6	47	10	Gravity Thickener Digester
10	Gujarat	Surat	Bhatar	CAS	2000	120	80-90 (2004)	Operational	101	439	53	10.4	180	35	Thickener Digester Drying Bed
11	Uttar Pradesh	Varanasi	Dinapur	CAS+Trickling Filter	1994	80	88 (2011)	Operational	156 N/A	438 N/A	417 N/A	27 14	72 39	53 45	Digester Drving Bed
12	Delhi	Delhi	Kondli 25-II	CAS	N/A	113.65	57.96(2003.11) 83.65(2004.9)	Operational	261 192	588 420	604 212	34 5	50 48	45 11	
13	Chandigarh	Chandigarh	Mohali-I (Diggiyan)	CAS(+Tertiary)	1985	68.19 (15MGD)	68.19 (15MGD)	Operational	227	548	311	39 (18)	92 (46)	49 (35)	Digester Drying Bed
14	Delhi	Delhi	Okhla 16	CAS	N/A	72.73	40.91(2003.11) 67.28(2004.9)	Operational	207 206	486 411	291 364	48 18	108 60	83 32	
15	Tamil Nadu	Chennai	Perungudi	CAS	N/A	54	65 (2011)	Operational	135	255	232	25	39	16	Gravity Thickener Digester
16	Tamil Nadu	Chennai	Koyambedu	CAS	N/A	60	60 (2011)	Operational	129	776	265	9	67	17	Gravity Thickener Digester
17	Delhi	Delhi	Coronation Piallar20-II	CAS	N/A	90.92	56.55(2003.11) 43.46(2004.9)	Operational	48 148	172 278	342 205	15 21	48 57	93 17	
18	Delhi	Delhi	Kondli 10-I	CAS	N/A	45.46	56.55(2003.11) 34.96(2004.9)	Operational	241 155	507 252	363 212	27 28	140 123	68 55	
19	Delhi	Delhi	Okhla 12	CAS	N/A	54.55	39.09(2003.11) 52.735(2004.9)	Operational	204 206	517 411	498 364	10 4	54 33	21 3	
20	Delhi	Delhi	Coronation Piallar10-I	CAS	N/A	45.46	40.84(2003.11) 52.51(2004.9)	Operational	112 140	317 273	179 156	18 19	61 44	35 18	
21	Gujarat	Surat	Singanapur	CAS	2003	100	50 (2004)	Operational	62	601	128	29	252	60	Thickener Digester Drying Bed
22	Delhi	Delhi	Rithala Old-40	CAS	N/A	181.84	46.28(2003.11) 45.46(2004.9)	Operational	205 110	399 374	330 148	14 17	54 64	75 18	
23	Delhi	Delhi	Pappankalan 20	CAS	N/A	90.92	37.73(2003.11) 45.46(2004.9)	Operational	103 326	275 602	142 642	10 16	46 41	39 24	
24	West Bengal	Kolkata	Cossipore Chitpur	CAS	1987	45	25-45 (2004.5)	Operational	69	194	165	8	49	16	Gravity Thickener Digester (+gas holder) Dehydrator (Centrifug
25	Gujarat	Vadodara	Gajarwadi	CAS	2003	66	42 (2004)	Operational	162	634	81	20	86	28	Thickener Digester Drying Bed
26	Gujarat	Surat	Anjana	CAS	1996	82.5	35-40 (2004)	Operational	94	748	138	19.6	106	12	Thickener Digester Drying Bed
27	Gujarat	Vadodara	Tarsali	CAS	2001	52	18 (2004)	Operational	88	569	110	15.6	90	13	
28	West Bengal	Kolkata	Garden Reach	CAS	1987	47.5		Operational (trial phase:2011)	13	51	23.6	8	7	31	Digester

Appendix B2.4 Past Record of	CAS and SBR Plants in India (1/2)
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Source: "Performance Evaluation of Sewage Treatment Plants under NRCD", CPCB 2013 Note: Listed only STPs of more than 10MLD capacity

			- r r					is and s					(
				Process of		Designed				Inlet			Outlet		
SI No.	State	City	STP Name	Sewage	Year of Commission	capacity	Actual Treatment (MLD)	Status operation	BOD	COD	TSS	BOD	COD	TSS	Sludge Treatment
				Treatment		(MLD)	, í		(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	
29	Tamil Nadu	Chennai	Nesapakkam	CAS	N/A	40	43 (2011)	Operational	138	651	3700	5	63	5	Gravity Thickener Digester
30	West Bengal	Kolkata	Garden Reach (old)	CAS	1987	47.5	30-38 (2004.6)	-	115	297	221	32	112	62	Gravity Thickener Digester
31	Delhi	Delhi	Kondli 10-II	CAS	N/A	45.46	28.36(2003.11)	Operational	237	615	519	14	50	16	Centrifugal Dehydrator
51	Deini	Deini	Kondii 10-11	CAS	IN/A	45.40	42.32(2004.9)	Operational	192	420	212	14	129	68	
32	Bihar	Patna	Saidpur	CAS	1985	45 (17+28)	33 (2011)	Operational	130	315	288	5	8	8	Digester Drying Bed
33	Uttar Pradesh	Allahabad	Naini	CAS	1987	60	27.57 (2011)	Operational	86	176	147	18.6	28	18	Digester Drying Bed
34	Delhi	Delhi	Yamuna Vihar	CAS	N/A	45.46	27.27(2003.11)	Operational	174	505	391	17	84	44	
			10-I						134	319	221	8	57	47	
35	Bihar	Patna	Beur	CAS	1985	35 (20+15)	24 (2011)	Operational	72	169	116 (2005)	38	50	66 (2005)	Digester Drying Bed
36	Delhi	Delhi	Nilothi 40	CAS	N/A	181.84	15(2003.11)	Operational	90	328	432	4	26	21	
							21.59(2004.9)		74	190	110	3	41	15	
37	Uttrakhand	Haridwar	Jagjeetpur	CAS	N/A	18	18 (2004)	Operational	195 N/A	557 N/A	463 N/A	6 14	47 68	26 46	Gravity Thickener Digester Drying Bed
38	Bihar	Patna	Beur (new)	CAS	N/A	15		Operational							
39	Delhi	Delhi	Yamuna Vihar 10-II	CAS	N/A	45.46	14.77 (2003.11)	Operational	199 92	538 407	405 301	20 8	44 71	39 60	
40	Uttar Pradesh	Varanasi	DLW	CAS	N/A	12	10.82(2005.3)	Operational	86	169	113	8	59	23	Digester Drying Bed
41	West Bengal	Bhatpara	Jagaddal (New)	CAS	N/A	10	N/A (2004.5)	Operational	179 126	466 392	442 N/A	54 66	141 165	72 N/A	Thickener Digester Drying Bed
SBR															
1	Madhya Pradesh	Indore	Kabitkhedi	SBR	N/A	245	N/A	Operational							
2	Maharashtra	Navi Mumbai	Nerul	SBR (C-Tech)	N/A	100	N/A	Operational				6	26	13.5	
3	Maharashtra	Navi Mumbai	Airoli	SBR (C-Tech)	N/A	80	N/A	Operational				13.5	53	20	
4	Maharashtra	Kolhapur	Kolhapur	SBR (C-Tech)	N/A	76	N/A	Under construction in 2011							
5	Haryana	Badshapur	Faridabad	UASB+SBR	N/A	65 (45+20)	45	Operational	186	549		28 & 50	73 & 118		
6	Maharashtra	Pune	Mundhwa	SBR (C-Tech)	2009	45	N/A	Operational	250 (Design)	-		<10 (Design)	-		
7	Maharashtra	Pune	Kharadi	SBR	N/A	40	N/A	Operational							
8	Uttrakhand	Haridwar	Jagjeetpur	SBR (C-Tech)	N/A	27	N/A	Operational	-	-	-	13	42	18	
9 10	Punjab Tamil Nadu	Jalandhar Madurai	Fulariwala Avanaiapuram	SBR (C-Tech) SBR (C-Tech)	N/A 2011	25 60 (2025) 125 (2040)	22 (2011) 15 (2011)	Operational Operational	154 180	324 384	177 270	13.5 3	39 28	28 4	
11	Maharashtra	Bhiwandi	Bhiwandi NCMC	SBR	2010	125 (2040)		Operational							
12	Goa	Panaji	Tonca	SBR (C-Tech)	N/A	12.5	12 (2011)	Operational	140	340	204	4	40	9	
13	Tamil Nadu	Madurai	Sakkimangalam	SBR (C-Tech)	2011	45.7	10 (2011)	Operational	230	536	3940	4	64	6	
Standards	for discharge in	istreams										<30	<250	<100	
			CB (Gujarat Po	llution Control B	oard)							<30	<100	<30	

Appendix B2.4 Pa	st Record of	CAS and SBR	Plants in	India (2	2/2)
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Source: "Performance Evaluation of Sewage Treatment Plants under NRCD", CPCB 2013 Note: Listed only STPs of more than 10MLD capacity

Item	Unit	Without Digestion	With Digestion	Note
(1)Sludge generation in 2031	m3/year	65,070	40,994	
(2)Area for disposal site	ha	24.4	15.4	(1)/2avrX30years/4m
(3) Digestion Area	ha		1.2	
(4) Land cost	Rs	1,220,064,895	828,640,884	
(5) Construction cost of sludge digestion facilities	Rs		395,866,080	840,480,000X0.471
(6) Annual O&M cost	Rs/year		17,996,160	43,260,000X0.416
(7) Sludge transportation cost	Rs/year	7,580,670	4,775,822	Rs.233/m3
(8) 30 years cost performance with 0% inflation.	Rs	1,447,484,991	1,907,666,424	-460,181,433

Appendix B2.5 Cost Comparison on Sludge Digestion

Source: JICA Study Team

	Screw Press	Belt Press	Centrifuges
Operation	Simple	Relatively simple (require attention)	Moderate (minimal attention when operations are stable)
Maintenance	Wash water (fewer than belt press)	 Relatively simple Belt washing Replacing the belt 	Easy to clean
Noise	Low	Medium	High
Odour	Low	High	Low
Sludge cake volume	Normal	Normal	Small
Capital cost	Medium	Low	High
Power consumption	Low	Low	High
Maintenance cost	Low	Low	High
Manufacturer in India	Few	Many	Many
Experience in India	Very Few	Few	Moderate
Evaluation	Second	Third	First

Appendix B2.6 Comparison of Sludge Dehydrators

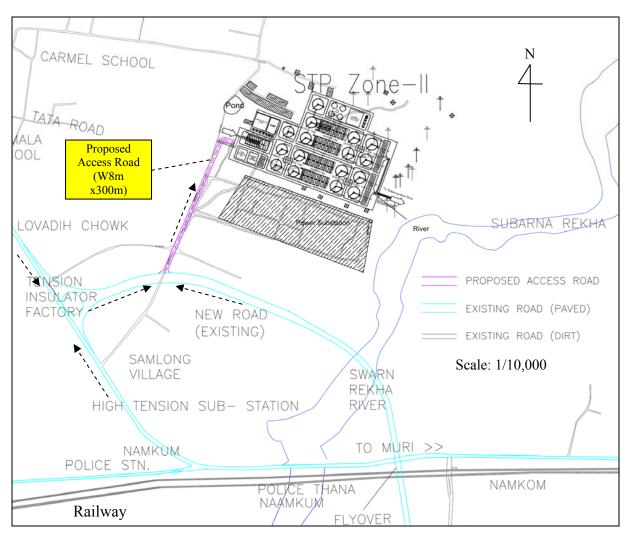
Source: JICA Study Team (Referenced with CPHEEO manual 2012)

Appendix B2.7 Numbers and Dimensions of Facilities with Specification of Major Equipments for STP Zone-II (CAS 86MLD)

						Nos			Operati	on (nos)		
SI		D'				INOS			rage	Pe	ak	
No.	Structure/Equipment	Dimer	Dimension/Specification R		Regular	Stand -by	Total	Regular	Stand -by	Regular	Stand -by	Note
1	Inlet Pipe		φ1400			0	1	1	0	1	0	
2	Coarse Screen	W 1.2m,	Wire screen	(manual)	4	0	4	2	2	4	0	
3	Grit Chamber	W1.2m	L15m	D1.5m	4	0	4	2	2	4	0	
	Grit Pump		22kW		4	0	4	2	2	4	0	
4	Fine Screen	W 2m X	3.7 kW, M	echanical	4	0	4	2	2	4	0	
5	Lift Pump	φ700 X	66m3/min X	160kW	1	1	2	1	1	1	1	
3	Liit Pump	φ500 X	33m3/min X	K 80kW	2	0	2	0	2	2	0	
6	Primary Sedimentation Tank	φ23	3.0	D3.5m	8	0	8	8	0	8	0	
	Primary Sludge Pump	φ100 X	0.8m3/min 3	K3. 7kW	4	2	6	4	2	4	2	
7	Aeration Tank	W9.0m	L50m	D6.0m	8	0	8	8	2	-	-	
	Bypass Pipe		φ1100		-	1	1	-	1	(1)		Excess flow from inlet of aeration tank to disinfection tank (need to minimize the use by proper operation)
	Diffuser	Dif	Diffusion plate type									unit with blower
	Return Sludge Pump		60 kW		4		4	4		4		
8	Blower Building				-	-	1	1	-	1	-	
	Blower	160m3/min X 220kW		1	1	2	1	1	-	-		
			80m3/min X 140kW		2	0	2	2	0	-	-	
9	Final Sedimentation Tank	φ25		D3.5m	8	0	8	8	0	-	-	
	Secondary Sludge Pump	1	X 3m3/min X	15kW	12	4	16	12	4	-	-	
10	Chlorination Tank	W2.0m	L120m	D2.0m	4	0	4	4	1	4	1	
	Chlorine Dosing Pump	1 pump each fo	or Unit No. 1&	2 and 3&4	2	2	4	2	2	2	2	With pure chlorine gas in the cylinder
	Discharge Pipe		φ1200		2	0	2	1	1	2	0	
12	Sludge Thickener (Gravity)	φ12		D4.0m	4	0	4	4	0	-	1	
	Thickened Sludge Pump	φ100 X ().8m3/min 1	X3. 7kW	2	2	4	2	2	-	-	
13	Sludge Dewatering Facility		-		-	-	1	-	-	-	-	
	Centrifugal Dehydrator	20	m3/h X 66 k	W	3	1	4	3	1	-	-	Incl. thickened sludge supply pump
	Chemical Dosing Pump		-		1	0	1	1	0	-	-	Organic coagulant
	Hopper for dewatered sludge		-		1	0	1	1	0	-	-	
101	Chemicals Storage		-		-	-	1	1	-	1	-	
102	Electric Substation	33kV X 2,500kVA		1	1	1	1	1	2	0		
103	Power Generation Unit	6.6k	6.6kV X 1,875kVA		1	0	1	1	-	1	-	
104	Administrative Block		-		-	-	1	1	-	1	-	
	Control Panel		-		-	-	1 unit	1	-	1	-	With PC for control and monitoring
	Laboratory		-		-	-	1	1	-	1	-	
105	Oil House		-		-	-	1	1	-	1	-	Oil for generator
106	Ware House		-		-	-	1	1	-	1	-	Coagulants for sludge

Appendix B2.8 Numbers and Dimensions of Facilities with Specification of Major Equipments for STP Zone-III&IV (CAS 50MLD)

								1	Operati	ion (nos)		
SI		D .				Nos		Average		Pe	ak	
No.	Structure/Equipment	Structure/Equipment Dimension/Specification		Regular	Stand -by	Total	Regular	Stand -by	Regular	Stand -by	Note	
1	Inlet Pipe		φ1200		1	0	1	1	-	1	•	
2	Coarse Screen	W 1m, V	Wire screen	(manual)	2	0	2	2	-	2	-	
3	Grit Chamber	W1.0m	L10m	D1.5m	4	0	4	2	2	4	0	
	Grit Pump		22.0kW		2	0	2	2	-	2	-	
4	Fine Screen		3.7kW, Me		2	0	2	2	-	2	-	
5	Lift Pump		33m3/min X		2	0	2	1	1	2	0	
-	1		15m3/min	X75kW	1	1	2	1	1	1	1	
6	Primary Sedimentation Tank	φ25		D3.5m	4	0	4	4	-	8	-	
	Primary Sludge Pump	φ100 X ().8m3/min	X3. 7kW	2	1	3	2	1	2	1	
7	Aeration Tank	W 9 m	L 50m	D 5m	4	0	4	4	-	4	-	
												Excess flow from inlet of aeration tank
	Bypass Pipe		φ800		-	1	1	-	1	(1)	-	to disinfection tank (need to minimize
											the use by proper operation)	
	Diffuser	Diffuser Plate Type										
8	Blower Building	-		-	-	1	1	-	1	-		
	Blower	160m3/min X 220kW			1	0	1	1	0	-	-	
			3/min X 140	0kW	1	1	2	1	1	-	•	
- 9	Final Sedimentation Tank	φ27		D3.5m	4	0	4	4	0	-	-	
	Secondary Sludge Pump	φ200 X	X 3m3/min X	K 15kW	4	2	6	4	2	-	-	
10	Chlorination Tank	W2.0m	L140m	D2.0m	2	0	2	2	-	2	•	
	Chlorine Dosing Pump		-		2	0	2	2	0	2	0	
11	Discharge Pipe		φ900		2	0	2	1	1	2	0	
12	Sludge Thickner (Gravity)	φ12		D4.0m	4	0	4	4	0	4	0	
	Thickened Sludge Pump	φ100 X ().8m3/min	X3. 7kW	1	1	2	1	1	1	1	
13	Sludge Dewatering Facility		-		-	-	1	-	-	-	-	
	Centrifugal Dehydrator	20	m3/h X 66 l	κW	2	1	3	2	1	2	1	Incl. thickened sludge supply pump
	Chemical Dosing Pump		-		1	0	1	1	0	1	0	Organic coagulant
	Hopper for dewatered sludge		-		1	0	1	1	0	1	0	
101	Chemicals Storage	-		-	-	1	1	-	1	-		
102	Electric Substation	33kV X1,500kVA		1	1	1	1	1	2	0		
103	Power Generation Unit	6.6	cV X 1250k	«VA	1	0	1	1	-	1	-	
104	Administrative Block		-		-	-	1	1	-	1	-	
	Control Panel		-		-	-	1 unit	1	-	1	-	With PC for control and monitoring
	Laboratory		-		-	-	1	1	-	1	-	
105	Oil House		-		-	-	1	1	-	1	-	Oil for generator
106	Ware House		-		-	-	1	1	-	1	-	Coagulants for sludge

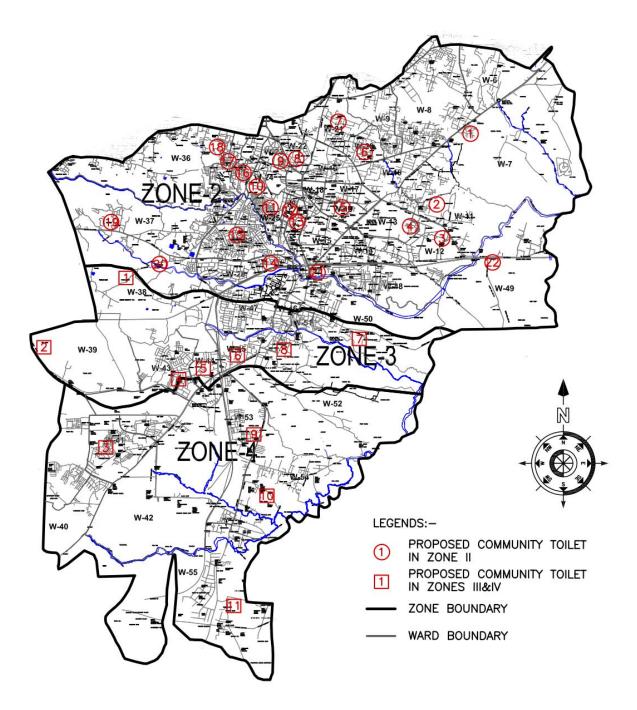


Source: JICA Study Team

Appendix B2.9 Proposed Access Road for STP Zone-II

Appendix B3

CHAPTER B3 REFERENCIAL TABLES AND FIGURES ON PLAN OF SANITARY FACILITIES AND OPERATION



Appendix B3.1 Proposed Locations for New Community Toilets

		Proposed Toilet	Existing	Water Supply
SI No.	Ward No.	Location	Pipe	Groundwater
Zone II				
1	7	Hotwar		X
2	11	Lowadhi Basti	Х	
3	12	Samlong		X
4	13	Gungu Toli	Х	
5	16	Karbala Tank		X
6	20	PNT Colony	Х	
7	21	Lower Karamtoli	Х	
8	22	RMC Road	Х	
9	23	Bakri Bazar	Х	
10	24	Bhumiyar Toli	Х	Х
11	25	OPP Ranchi Lake	Х	
12	26	Hindpidi	Х	
13	27	Madarsa	Х	
14	28	Dhela Toli	Х	
15	29	Ashok Nagar	Х	Х
16	30	Pahari Mandir	Х	Х
17	31	Kumar Toli	Х	Х
18	36	Hinoo	Х	
19	37	Nawa Toli		
20	38	Mukti Dham	Х	X
21	48	Anand pur,Namkum	Х	
22	49	Namkum		Х
Zones III&	IV			
1	38	Pundag Basti	Х	х
2	39	Tiril Basti	Х	Х
3	41	Gwala Toli		х
4	43	Naya Toli		Х
5	44	Dhurva Sector2		Х
6	45	Shukla Colony	Х	
7	50	Bada Ghaghra Basti	Х	X
8	52	Hinoo	Х	
9	53	Khuti road	Х	
10	54	Patel Nagar	Х	
11	55	Tupudana Basti	Х	

Appendix B3.2 Existing Water Supply near Proposed Community Toilets

Appendix B4

CHAPTER B4 PROJECT COST ESTIMATE

Appendix-B4.1: Corrected DPR Cost

t Zone-II (1/4)

		Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
Zone							
		ty Sewer					
(1) P		nstallation					
	PEp						
	Mate	erial Procurement	1- 1	11			
		Class SN8 structured do		296,244			Montrat note
		150 mm dia 200 mm dia	m	296,244	246 455	10,131,024	Market rate ditto
		250 mm dia	m m	13,635	825	11,251,832	ditto
		300 mm dia	m	14,394	1,110	15,984,160	ditto
		400 mm dia	m	13,688	1,622	22,201,760	ditto
		600 mm dia	m	20,400	3,893	79,414,330	ditto
		800 mm dia	m	8,549	6,551	55,999,968	ditto
		1000 mm dia	m	2,812	10,299	28,960,199	ditto
	Insta	allation					
		150 mm dia	m	296,244	21	6,277,414	ditto
		200 mm dia	m	22,250	36	790,760	ditto
		250 mm dia	m	13,635	36	484,586	ditto
		300 mm dia	m	14,394	71	1,023,301	ditto
		400 mm dia	m	13,688	71	973,072	ditto
		600 mm dia	m	20,400	113	2,314,205	
		800 mm dia	m	8,549	152	1,300,862	ditto
	DCT	1000 mm dia	m	2,812	215	603,733	ditto
	RC F						
	wiate	erial Procurement					1
		NP3 R.C.C. pipe as per 1200 mm dia		3,533	5,079	17,940,949	JSR
		1400 mm dia	m	2,859	6,888	19,692,182	ditto
	Inst	allation	m	2,039	0,008	19,092,182	
		1200 mm dia	m	3,533	778	2,749,872	ditto
		1400 mm dia	m	2,859	856	2,447,938	ditto
(2) C	'ivil v	vork for pipe installation		2,009	000	2,,>50	
		ement demolishing					
		Demolishing	m3	159,345	452	71,995,160	DSR
		Disposal of demolished	m3	159,345	170	27,069,601	JSR
	Exca	vation					
		Earthwork in	m3	1,117,151	116	129,947,049	ditto
		Extra for earthwork in					
		1.5 m to 2.5 m depth	m3	359,045	6	2,032,196	ditto
		2.5 m to 3.5 m depth	m3	209,566	11	2,372,282	ditto
		3.5 m to 4.5 m depth	m3	122,255	17	2,075,891	ditto
		4.5 m to 5.5 m depth	m3	71,588	23	1,620,760	ditto
		5.5 m to 6.5 m depth	<u>m3</u>	40,707	28	1,152,009	
		6.5 m to 7.5 m depth	<u>m3</u>	21,189	34	719,588	ditto
		7.5 m to 8.5 m depth	<u>m3</u>	9,873	40	391,170	
		8.5 m to 9.5 m depth	m3	2,396 12	45 51	108,491	ditto
	Sanc	9.5 m to 10.5 m depth I foundation	m3	12	31	631	ditto
	Sanc	Providing coarse sand	m3	49,167	165	8,094,929	JSR
		PCC bedding	m3	2,091	2,942	6,153,096	ditto
	Back	filling	11.0	2,071	2,742	0,155,070	ditto
		Earthwork in back	m3	2,265,925	40	91,588,669	ditto
	Disp	osal		,,	.0	,	
		Carriage of materials by					
		Earth upto 5th km	m3	101,355	170	17,218,186	JSR
		Earth beyond 5 km but	m3	101,355	233	23,579,226	ditto
_		pering and Shuttering					
		0-1.5 m depth	m2	400,742	98		DSR
		1.5-2.5 m depth	m2	495,235	103	50,874,127	
		2.5-4.5 m depth	m2	442,427	114	50,275,848	ditto
(0) -		Beyond 4.5m	m2	145,766	3,364	490,304,046	Steel Sheet pile
(3) N	1anh						D. 0D
		hole (Bottom dia. 0.9 m)	no.	10,066	10,325	103,930,535	
		hole (Bottom dia. 1.2 m)	no.	2,423	17,627	42,710,001	
		hole (Bottom dia. 1.5 m)	no.	4,746	43,578	206,819,462	
(4) P		manhole restoration	no.	862	11,753	10,127,913	ditto
(+) K		urface road	m3	238,317	1,956	466,148,218	ditto
		M surface road	m3	73,328	1,956	77,768,031	ditto
		urface road	m3	54,996	6,494	357,134,650	JSR
		vy crossing		54,220	0,474	557,154,050	
) using pipe jacking	m	90	95,000	8,550,000	Market rate
		00 using pipe jacking	m	90	130,000	11,700,000	ditto
(6) R		Crossing				,,	
		Protection by concrete	m3	345	6,494	2,240,361	JSR
(7) P		tion Work in River Area					
		Protection by concrete	m3	575	6,494	3,733,935	ditto
		Total c	ost A: 🤇	Gravity Sewer		2,661,167,269	

Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
8: Pump Station and Rising Main					
B1: SPS-A					
81-1 Pump station					
1) Mechanical Facility					
Cost of Pumps @ 20000/	kW	137	34,400		Market rate
Mechanical Screens	Each	2	4,317,200	8,634,400	ditto
Gates (0.8 m X 0.8 m) 2) Electrical Facility	Each	5	739,600	3,698,000	ditto
2) Electrical Facility Miscellaneous	LS	1		1.006.156	1:44 -
		-	0.000	1,096,156	
Cost of HT Panel	Each	1	860,000	860,000	ditto
Cost of Transformer Cost of LT Panel	Each Set	1	1,083,600 688,000	1,083,600 688,000	ditto ditto
	Set	1	430,000	430,000	ditto
Cost of cabling		1	189,200	189,200	
Cost of Earthing Cost of DG Sets	Lot Each	1	5,074,000	5,074,000	ditto ditto
3) Civil and building work of pum			5,074,000	5,074,000	ditto
Civil works (Tank)	m3	270	15.400	4 159 000	Based on standard design
Timbering for Tank	m3 m2	576	5.045	4,158,000 2,906,182	Steel sheet pile
Civil works (Building)	m2 m2	100	5,045		Market rate
Cost for Boundary wall,	LS	100	7,390	2,576,814	
Cost for Boundary Wall, 31-2 Rising Main	பல	1		2,370,814	anto
1) Pipe installation					
Procurement and installation	of DCT	nine			
600 mm dia	m	1,600	16,799	26 979 720	Market rate
2) Civil work for pipe installation	m	1,000	10,799	20,070,720	wiaiket läte
Pavement demolishing					
Demolishing	m3	640	452	289,164	DSR
Disposal of demolished	m3	640	170	108,723	
Excavation	шь	040	170	108,723	ditto
Earthwork in	m3	2,592	116	301,501	JSR
Sand foundation	ms	2,592	116	301,501	JSK
Providing coarse sand	m3	288	165	47,416	ditto
Backfilling	nıs	200	105	47,410	ditto
Earthwork in back	m3	3,388	40	136,927	ditto
Disposal	m3	5,566	40	130,927	
Carriage of materials by	no				
Earth upto 5th km	m3	1,296	170	220,164	ditto
Earth beyond 5 km but	m3	1,290	233	301,501	ditto
Timbering and Shuttering	m2	1,290	235	501,501	ditto
0-1.5 m depth	m2	6,400	98	628,364	DSR
3) Road restoration	1112	0,400	20	020,504	DSR
BT surface road	m3	640	1,956	1,251,840	ditto
4) River Crossing	1112	040	1,250	1,201,040	anto
Foundation and pier for pipe	no	2	69,083	138,165	ditto
roundation and plerior pipe	10	2	07,005	67,149,238	unto
32: SPS-B				07,147,230	
32-1 Pump station					
1) Mechanical Facility					
Cost of Pumps @ 20000	kW	302	34,400	10,388,800	Market rate
Mechanical Screens	Each	2	5,314,800	10,588,800	ditto
Gates (1.5 m X 1.5 m)	Each	5	1,599,600	7,998,000	ditto
2) Electrical Facility	Latin	5	1,577,000	7,220,000	anto
Miscellaneous	LS	1		1,403,403	ditto
Cost of HT Panel	Each	1	860,000	860,000	ditto
Cost of Transformer	Each	1	1,634,000	1,634,000	ditto
Cost of LT Panel	Set	1	1,204,000	1,204,000	ditto
Cost of cabling	Set	1	602,000	602,000	ditto
Cost of Earthing	Set	1	258,000	258,000	ditto
Cost of DG Sets	Each	1	7,740,000	7,740,000	ditto
3) Civil and building work of pum		-	7,740,000	7,740,000	unto
Civil works (Tank)	m3	830	15,400	12,782,000	Based on standard design
Timbering for Tank	m2	710	5,045		Steel sheet pile
	1112				
Civil works (Building)	m2	110	7,396	813,560	Market rate

Appendix B4.1: Corrected DPR Cost Zone-II (2/4)

			0		• • • • • • •	
B2-2	Description Rising Main	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	pe installation					
	Procurement and installation	of DCI	pipe			
	1000 mm dia	m	1,280	35,431	45,351,680	Market rate
	ivil work for pipe installation		-			
	Pavement demolishing Demolishing		512	450	221 221	DSD
	Disposal of demolished	m3 m3	512 512	452 170	231,331 86,979	DSR ditto
	Excavation	шэ	512	170	80,777	uitto
	Earthwork in	m3	3,584	116	416,891	JSR
	Sand foundation					
	Providing coarse sand	m3	307	165	50,577	ditto
	Backfilling		0.004	10	101.004	
	Earthwork in back Disposal	m3 m3	3,091	40	124,926	ditto
	Carriage of materials by	ШЭ	-			
	Earth upto 5th km	m3	1,792	170	304.425	ditto
	Earth beyond 5 km but	m3	1,792	233	416,891	ditto
	Timbering and Shuttering	m2				
(0) F	1.5-2.5 m depth	m2	5,120	103	525,964	DSR
	oad restoration	~2	510	1.055	1 001 472	ditto
	BT surface road iver Crossing	m3	512	1,956	1,001,472	
	Foundation and pier for pipe	no	10	69,083	690,827	ditto
			10	07,005	114,010,319	
B3:	SPS-C				,	
B3-1	Pump station					
(1) M	lechanical Facility					
\square	Cost of Pumps @ 20000/	kW	12	34,400		Market rate
	Mechanical Screens	Each	2	2,941,200	5,882,400	
(2) F	Gates (0.3 m X 0.3 m) ectrical Facility	Each	5	258,000	1,290,000	ditto
(2)L	Miscellaneous	LS	1		991,365	ditto
	Cost of LT Panel	Set	1	258,000	258,000	
	Cost of cabling	LS	1	103,200	103,200	
	Cost of Earthing	LS	1	77,400	77,400	ditto
	Cost of DG Sets	Each	1	1,161,000	1,161,000	ditto
(3) C	ivil and building work of pum					
	Civil works (Tank) Timbering for Tank	m3	150 190	15,400 5,045		Based on standard design
	Civil works (Building)	m2 m2	45	7,396		Steel sheet pile Market rate
	Cost for Boundary wall,	LS		1,370	1,086,163	ditto
B3-2	Rising Main				,,	
	pe installation					
	Procurement and installation					
	400 mm dia	m	650	5,204	3,382,501	Market rate
	ivil work for pipe installation					
\vdash	Pavement demolishing Demolishing	m3	260	452	117,473	DSR
	Disposal of demolished	m3	260	452	44,169	
	Excavation			1,0		
	Earthwork in	m3	553	116	64,267	ditto
	Sand foundation					
\square	Providing coarse sand	m3	83	165	13,645	ditto
\vdash	Backfilling	-	1.085		10.7-	1
\vdash	Earthwork in back Disposal	m3 m3	1,073	40	43,374	aitto
\vdash	Carriage of materials by	1115				
\vdash	Earth upto 5th km	m3	276	170	46,929	ditto
	Earth beyond 5 km but	m3	276	233	64,267	ditto
	Timbering and Shuttering					
	0-1.5 m depth	m2	2,600	98	255,273	DSR
	oad restoration	-	200	1.07	#00 #	1
	BT surface road	m3	260	1,956	508,560	ditto
	iver Crossing Foundation and pier for pipe	no	10	69,083	690,827	ditto
\vdash	and plet for pipe	no	10	09,063	20,095,068	
B4:	SPS-D				20,020,000	
	Pump station					
	lechanical Facility					
	Cost of Pumps @ 20000	KW	24	34,400		Market rate
\square	Mechanical Screens	Each	2	2,924,000	5,848,000	
	Gates (0.4 m X 0.4 m)	Each	2	309,600	619,200	ditto

Appendix B4.1: Corrected DPR Cost Zone-II (3/4)

11			u DI K COS		· · ·
Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
2) Electrical Facility	IC			000 700	1
Miscellaneous	LS	1	201.000	832,738	
Cost of LT Panel	Set	1	301,000	301,000	
Cost of cabling	LS	1	172,000	172,000	
Cost of Earthing	LS	1	103,200	103,200	
Cost of DG Sets	Each	1	1,290,000	1,290,000	ditto
3) Civil and building work of pun			1 5 100	4 4 4 9 9 9 9	
Civil works (Tank)	m3	95	15,400		Based on standard design
Timbering for Tank	m2	218	5,045		Steel sheet pile
Civil works (Building)	m2	45	7,396		Market rate
Cost for Boundary wall,	LS	1		963,068	ditto
84-2 Rising Main					
1) Pipe installation Procurement and installation	af DCL				
			5 20 4	2 122 200	
300 mm dia	m	600	5,204	3,122,308	Market rate
2) Civil work for pipe installation					
Pavement demolishing		a (a	150	100.104	Dan
Demolishing	m3	240	452	108,436	
Disposal of demolished	m3	240	170	40,771	JSK
Excavation					1
Earthwork in	m3	567	116	65,953	ditto
Sand foundation		_			
Providing coarse sand	m3	81	165	13,336	ditto
Backfilling					
Earthwork in back	m3	1,038	40	41,939	ditto
Disposal	m3				
Carriage of materials by					
Earth upto 5th km	m3	284	170	48,161	ditto
Earth beyond 5 km but	m3	284	233	65,953	ditto
Timbering and Shuttering					
0-1.5 m depth	m2	2,400	98	235,636	DSR
3) Road restoration					
BT surface road	m3	240	1,956	469,440	ditto
4) River Crossing					
Foundation and pier for pipe	no	10	69,083	690,827	ditto
				18,752,288	
Total cos	t B: Pur	np Station and	Rising Main	220,006,914	
C: Sewerage Treatment Plant					
103,000	m3/day	103,000	9,000	927,000,000	Quotation
Appurtenant facilities (LS			139,050,000	
Total	cost C:	Sewerage Tre	eatment Plant	1,066,050,000	
): House Connection					
Installation of inspection cha	no	28,666	8,090	231,907,940	Market rate
		20,000	0,070	251,907,940	
	Tet	Loost D. Us	o Connection	221 007 040	<u> </u>
	Tota	l cost D: Hous	e connection	231,907,940	
	\mid				l
C: Drainage Facility					
1) RCC precast drain	m	504,110	7,496		Average of DPR
2) Culvert	m	7,840	14,274	111,904,416	
3) Piping	m	2,050	12,050	24,702,359	ditto
4) Dismantling existing drains &	LS			391,521,972	
5) Pavement demolishing					
Demolishing	m3	10,547	452	4,765,100	DSR
Disposal of demolished	m3	10,547	170	1,791,639	JSR
6) Road restoration		10,0 .7	1.0	1,721,000	
BT surface road	m3	10,547	1,956	20,628,954	DSR
Di sullace load	mb	10,547	1,930	20,020,934	DOK
		al assá E: D: - '	mana E114	4 222 825 285	<u> </u>
	Tot	al cost E: Drai	nage Facility	4,333,927,385	
					1

Appendix B4.1: Corrected DPR Cost Zone-II (4/4)

	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
one-Ш						
	vity Sewer					
	installation pipe					
	terial Procurement					
ivia	Class SN8 structured do	uble wa	ull polvehylene	piping system	ns as per EN:13476-3	
	150 mm dia	m	125,109	246		Market rate
	200 mm dia	m	14,235	455	6,481,603	ditto
	250 mm dia	m	10,604	825	8,750,628	ditto
	300 mm dia	m	8,960	1,110	9,949,372	ditto
	400 mm dia	m	7,421	1,622	12,036,229	ditto
	600 mm dia	m	7,992	3,893	31,111,720	ditto
	800 mm dia	m	3,352	6,551	21,960,476	ditto
Inct	1000 mm dia tallation	m	3,148	10,299	32,423,406	ditto
mst	150 mm dia	m	125,109	21	2,651,066	ditto
_	200 mm dia	m m	14,235	36	505,910	ditto
	250 mm dia	m	10,604	36	376,866	ditto
	300 mm dia	m	8,960	71	636,956	ditto
	400 mm dia	m	7,421	71	527,531	ditto
	600 mm dia	m	7,992	113	906,624	ditto
	800 mm dia	m	3,352	113	510,135	ditto
	1000 mm dia	m	3,148	215	675,930	ditto
RC	Pipe					
	terial Procurement					
	NP3 R.C.C. pipe as per					
	1200 mm dia	m	8,133	5,079	41,305,144	JSR
	1400 mm dia	m	-	6,888	-	ditto
Inst	tallation					
	1200 mm dia	m	8,133	778	6,330,983	ditto
	1400 mm dia	m	-	856	-	ditto
	work for pipe installation					
Pav	vement demolishing		75.500	150	24440.202	DOD
	Demolishing	m3	75,582	452	34,149,202	DSR
Deer	Disposal of demolished	m3	75,582	170	12,839,825	JSR
Exc	avation		575 296	116	CC 020 070	1:44 -
	Earthwork in	m3	575,386	116	66,928,878	ditto
	Extra for earthwork in 1.5 m to 2.5 m depth	m3	186,266	6	1 054 267	ditto
	2.5 m to 3.5 m depth	m3	107,653	11	<u>1,054,267</u> 1,218,638	ditto
	3.5 m to 4.5 m depth	m3	63,671	17	1,081,130	
	4.5 m to 5.5 m depth	m3	35,816	23	810,880	ditto
	5.5 m to 6.5 m depth	m3	19,712	23	557,843	ditto
	6.5 m to 7.5 m depth	m3	10,619	34	360,617	ditto
	7.5 m to 8.5 m depth	m3	5,193	40	205,741	ditto
	8.5 m to 9.5 m depth	m3	1,057	45	47,857	ditto
	9.5 m to 10.5 m depth	m3	12	51	631	ditto
San	d foundation					
	Providing coarse sand	m3	24,552	165	4,042,194	JSR
	PCC bedding	m3	992	2,942	2,918,573	ditto
Bac	kfilling					
	Earthwork in back	m3	1,104,773	40	44,654,935	ditto
Dis	posal					
	Carriage of materials by					
	Earth upto 5th km	m3	51,232	170	8,703,292	JSR
	Earth beyond 5 km but	m3	51,232	233	11,918,612	ditto
Tim	bering and Shuttering					
	0-1.5 m depth	m2	187,595	98	18,418,429	
	1.5-2.5 m depth	m2	232,833	103	23,918,289	ditto
	2.5-4.5 m depth	m2	214,155	114	24,335,834	
	Beyond 4.5m	m2	72,409	3,364	243,557,581	Steel Sheet pile
3) Manh				10.00-	45 500 555	DOD
	nhole (Bottom dia. 0.9 m)	no.	4,427	10,325	45,708,373	
	nhole (Bottom dia. 1.2 m) nhole (Bottom dia. 1.5 m)	no. no.	1,234	17,627	21,751,606	ditto
	p manhole	no.	2,376 402	43,578 11,753	<u>103,540,464</u> 4,722,833	ditto ditto
	restoration	110.	402	11,753	4,722,833	uno
	surface road	m3	113,400	1,956	221,810,639	ditto
	3M surface road	m3	34,892	1,930	37,004,918	ditto
	surface road	m3	26,169	6,494	169,937,934	JSR
	vay crossing	110	20,109	0,474	107,757,754	5.51
5) Railw	Crossing					
		m3	345	6.494	2,240,361	ditto
	Protection by concrete		545	0,424	2,240,301	
5) River	Protection by concrete ection Work in River Area					
5) River	ection Work in River Area Protection by concrete	m3	575	6,494	3.733.935	ditto
5) River	ction Work in River Area	m3	575	6,494	3,733,935	ditto

Appendix B4.1: Corrected DPR CostZone-III&IV(1/4)

Zone-III&IV (2/4)

Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
B: Pump Station and Rising Ma		Quantity.	Tute (101)		itemati ite
B1: SPS-A					
B1-1 Pump station					
(1) Mechanical Facility					
Cost of Pumps @ 2000	0/ kW	270	34,400		Market rate
Mechanical Screens	Each	2	3,990,400	7,980,800	
Gates (0.8 m X 0.8 m)	Each	5	1,032,000	5,160,000	ditto
(2) Electrical Facility					
Miscellaneous	LS	1		1,290,000	ditto
Cost of HT Panel	Each	1	860,000	860,000	ditto
Cost of Transformer	Each	1	1,634,000	1,634,000	
Cost of LT Panel	Set	1	1,204,000	1,204,000	
Cost of cabling	Set	1	602,000	602,000	
Cost of Earthing	Lot	1	258,000	258,000	ditto
Cost of DG Sets	Each	1	7,740,000	7,740,000	ditto
(3) Civil and building work of put			1 5 100	< 1 <0.000	N
Civil works (Tank)	m3	400	15,400		Based on standard design
Timbering for Tank	m2	509	5,045	2,567,127	Steel sheet pile
Civil works (Building)	m2	110	7,396	813,560	
Cost for Boundary wal	l, LS	1		3,556,917	anto
B1-2 Rising Main					l
(1) Pipe installation Procurement and installation	n of DCT	nine	├		
700 mm dia	m	1,700 <u>1</u> ,700	26,790	15 542 270	Market rate
(2) Civil work for pipe installation		1,700	26,790	45,543,270	warket rate
Pavement demolishing	1				
Demolishing	m3	680	452	307,236	DSB
Disposal of demolished		680	170	115,518	
Excavation		060	170	115,518	
Earthwork in	m3	3,205	116	372,747	JSR
Sand foundation	mo	3,205	110	572,747	351
Providing coarse sand	m3	332	165	54,578	ditto
Backfilling	ms	552	105	54,578	anto
Earthwork in back	m3	3,766	40	152,212	ditto
Disposal	m3	3,700	40	152,212	ditto
Carriage of materials by					
Earth upto 5th km	, m3	1.602	170	272,190	ditto
Earth beyond 5 km bu		1,602	233	372,747	ditto
Timbering and Shuttering	m2	-,		. . . ,	
0-1.5 m depth	m2	6,800	98	667,636	DSR
(3) Road restoration		01000			
BT surface road	m3	680	1,956	1,330,080	ditto
(4) River Crossing			-,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-,,	1
Foundation and pier for pip	e no	2	69,083	138,165	ditto
				98,440,786	
B2: SPS-B					
B2-1 Pump station					
(1) Mechanical Facility					
Cost of Pumps @ 2000	0/ kW	95	34,400	3,268,000	Market rate
Mechanical Screens	Each	2	4,317,200	8,634,400	ditto
Gates (1.5 m X 1.5 m)	Each	5	722,400	3,612,000	ditto
(2) Electrical Facility					
Miscellaneous	LS	1		1,205,032	ditto
Cost of HT Panel	Each	1	860,000	860,000	ditto
Cost of Transformer	Each	1	688,000	688,000	ditto
Cost of LT Panel	Set	1	602,000	602,000	ditto
Cost of cabling	Set	1	344,000	344,000	ditto
	Set	1	189,200	189,200	ditto
Cost of Earthing		1	4,042,000	4,042,000	ditto
Cost of Earthing Cost of DG Sets	Each	1			
			.,,		
Cost of DG Sets			15,400	5,852,000	Based on standard design
Cost of DG Sets (3) Civil and building work of put	mp statio	n			Based on standard design Steel sheet pile
Cost of DG Sets (3) Civil and building work of pu Civil works (Tank)	mp statio m3	n 380	15,400		

Appendix B4.1: Corrected DPR Cost

Source: JICA Study Team

B4-6

Appendix B4.1: Corrected DPR Cost Zone-III

Zone-III&IV (3/4)

	Description	Unit	Quantity	Pote (Pc)	Amount (Bc.)	Remarks
B2-2	Rising Main	Omt	Quantity	Rate (Rs.)	Amount (Rs.)	Kemarks
(1) Pi	ipe installation					
	Procurement and installation	of DCI	pipe			
	700 mm dia	m	1,200	14,026	16,831,056	Market rate
	ivil work for pipe installation					
	Pavement demolishing Demolishing	m3	480	452	216.972	DCD
	Disposal of demolished	 m3	480	452	216,873 81,542	
	Excavation	mb	480	170	81,542	
	Earthwork in	m3	2,262	116	263,116	JSR
	Sand foundation					
	Providing coarse sand	m3	234	165	38,526	ditto
	Backfilling					
	Earthwork in back	m3	2,658	40	107,444	ditto
	Disposal Carriage of materials by	m3				
	Earth upto 5th km	m3	1,131	170	192,134	ditto
	Earth beyond 5 km but	m3	1,131	233	263,116	
	Timbering and Shuttering	m2	.,		,	
	1.5-2.5 m depth	m2	4,800	103	493,091	DSR
	oad restoration					
	BT surface road	m3	480	1,956	938,880	ditto
	iver Crossing					
	Foundation and pier for pipe	no	10	69,083	690,827	ditto
D2.	SPS-C				56,081,835	
	Pump station					
	Iechanical Facility					
(1) 10.	Cost of Pumps @ 20000	kW	304	34,400	10.457.600	Market rate
	Mechanical Screens	Each	2	4,334,400	8,668,800	
	Gates (0.3 m X 0.3 m)	Each	5	928,800	4,644,000	
(2) E	lectrical Facility					
	Miscellaneous	LS	1		1,096,156	ditto
	Cost of HT Panel	Each	1	860,000	860,000	
	Cost of Transformer (31		1	1,083,600	1,083,600	
	Cost of LT Panel	Set	1	688,000	688,000	
	Cost of cabling	LS	1	430,000	430,000	
	Cost of Earthing	LS Each	1	189,200 5,074,000	189,200	
(3) C	Cost of DG Sets ivil and building work of pum			3,074,000	5,074,000	
(3) C	Civil works (Tank)	m3	515	15,400	7.931.000	Based on standard design
	Timbering for Tank	m2	707	5,045		Steel sheet pile
	Civil works (Building)	m2	100	7,396		Market rate
	Cost for Boundary wall,	LS	1		3,567,921	ditto
	Rising Main					
	ipe installation					
	Procurement and installation					
(D) C	800 mm dia ivil work for pipe installation	m	5,000	10,821	54,104,380	Market rate
	Pavement demolishing					
	Demolishing	m3	2,000	452	903,636	DSR
	Disposal of demolished	m3	2,000	170	339,760	
	Excavation		_,	2.0	222,000	
	Earthwork in	m3	8,100	116	942,192	ditto
	Sand foundation					
	Providing coarse sand	m3	900	165	148,176	ditto
	Backfilling	-				
	Earthwork in back	m3	10,586	40	427,886	ditto
	Disposal	m3				l
	Carriage of materials by Earth upto 5th km	m3	4,050	170	688,014	ditto
	Earth beyond 5 km but	m3	4,050	233	942,192	ditto
	Timbering and Shuttering		-,050	235	772,172	
	0-1.5 m depth	m2	20,000	98	1,963,636	DSR
(3) R	oad restoration					
	BT surface road	m3	2,000	1,956	3,912,000	ditto
<u> </u>	iver Crossing					
	Foundation and pier for pipe	no	10	69,083	690,827	ditto
D ć	SPG D				114,061,731	
	SPS-D	ļ				
	Pump station Iechanical Facility					<u> </u>
(1)N	Cost of Pumps @ 2000/	KW	64	34,400	2 201 600	Market rate
	Mechanical Screens	Each	2	4,334,400	8,668,800	
	Gates (0.4 m X 0.4 m)	Each	5	928,800	4,644,000	
	Carco (0.7 m / 0.7 m)		5	/20,000	-,0,000	1

	Appendix	D4.1:	Corrected I	DPR Cost	Lone-III&IV	(4/4)
	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
(2) El	lectrical Facility					
	Miscellaneous	LS	1		1,096,156	ditto
	Cost of HT Panel	Each	1	860,000	860,000	ditto
	Cost of Transformer (31:	Each	1	1,083,600	1,083,600	ditto
	Cost of LT Panel	Set	1	688,000	688,000	ditto
	Cost of cabling	LS	1	430,000	430,000	ditto
	Cost of Earthing	LS	1	189,200	189,200	ditto
	Cost of DG Sets (315KV	Each	1	5,074,000	5,074,000	ditto
(3) Ci	ivil and building work of pum	p statio	n			
	Civil works (Tank)	m3	515	15,400	7,931,000	Based on standard design
	Timbering for Tank	m2	502	5,045	2,532,818	Steel sheet pile
	Civil works (Building)	m2	100	7,396	739,600	Market rate
	Cost for Boundary wall,	LS	1		2,948,721	ditto
B4-2	2 Rising Main					
(1) Pi	ipe installation					
]	Procurement and installation	of DCI	pipe			
	400 mm dia	m	2,500	10,821	27,052,500	Market rate
(2) Ċi	ivil work for pipe installation		ĺ ĺ		, ,	
	Pavement demolishing					
	Demolishing	m3	1,000	452	451,818	DSR
-	Disposal of demolished	m3	1,000	170	169,880	
	Excavation		1,000	1,0	-07,000	
Ť	Earthwork in	m3	5,750	116	668,840	ditto
	Sand foundation		5,750	110	000,040	
ť	Providing coarse sand	m3	750	165	123.480	ditto
1	Backfilling	no	150	105	125,400	ditto
	Earthwork in back	m3	9,372	40	378,816	ditto
1	Disposal	m3	9,312	40	578,810	ditto
	Carriage of materials by	mb				
	Earth upto 5th km	m3	2,875	170	488,405	ditto
	Earth beyond 5 km but	m3	2,875	233	668,840	
,	Timbering and Shuttering	nıs	2,873	255	008,840	ditto
			10,000	08	001.010	DCD
(2) D	0-1.5 m depth oad restoration	m2	10,000	98	981,818	DSR
<u> </u>		2	1 000	1.056	1.056.000	11
	BT surface road	m3	1,000	1,956	1,956,000	ditto
	iver Crossing		10	60.000	<00.0 27	11
	Foundation and pier for pipe	no	10	69,083	690,827	ditto
					72,718,720	
	T-4-1	4 D . D		D:-: M-:	241 202 052	
	10tal Cos	t B: Pui	mp Station and	RISING MAIN	341,303,073	
C: Se	ewerage Treatment Plant					
		m3/day	53,000	9,000	477,000,000	Quotation
	Appurtenant facilities (1	LS			71,550,000	
	Total	cost C:	Sewerage Tre	eatment Plant	548,550,000	
D: He	ouse Connection					
]	Installation of inspection cha	no	28,666	8,090	231,907,940	Market rate
		-	- /	- /	- , ,	
-		Tata	l cost D: Hous	e Connection	231.907.940	
		1018	a cost D. Hous		<i>231,707,7</i> 40	
E. D	noineae Facilit					
	rainage Facility		000.000	0.107	1.070.455.015	
	CC precast drain	m	239,820	8,187		Average of DPR
~ /	ulvert	m	2,470	18,125	44,769,108	ditto
(3) Pi	· · ·	m	1,940	6,228	12,082,126	ditto
<u>`</u>	ismantling existing drains & s	LS			202,030,805	
(5) Pa	avement demolishing					
	Demolishing	m3	5,137	452	2,320,900	DSR
	Disposal of demolished	m3	5,137	170	872,640	
(6) R	oad restoration	-	-,			
<u> </u>	BT surface road	m3	5,137	1,956	10,047,581	DSR
	21 Surface road	mo	5,157	1,750	10,047,501	250
		T_{c4}	al cost E: Dea	naga Facility	2 235 570 075	
		Tot	tal cost E: Drai	inage Facility	2,235,579,975	

Appendix B4.1: Corrected DPR Cost

Zone-III&IV (4/4)

Appendix B4.2: Construction Cost	Zone-II (1/13)
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1) Pipe in 1) PE pi	Description vity Sewer - Trunk TR-1&2 istallation (Procurement & Installation) ipe Class SN8 structured double wall polyehy 150 mm dia 2000 - Li	Unit /lene pip	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
A-1: Grav 1) Pipe in 1) PE pi	stallation (Procurement & Installation) ipe Class SN8 structured double wall polyehy 150 mm dia	lene pip				
1) Pipe in 1) PE pi	stallation (Procurement & Installation) ipe Class SN8 structured double wall polyehy 150 mm dia	lene pip				
	150 mm dia	lene pip				
		1 P	ing systems as	s per EN:13476	-3	
		m	1,985	294		Market rate (Quotation)
	200 mm dia	m	2,075	540	1,120,411	
	250 mm dia 300 mm dia	m m	2,315 1,725	947 1,300	2,191,925 2,241,953	
4	350 mm dia	m	510	1,500	806,331	
	400 mm dia	m	990	1,361	1,843,775	
	450 mm dia	m	1,080	2,499	2,698,399	
	500 mm dia	m	200	3,135	626,927	
	600 mm dia	m	1,580	4,407	6,962,863	
	700 mm dia	m	820	5,884	4,825,290	
	800 mm dia	m	350	7,362	2,576,743	
	900 mm dia 1000 mm dia	m m	- 2.230	9,464 11,565	25,790,940	do do
	Pipe NP3 R.C.C. pipe as per I.S.S. 458-1971	m	2,230	11,505	23,790,940	40
	1100 mm dia	m	200	5,906	1,181,101	JSR 1.119, 10.6.2.5
	1200 mm dia	m	1,988	6,442	12,807,432	
	1400 mm dia	m	243	7,516	1,826,412	do
	vork for pipe installation					
	ement demolishing	+				
	Demolishing	m3	8,521	497	, ,	DSR15.2.2
	Disposal of demolished pavement ch Excavation (Normal 75%, Rock 25%)	m3	8,521	223	1,901,417	JSR 3.4
	ch Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m	m3	95,364	450	12 001 020	DSR2.8.1, 2.9.1, 2.11, 2.12
	Excavation beyond 4.5 m	m3	8,825	1,352		DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12
	foundation		0,023	1,552	11,720,200	10112.11, 10112.12
	Providing coarse sand	m3	15,163	223	3,379,164	JSR5.1.10
	Backfilling					
	Backfilling up to 4.5 m depth	m3	78,729	143	11,284,527	DSR 2.25, 2.26
	Backfilling beyond 4.5m depth	m3	5,131	227	1,163,446	do
	osal of excavated soil in pipe trench					
	Earth up to 5th km	m3	10,164	187	1,899,378	
	Earth beyond 5 km but upto 10 km	m3	10,164	256	2,601,006	JSR 3.2
	pering and Shuttering	m2	2.752	108	405 179	DODO 161
	0-1.5 m depth 1.5 m to 2.5 m	m2	3,752 20,498	108		DSR2.16.1 DSR2.16.2
	2.5 m to 4.5 m	m2	60,036	115		DSR2.16.3
	Beyond 4.5m (ave: 6.0 m)	m2	40,074	4,113	164,842,743	
3) Manho			101011			
Manl	hole (Bottom dia. 0.9 m) H < 1.5 m	no.	54	12,535	681,528	DSR19.9.1.2, 19.10.2, 19.16
	hole (Bottom dia. 1.2 m) $1.5 < \text{H} < 2.5$	no.	223	19,420		DSR19.11.1.2, 19.12.2, 19.16
	hole (Bottom dia. 1.5 m) 2.5 < H< 4.5	no.	373	54,229		DSR19.13.1.2, 19.14.2, 19.17
	hole (Bottom dia. 1.5 m) 4.5 < H	no.	145	92,961	13,497,577	
	manhole restoration	no.	518	16,287	8,437,875	DSR19.22.2, 19.23.2
,	M surface road			1.167		DSR16.13.2
	urface road	m3 m3	- 7,243	1,167 2,152	- 15 587 210	DSR16.13.1
	urface road	m3	1,278	4,873	6,228,667	
	Crossing Pipe Bridge		-,-,-	.,	0,220,000	
R-1 D800	0 L=25m					
Pipe	installation (Procurement & Installation)					
	DCI pipe D800	m	25	14,360	359,000	DSR 18.72
	ication of girder	+				
	Formwork	m2	125	335		DSR 5.9.2
	Concrete Re-bar	m3 kg	26	7,632		DSR 5.2.1 DSR 5.22.4
	allation (20ton crane)	day	2,550	67 11,663		DSR 5.22.4 DSR 01-0028, 02-0157
	tment	auy	2	11,005	43,343	251(01 0020, 02-0137
	Formwork	m2	192	335	64.224	DSR 5.9.2
	Concrete	m3	108	7,632	. ,	DSR 5.2.1
	Re-bar	kg	9,720	67		DSR 5.22.4
	Excavation (rock)	m3	324	595		DSR 2.6.1
	Backfill	m3	216	143		DSR 2.25, 2.26
	Soil disposal	m3	108	153	16,556	DSR 1.1.2
	porary works		-		-	DODACI
	Excavation (rock)	m3	200	595		DSR 2.6.1
	Embankment Sheet pile (L=4m)	m3	200 100	102 4,920	20,400 492,000	DSR 2.38
	Dewatering	no. LS	100	4,920	,	211,700 Rs./site
- - ¦	20. atomig	<u>ш</u>			423,400	211,/00 K3/81C
	Total cost A	-1: Grav	vity Sewer - Tr	unk TR-1&2	397,027,200	TR-1&2
+	2000 00013				-> , , , , , , , , , , , , , , , , , , ,	
1. Cro	wity Sewer - Trunk TR-3&4&5					
<u></u>	stallation (Procurement & Installation)					
1) Pipe in				s per EN:13476	2	1

Appendix B4.2: Construction Cost	Zone-II	(2/13)	
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UDecompositionIde (Not (Not (Not (Not (Not (Not (Not (Not		Appendix 64.2: C	onsu		COSt	Zone-II (2	2/13)
■ m 955 546 51559 do ■ 250mmda m 1,500 420 2,30,420 do ■ 250mmda m 1,800 1,800 2,30,420 do ■ 350mmda m 1,800 4200 2,30,420 do ■ 550mmda m 1,800 4,007 3,25,441 do ■ 550mmda m 2,260 1,555 do do ■ 000mmda m 1,00 7,25,841 do do do ■ 0000mda m 1,00 1,00 do do do do ■ 1000mda m - 6,566 - SSR 1.19, 10,2,5 do ■ 1000mda m - - 6,660 2,57020 SSR 3.1,21,11,21,21 ■ 10000mda m - - 1,552 SSR 3.1,21,21,11,21,21 do do do		Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
Bornarda m 1,800 2,334,62 do Bornarda m -<		200 mm dia	m	955			
■ Sommain m 1.580 do do ■ 400mmdia m 1.820 3.5094 do ■ 300mmdia m 1.820 3.518 do ■ 300mmdia m 8.00mmdia do 3.115 do ■ 300mmdia m 1.00 3.158 do do 3.158 do 3.158 <td></td> <td>250 mm dia</td> <td>m</td> <td>1,520</td> <td>947</td> <td>1,439,191</td> <td>do</td>		250 mm dia	m	1,520	947	1,439,191	do
a 80 mm dn m 1.800 1.850 3.599.34 do. a 800 mm dn m a 3.113 a do. a 800 mm dn m a 3.113 a do. a 800 mm dn m 8.80 4.497 3.125.844 do. a 800 mm dn m 0.400 3.690 do. do. a 800 mm dn m 1.431 1.1561 do. do. a 800 mm dn m 1.433 1.1560 do. do. a 800 mm dn m 1.431 1.1561 lo. do. a 800 mm dn m - 5.668 .587.119 do. do. a 120 mm dn m - 5.642 do.		300 mm dia	m	1,800	1,300	2,339,429	do
Bornandia m		350 mm dia	m	-	1,581	-	do
a Souranda m \sim $2,00$ do a Souranda m a \sim \sim \sim a Dommida m 20 \sim \sim \sim a Dommida m 20 \sim \sim \sim a Dommida m 20 \sim \sim \sim \sim b Dommida m \sim $<$ \sim \sim \sim $<$ a Dommida m \sim $<$ $<$ \sim $<$ $<$ $<$ \sim $<$ \sim $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ $<$ <t< td=""><td></td><td>400 mm dia</td><td>m</td><td>1,890</td><td>1,862</td><td>3,519,934</td><td>do</td></t<>		400 mm dia	m	1,890	1,862	3,519,934	do
Sourmedia m i 3.33 do 0 formedia m 800 media m 200 5.848 1.175000 do 0 formedia m 1.00 5.848 1.175000 do 0 formedia m 1.00 0.36574 do do 0 formedia m 1.00 0.5641 do do 100 modia m 0.442 0.57381 do do 100 modia m 0.442 0.00 do do 100 modia m 0.442 0.00 do do 100 modia m 0.457 4.97 3.06106 DSR1522 DSR1522 100 Densibing inducement m1 0.417 4.97 3.06106 DSR1522 1.211, 212, 212, 212 100 Densibing inducement m1 6.157 4.97 3.06106 DSR21, 138, 12, 211, 212, 212 100 Densibing inducement m1 6.157 4.97 3.986 3.83, 10.		450 mm dia	m	-		-	
BOOmmla m 800 4.477 3.245.844 do 300 mmda m 200 5.884 1.176.000 do do 900 mmda m		500 mm dia	m	-		-	
Norman m 200 5.884 1,17,500 do 800 mmda m 1.40 7.362 10.050,74 do do 1000 mmda m 1.43 11.565 16.573,28 do do 218 CFpc, NF3 RCC, pie aper 1.55, 458 U71 m - 5.506 J.87,119, 10.6.2.5 1100 mmda m - 5.506 J.87,119, 10.6.2.5 do 1100 mmda m - 5.506 J.87,119, 10.6.2.5 do 1100 mmda m - 7.516 do do 1100 mmda m - 7.526 do do do 1100 mmda m - 1.537 30.606 D88152.2 do 1100 mmda m3 6.6230 450 299,020 D882.81,2.9.1,2.11,2.12 Escavation up to 4.5m m3 do do do 1100 mmda m3 1.539 2.50.001 DS82.85,2.2.6 do do do do do do		600 mm dia		850		3 745 844	
Stormada m 1,400 7,502 10,007,074 do 1900 mm dia m 1,433 11,555 15,57,231 do 200 mm dia m 1,433 11,555 15,57,231 do 1100 mm dia m - 5,566							
SO menda m m 1.433 11.556 1.6573.281 do 1100 media m - 5.006 1.6573.281 do 1100 media m - 5.006 J.857.281 do 1100 media m - 6.421 - do 1100 media m - 7.516 - do 1100 media m - 7.516 - do 1100 media m - 7.516 - do 1100 media formbing m - 1.717 4.717 4.717 3.7011 State 1100 media beyoad 4.5 m m3 6.520 - <td></td> <td></td> <td></td> <td></td> <td>- 1</td> <td></td> <td></td>					- 1		
Into marka m I,433 I,1650 Io 507 Io 507 I 100 mm dia m . .506 JSR 119, 10.6.2.5 I 200 mm dia m I 200 mm dia m I 200 mm dia m				1,100		10,500,577	
Discrept MPR RCC (ppe App at Spr 15.8 458-197) m - 5.950 - <t< td=""><td></td><td></td><td></td><td>1.433</td><td><i>,</i></td><td>16 573 281</td><td></td></t<>				1.433	<i>,</i>	16 573 281	
I 100 mm da m - 5,900 JSR 1110, 10.0.2.5 I 200 mm da m - 6,42 - - - Optimum demolishing m - 7,516 - - - Dannishing m - 7,516 - - - Dannishing m3 6,157 497 3,061,065 DSR152.2 - Dannishing m3 6,157 497 3,061,065 DSR23,1,291,211,212 - Description for Marking m6 - <td>2) RC1</td> <td></td> <td></td> <td>1,455</td> <td>11,505</td> <td>10,575,201</td> <td>40</td>	2) RC1			1,455	11,505	10,575,201	40
I 200 mm dia m - 6.42 - do IB00 mm dia m - 7.516 - do Dermolishing m - - - - - Demolishing m3 6.157 297 3.061.065 DSR215.22 - Depcisol of demolished pavement m3 6.157 293 1.073.090 DSR215.22 - Exeration leyond 4.5 m m3 6.620 440 2070.021 DSR23.1, 29.1, 211, 212 Depcisol for exeration leyond 4.5 m m3 6.620 440 2070.021 DSR23.1, DSR21.1, DSR21.12 J Depsid for exeration leyond 4.5 m m3 - 1.352 - do - J Depsid for exeration of in pipt tenh m3 7.940 1.87 1.483.827 JSR 3.1 - do - - - - - - - - - - - - - - - - - - <t< td=""><td>2) KC I</td><td></td><td>m</td><td></td><td>5 006</td><td></td><td>ISB 1 110 10 6 2 5</td></t<>	2) KC I		m		5 006		ISB 1 110 10 6 2 5
I H20 mm dia m - 7,516 - do D/Porenett denoishing -				-	<i>,</i>	-	,
C2 Cold work for pipe installation Image: C2 Cold work for pipe installation Image: C2 Cold work for pipe installation Demolshing m3 6,157 427 306.066 DSR15.2.2 Deposed of demolshed parement m3 6,157 223 1373.89 NR3.4 2) Tench Excavation Normal 75%, Rock 25%) m6 66.20 450 207.0201 DSR2.81, 2.91, 2.11, 2.12 Decavation hey ond 4.5 m m3 6.20 450 207.0201 DSR2.81, 2.91, 2.11, 2.12 Decavation hey ond 4.5 m m3 6.20 450 207.0201 DSR2.81, 2.91, 2.11, 2.12 Decavation hey ond 4.5 m m3 6.20 450 207.0201 DSR2.81, 2.91, 2.11, 2.12 Decavation hey ond 4.5 m m3 7.940 143 7.219.568 DSR2.52, 2.66 Backfilling up to 4.5 mdepth m3 7.940 181 1.483.87 1.483.87 Deravement devond 3 brank upto 10 km m3 7.940 181 1.483.87 1.58.12 Deravement devond 3 brank upto 10 km m3 7.940 1.27.35 DS2.49.12 DS				-		-	
Diprocent derolishing noil noil< noil< noil n	(2) (2::1.		m	-	7,516	-	do
Demoisning nd 6.157 447 3.06.065 DSR 15.2.2 Disposal of demoisned press nd 6.57 2.23 1.373.89 JR8.3.4 2) Treach Exavation (Normal 75%, Rock 25%) nd 6.520 4.50 2.97,00.00 DSR 2.8.1.2.9.1.2.11, 2.12 Exavation beyond 4.5 m nd 6.520 4.50 2.97,00.00 DSR 2.8.1.2.9.1, 2.11, 2.12 Deprosing one sand nd 1.520 2.28 2.99,0.00 DSR 2.1.10.82.12 IPpre Backfiling apt od 5.m depth nd 1.52							
Desposal of demolshed pavement n3 6.157 223 1.373.899 JSR 3.4 Descavation (Normal 798, Role 2%) n3 6.250 450 29,790.201 DSR 2.1, 20.1, 2.1, 2.12 Descavation beyond 4.5m n3 6.250 450 29,790.201 DSR 2.1, DSR 2.12 Beckfiling coanes and n3 1.323 22,900.401 DSR 2.1, DSR 2.12 Providing coanes and n3 5.0.369 143 7.19.568 DSR 2.52 Backfiling pet od.4.5m depth n3	I) Pave						
2) Treach Escavation (Normal 75%, Rock 25%) - - - - Beavarion up to 4.5 m n3 6.520 4.50 2.97,90,201 DSR2.3.1.2.0.1,2.11,2.12 Beavarion beyond 4.5 m n3 6.520 4.50 2.97,90,201 DSR2.1.1.DSR2.12 By prostand fing - - - - - - By prostand fing - - - - - - Backfilling up to 4.5 m depth n3 5.03,269 143 7.219,560 DSR2.5.2.6 Backfilling beyond 4.5 m depth n3 7.240 125 4.63 - 5) Disposal of exavated soil in pipe trench -		Demolishing	1				
Example of Sam $n3$ $6-250$ 490 $29,790,20$ DSR2.1, 20, 2.11, 2.12 Jeravation beyond 45m $n3$ $1-25$ $1-252$ <			m3	6,157	223	1,373,899	JSR 3.4
Exacution beyond 45 m n3 1.32 DBR 11.DSR2.12 Providing coarse and n3 13.239 223 299.406 ISS 1.10 Prove ling coarse and n3 13.239 223 299.406 ISS 1.10 Prove ling coarse and coarse coarse and coarse and coarse and coarse and coarse coarse and	2) Trer						
3) Ppr donation m			m3	66,250			
3) Ppr donation m			m3	-	1,352		
Providing coarse sand n3 13,23 223 2.99,061 SRS 1.10 Backfilling n 50,059 145 7,219,580 December 2.5,2.2.6 Backfilling beyond 4.5 widenth n3 50,277 do do S) Disposal of exavated soilin pipe trench n3 7,940 145 7,219,580 DSR 2.5,2.2.6 Backfilling beyond 4.5 midenth n3 7,940 256 2,031,551 JSR 3.2 0 Timbering and Shuttering n2 2,882 108 311,283 DSR 1.6.2 1.5 m top 2.5 m n2 1,737 113 1,377,441 DSR 1.6.2 1.2 mot 0.4 m n0 1,21,77 113 1,377,441 DSR 1.6.2 1.2 Manhoke n0 12 19,423 2,566,707 DSR 10,11.1.2 19,122.19,102.19,16 Manhoke (Bottom du, 1.5 m) 1.5 < H < .5	Pipe						
$\begin{aligned} Ppc Backfilling = vol =$			m3	13.239	223	2,950,405	JSR5.1.10
Backfilling up to 45 m depth m3 50.369 H3 7.219/58 Descent 27 do 5) Disposal of exavated soil in pipe trench m3 7.940 H37 1.483.827 JSR 3.2 Earth bryond Sub tur m3 7.940 157 1.483.827 JSR 3.2 0 10 15 m depth m2 2.882 108 311.283 DSR 3.2 0 115 m depth m2 2.882 108 311.283 DSR 2.16.1 1 15 m depth m2 4.733 125 S.967.281 DSR 1.61.2 1 5 m to 25 m m2 4.733 125 S.967.281 DSR 1.01.2, 19, 102, 19, 16 Manhok (Bottom dia, 1.2 m) 1.5 < H < 25	4) Pine		1	10,209		2,550,105	
Backfilling beyond 4.5m.depth m3 227 do Barth upp 5th km mail top for them mail top 5th km mail	., 1100		m2	50 260	143	7 210 540	DSR 2 25 2 26
5) Desposal of exeavated soil in pipe trench no. 7.940 187 1.483.827 JSR 3.2 Barth upto 5th km m3 7.940 256 2.031.951 JSR 3.2 6) Timbering and Shutering m2 2.882 108 311.283 DSR2.16.1 1.15 mto 2.5 m m2 12.5 T 113 1.373.41 DSR2.16.2 2.5 mto 0.4 5 m m2 47.738 125 5.5967.281 DSR2.16.3 Mathole Motion dia. 1.2 m) 1.5 c H < 2.5				50,509		1,219,308	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	5) Di			-	221	-	uu
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	JDIST			=	107	4 100 0/-	10D 2 2
(b) Theoring and Shuttering (b) Theoring and Shuttering (b) Theoring and Shuttering (b) Theoring and Shuttering (c) Is mice 25 m m2 12,157 113 1.37,3141 DSR2.16.2 (c) Is mice 25 m m2 47,738 125 5.967,281 DSR2.16.3 (c) Manhole m2 9,039 4.113 3.71,81,553 T.4 (c) Manhole (Bottom din, 0.9 m) H < 1.5 m		Earth upto 5th km	1				
			m3	7,940	256	2,031,951	JSR 3.2
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	6) Tim						
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		0-1.5 m depth	m2	2,882	108	311,283	DSR2.16.1
Beyon 4.5m (ave: 6.0 m) n2 9.039 4.113 37,181.553 T.4 (3) Manhole 1		1.5 m to 2.5 m	m2	12,157	113	1,373,741	DSR2.16.2
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		2.5 m to 4.5 m	m2	47,738	125	5,967,281	DSR2.16.3
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		Beyond 4.5m (ave: 6.0 m)	m2	9.039	4,113	37,181,553	T-4
Manhole (Bottom dia. $0.9 \text{ m} H < 1.5 \text{ m}$ no. 42 [12,535] 523,592 DSR19.9.1.2, 19.102, 19.16 Manhole (Bottom dia. 1.5 m) $4.5 < H < 2.5$ no. 122 19,420 2.566,197 DSR19.11.2, 19.142, 19.17 Manhole (Bottom dia. 1.5 m) $4.5 < H$ no. 33 92.961 3.044,483 do Drop manhole no. 329 16.287 5.362,540 DSR19.13.1.2, 19.142, 19.17 WBM surface road m3 5.234 2.152 11.262,797 DSR16.13.2 WBM surface road m3 5.234 2.152 11.262,797 DSR16.13.2 CS surface road m3 5.234 2.152 11.262,797 DSR16.13.2 (Formsork m2 m3 5.234 2.152 11.262,797 DSR16.13.2 (Formsork m2 m3 5.234 2.152 11.262,797 DSR16.13.2 (Formsork m2 m3 194,950 DSR 16.42 DSR 16.42 (Formsork m2 38 335 12,711 DSR 5.22.4	(3) Manh				,		
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Drop manhole no. 329 16,287 5,362,540 DSR19,22.2, 19,23.2 (4) Road restoration m3 - 1,167 DSR16,13.2 DSR16,13.2 BT surface road m3 5,234 2,152 11,262,797 DSR16,13.1 CC surface road m3 924 4,873 4,500,624 DSR16,42 (5) River Crossing Pipe Bridge - - - - - Pipe installation (Procurement & Installation) - - - - - Pipe installation (Procurement & Installation) -					,		
(4) Road restoration m3 m3 <td></td> <td></td> <td></td> <td></td> <td>,</td> <td></td> <td></td>					,		
WBM surface road m3 1,167 DSR16.13.2 BT surface road m3 5,234 2,152 11,262,77 DSR16.13.1 CC surface road m3 924 4,873 4,500,624 DSR16.42 (5) River Crossing Pipe Bridge 924 4,873 4,500,624 DSR16.13.1 (7) River Crossing Pipe Bridge 924 4,873 4,500,624 DSR16.13.1 (7) River Crossing Pipe Bridge 924 4,873 4,500,624 DSR16.7 Pipe installation (Procurement & Installation) 924 14,945 194,950 DSR 18.72 Formwork m2 38 335 12,711 DSR 5.2.1 Concrete m3 7 7,632 54,950 DSR 5.2.1 Re-bar kg 720 67 47,880 DSR 5.2.1 Abutment m2 - - - - Formwork m2 192 35 64,224 DSR 5.2.1 Re-bar kg 9,720 67 646,380 DS			110.	529	10,287	5,302,340	DSR19.22.2, 19.23.2
BT surface road m3 5,234 2,152 11,262,797 DSR16.13.1 CC surface road m3 924 4.873 4,500,624 DSR16.42 (SRiver Cossing Pipe Bridge m3 924 4.873 4,500,624 DSR16.42 (SRiver Cossing Pipe Bridge m3 924 4.873 4,500,624 DSR16.42 (SRiver Cossing Pipe Bridge m3 924 4.873 4,500,624 DSR16.42 (SRiver Cossing Pipe Bridge m3 12 194,950 DSR 18.72 m3 (SRiver Cossing Pipe Bridge m3 7,632 54,950 DSR 18.72 (Formwork m2 38 335 12,711 DSR 5.2.1 (Concrete m3 7,632 54,950 DSR 5.2.1 (Concrete m3 108 7,632 282,425 DSR 5.2.1 (Concrete m3 108 153 16,550 DSR 1.2.1 (Concrete m3 108 153 16,555 DSR 2.2.5,266 (Soli disposal							
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(5) River Crossing Pipe Bridge Image: Construct Construl Construct Construct Construct Construct Construl							
TR-3 D1000 L=10m Image: constraint of the second seco			m3	924	4,873	4,500,624	DSR16.42
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Fablication of girder m2 38 335 12,711 DSR 5.9.2 Concrete m3 7 7,632 54,950 DSR 5.2.1 Re-bar kg 720 67 47,880 DSR 5.2.4 Installation (20ton crane) day 2 11,663 23,325 DSR 0.028,02-0157 Abutment - - - - - - Concrete m3 108 7,632 824,226 DSR 5.9.2 Concrete m3 108 7,632 824,256 DSR 5.9.2 Concrete m3 108 7,632 824,256 DSR 5.2.1 Backfill m3 216 143 30,960 DSR 2.5, 1.2 Backfill m3 216 143 30,960 DSR 2.5, 2.26 Soil disposal m3 200 153 16.550 DSR 1.1.2 Temporary works - - - - - Excavation (rock) m3 200 10	Pipe						
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Abutment n2 12 335 64.24 DSR 5.9.2 Concrete m3 108 7,632 824.256 DSR 5.2.1 Re-bar kg 9,720 67 64.380 DSR 5.2.4 Excavation (rock) m3 324 595 192,806 DSR 2.2.5, 2.26 Backfill m3 216 143 30.960 DSR 2.2.5, 2.26 Soil disposal m3 108 153 16,555 DSR 1.1.2 Temporary works - - - - - Excavation (rock) m3 200 595 119,016 DSR 2.6.1 Exavation (rock) m3 200 102 20,400 DSR 2.38 Sheet pile (L=4m) no. 100 4,920 492,000 7-1(0) Dewatering IS 423,400 211,700 Rs /site - Fablication of girder - - - - Fablication of girder - - - -	Inst						
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Soil disposal m3 108 153 16,556 DSR 1.1.2 Temporary works - </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$							
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$			m3	108	153	16,556	DSR 1.1.2
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Ten			-		-	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Excavation (rock)	m3	200	595	119,016	DSR 2.6.1
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Embankment	m3	200	102	20,400	DSR 2.38
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Sheet pile (L=4m)	no.	100	4,920	492,000	T-1(0)
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Formwork m2 120 335 40,140 DSR 5.9.2 Concrete m3 23 7,632 171,720 DSR 5.2.1 Re-bar kg 2,250 67 149,625 DSR 5.2.2.4 Installation (20ton crane) day 2 11,663 23,325 DSR 01-0028,02-0157 Abutment - - - - - - Formwork m2 108 335 36,126 DSR 5.9.2 Querte m3 54 7,632 412,128 DSR 5.2.1	E-1.1			25	9,405	200,025	DSK 10.72
Concrete m3 23 7,632 171,720 DSR 5.2.1 Re-bar kg 2,250 67 149,625 DSR 5.2.4 Installation (20ton crane) day 2 11,663 23,325 DSR 01-0028, 02-0157 Abutment - - - - - Formwork m2 108 335 36,126 DSR 5.9.2 Concrete m3 54 7,632 412,128 DSR 5.2.1	Fab		<u> </u>				D0D 5 0 2
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Abutment - - Formwork m2 108 335 36,126 DSR 5.9.2 Concrete m3 54 7,632 412,128 DSR 5.2.1	Inst	allation (20ton crane)	day	2	11,663	23,325	DSR 01-0028, 02-0157
Formwork m2 108 335 36,126 DSR 5.9.2 Concrete m3 54 7,632 412,128 DSR 5.2.1						-	
Concrete m3 54 7,632 412,128 DSR 5.2.1			m2	108	335	36,126	DSR 5.9.2
			_				

	Appendix B4.2: C					3/13)
	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	excavation (rock)	m3	162	595	96,403	DSR 2.6.1
_	Backfill	m3	108	143	15,480	DSR 2.25, 2.26
Se	oil disposal	m3	54	153	8,278	DSR 1.1.2
	orary works		-		-	
E	Excavation (rock)	m3	200	595	119,016	DSR 2.6.1
Er	mbankment	m3	200	102	20,400	DSR 2.38
Sł	heet pile (L=4m)	no.	100	4,920	492,000	T-1(0)
D	Dewatering	LS			423,400	211,700 Rs./site
2-4 D400 I						
	nstallation (Procurement & Installation)					
D	DCI pipe D400	m	65	5,369	348,985	DSR 18.72
Fablica	ation of girder					
Fo	formwork	m2	176	335	58,705	DSR 5.9.2
C	Concrete	m3	18	7,632	133,942	DSR 5.2.1
Re	Re-bar	kg	1,755	67	116,708	DSR 5.22.4
Installa	lation (20ton crane)	day	2	11,663	23,325	DSR 01-0028, 02-0157
Abutm	nent		-		-	
Fo	Formwork	m2	94	335	31,309	DSR 5.9.2
C	Concrete	m3	32	7,632		DSR 5.2.1
	Re-bar	kg	2,916	67		DSR 5.22.4
	Excavation (rock)	m3	97	595		DSR 2.6.1
	Backfill	m3	65	143	9,288	
	oil disposal	m3	32	143		DSR 1.1.2
	bundation			155	.,	
_	Formwork	m2	36	335	12 042	DSR 5.9.2
	Concrete	m3	27	7,632		DSR 5.2.1
	Re-bar	kg	2,430	67		DSR 5.22.4
	Excavation (rock)	m3	2,450	595		DSR 5.22.4 DSR 2.6.1
_	Backfill	m3	54	143		DSR 2.25, 2.26
	loil disposal	m3	27	143		DSR 2.25, 2.26 DSR 1.1.2
Pier	onasposa		27	153	4,139	DOK 1.1.2
	Formwork	m2	- 54	225	- 19.072	DSR 5.9.2
	Concrete	_		335	,	
_		m3	20	7,632		DSR 5.2.1
_	Re-bar	kg	1,823	67	121,196	DSR 5.22.4
	orary works	-	-		-	
	excavation (rock)	m3	500	595		DSR 2.6.1
	Embankment	m3	500	102		DSR 2.38
	heet pile (L=4m)	no.	250	4,920	1,230,000	
D	Dewatering	LS			1,058,500	211,700 Rs./site
				TD 10407	101110000	
	Total cost A-1:	Gravity	Sewer - Trunk	x TR-3&4&5	186,478,324	
			Sewer - Trunl	x TR-3&4&5	186,478,324	
	ity Sewer - Sub-trunk and Collector TR-1&		Sewer - Trunk	x TR-3&4&5	186,478,324	
Pipe inst	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation)	2				
Pipe inst) PE pipe	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) Class SN8 structured double wall polyehy	2 lene pip	ing systems as	s per EN:13476	3	
Pipe inst) PE pipe 15	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia	2 lene pip m	ing systems as 193,359	per EN:13476 294	-3 56,806,435	
Pipe inst) PE pipe 15 20	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) be Class SN8 structured double wall polyehy 50 mm dia	2 lene pip m m	ing systems as 193,359 14,033	5 per EN:13476 294 540	-3 56,806,435 7,577,155	do
Pipe in st) PE pipe 15 20 25	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 50 mm dia	2 lene pip m m m	ing systems as 193,359 14,033 8,215	per EN:13476 294 540 947	-3 56,806,435 7,577,155 7,778,019	do do
Pipe inst) PE pipe 15 20 25 30	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia	2 lene pip m m m m	ing systems as 193,359 14,033 8,215 8,900	per EN:13476 294 540 947 1,300	-3 56,806,435 7,577,155 7,778,019 11,566,928	do do do
Pipe inst) PE pipe 15 20 25 30 40	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia	2 lene pip m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202	s per EN:13476 294 540 947 1,300 1,862	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992	do do do do
Pipe inst) PE pipe 15 20 25 30 40 60	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 50 mm dia 00 mm dia 00 mm dia 00 mm dia	2 lene pip m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292	s per EN:13476 294 540 947 1,300 1,862 4,407	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905	do do do do
Pipe inst) PE pipe 15 20 25 30 40 60 80	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia	2 lene pip m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202	; per EN:13476 294 540 947 1,300 1,862 4,407 7,362	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992	do do do do do do
Pipe inst) PE pipe 20 25 30 40 60 80 10	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia	2 lene pip m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292	s per EN:13476 294 540 947 1,300 1,862 4,407	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905	do do do do
Pipe inst) PE pipe 15 20 25 30 40 60 80 10 0) RC Pip	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia	2 lene pip m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292	per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905	do do do do do do do
Pipe inst PE pipe 15 20 25 30 40 60 80 10 10 10 11 11 11	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 200 mm dia	2 lene pip m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905	do do do do do do do JSR 1.119, 10.6.2.5
Pipe inst PE pipe 15 20 25 30 40 60 80 10 25 12 12 12 12 14 14	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 000 mm dia	2 lene pip m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292	per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905	do do do do do do do
Pipe inst PE pipe 15 20 25 30 40 60 80 10 25 12 12 14 Civil work	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 200 mm dia 000 mm dia 000 mm dia se NP3 R.C.C. pipe as per I.S.S. 458-1971 200 mm dia ork for pipe installation	2 lene pip m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905	do do do do do do do JSR 1.119, 10.6.2.5
Pipe inst PE pipe 15 20 25 33 40 60 10 12 12 14 14 14 14 14 14	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 200	2 lene pip m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - -	; per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - -	do do do do do do JSR 1.119, 10.6.2.5 do
Pipe inst PE pipe 15 20 25 30 40 60 80 10 12 14 Civil won) Pavem D	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia	2 lene pip m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - 102,735	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2
Pipe inst PE pipe 15 20 25 30 44 60 80 10 10 12 14 Civil wor Pavem D	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 000 mm dia	2 lene pip m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - -	; per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - -	do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2
Pipe inst PE pipe 15 20 333 400 66 80 100 12 140 61 120 121 141 Civil wor Pavem D D D D D	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 200	2 lene pip m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - 102,735 102,735	per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do DSR 1.119, 10.6.2.5 do DSR 15.2.2 JSR 3.4
Pipe inst PE pipe 15 20 33 40 60 80 10 10 11 14 Civil wor D D D D E E E	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 200 mm dia 200 mm dia 100 mm dia 200	2 lene pip m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - 102,735	: per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 497 497	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
Pipe inst Pipe inst PE pipe 15 26 30 40 40 60 80 10 11 14 Civil wor Pavem D D D Trench E E	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 10	2 lene pip m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - 102,735 102,735	per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do DSR 1.119, 10.6.2.5 do DSR 15.2.2 JSR 3.4
Pipe inst Pipe inst PE pipe 15 26 30 40 40 60 80 10 11 14 Civil wor Pavem D D D Trench E E	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 200 mm dia 200 mm dia 100 mm dia 200	2 lene pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - 102,735 102,735	: per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 497 497	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
Pipe inst Pipe inst PE pipe 15 20 25 30 40 40 60 80 10 10 10 10 12 14 Civil wor D D D D D D D D D D D D D	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 10	2 lene pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - 102,735 102,735	: per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 497 497	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12
Pipe inst Pipe inst PE pipe 15 20 25 36 40 66 80 10 10 10 12 12 12 12 12 12 12 12 12 12	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 0000	2 lene pip m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 450 1,352	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12
Pipe inst Pipe inst PE pipe 15 22 30 40 40 40 10 10 10 10 10 10 10 10 10 1	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 200 mm dia 000 mm dia 0000 mm dia 0000 mm dia 000 mm dia 000 mm dia 000 mm dia 0000	2 lene pip m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 450 1,352	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR5.1.10
Pipe inst Pipe inst PE pipe 15 26 30 40 40 60 80 10 10 10 11 14 Civil wor 12 14 Civil wor D Pavem D D D Trench E E Pipe Pipe Pipe Pipe Pipe B 8 8 8 8 8 8 8 8 8 8 8 8 8	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 10	2 lene pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	: per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 450 1,352	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR5.1.10 DSR 2.25, 2.26
Pipe inst Pipe inst PE pipe 15 20 25 30 40 60 80 10 10 10 10 10 10 10 10 10 1	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 000 m	2 lence pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 497 223 497 223 497 223 450 1,352	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR5.1.10
Pipe inst Pipe inst PE pipe 15 20 25 36 40 66 80 10 10 10 10 10 10 10 10 10 1	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) © Class SN8 structured double wall polyehy 50 mm dia 00	2 energipe m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	e per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 450 1,352 450 1,352 223 450	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR5.1.10 DSR 2.25, 2.26 do
Pipe inst Pipe inst PE pipe 15 20 25 30 40 40 40 40 40 40 40 40 40 4	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 000 mm dia 200	2 lene pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	: per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 450 1,352 450 1,352 223 450 1,352 143 227 143	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do do do do do SR 1.119, 10.6.2.5 do DSR 15.2.2 JSR 3.4 DSR 2.8, 1, 2.9, 1, 2.11, 2.12 DSR 2.11, DSR 2.12 JSR 5.1.10 DSR 2.25, 2.26 do JSR 3.2
Pipe inst Pipe inst PE pipe 15 20 30 40 40 50 10 10 10 10 10 10 10 10 10 1	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 0mm dia 00 0mm dia 00 0mm dia e NP3 R.C.C. pipe as per LS.S. 458-1971 200 mm dia 400 mm dia 400 mm dia rk for pipe installation nent demolishing Demolishing Demolishing Demolishing Disposal of demolished pavement h Excavation UN oral 75%, Rock 25%) Excavation beyond 4.5 m Doundation roviding coarse sand Sackfilling Backfilling beyond 4.5 m depth Sal of excavated soil in pipe trench arth upto 5th km	2 energipe m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	e per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 450 1,352 450 1,352 223 450	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do do do do do SR 1.119, 10.6.2.5 do DSR 15.2.2 JSR 3.4 DSR 2.8, 1, 2.9, 1, 2.11, 2.12 DSR 2.11, DSR 2.12 JSR 5.1.10 DSR 2.25, 2.26 do JSR 3.2
Pipe inst Pipe inst PE pipe 15 20 25 30 40 60 80 10 10 10 10 10 10 10 10 10 1	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 000 m	2 lence pipp m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 497 223 497 223 497 223 497 223 497 1,352 223 143 227 187 256	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR5.1.10 DSR 2.25, 2.26 do JSR 3.2 JSR 3.2
Pipe inst Pipe inst PE pipe 15 20 25 30 40 60 80 10 12 12 14 10 12 12 14 10 12 12 14 10 12 12 12 12 12 12 12 12 12 12	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 000 mm dia 000 mm dia e NP3 R.C.C. pipe as per I.S.S. 458-1971 200 mm dia 400 mm dia 400 mm dia 400 mm dia 400 mm dia 400 mm dia 9 mp 3 R.C.C. pipe as per I.S.S. 458-1971 200 mm dia 400 mm dia 400 mm dia 400 mm dia 400 mm dia 50 sposal of demolished pavement h Excavation (Normal 75%, Rock 25%) 5xcavation up to 4.5 m 5xcavation beyond 4.5 m 500 mm dia 400 fm 4.5 m 500 mm dia 500	2 enere pipp m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 450 1,352 223 450 1,352 223 143 227 187 226 108	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR5.1.10 DSR 2.25, 2.26 do JSR 3.2 JSR 3.2 DSR2.16.1
Pipe inst Pipe inst PE pipe 15 22 30 40 60 80 10 10 10 10 10 10 10 10 10 1	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 000 mm dia 200	2 lene pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	: per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR5.1.10 DSR 2.25, 2.26 do JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2
Pipe inst Pipe inst PE pipe 15 20 30 40 40 40 80 10 10 10 10 10 10 10 10 10 1	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 00 mm dia 000 mm dia 000 mm dia 000 mm dia 000 mm dia 100	2 leene pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 	s per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 6,443 8,576 497 223 497 223 497 223 497 223 497 223 497 223 497 223 497 223 143 227 56 187 2256 108 113 125	-3 -3 -3, 56,806,435 7,778,019 11,556,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR 5.1.10 DSR 2.25, 2.26 do JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR2.16.3
Pipe inst Pipe inst PE pipe 15 20 20 20 20 20 20 20 20 20 20	ity Sewer - Sub-trunk and Collector TR-1& tallation (Procurement & Installation) e Class SN8 structured double wall polyehy 50 mm dia 00	2 lene pip m m m m m m m m m m m m m m m m m m	ing systems as 193,359 14,033 8,215 8,900 6,202 9,292 3,188 - - - - - - - - - - - - -	: per EN:13476 294 540 947 1,300 1,862 4,407 7,362 11,565 	-3 56,806,435 7,577,155 7,778,019 11,566,928 11,550,992 40,949,905 23,472,578 - - - - - - - - - - - - -	do do do do do do do JSR 1.119, 10.6.2.5 do DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12 JSR 5.1.10 DSR 2.25, 2.26 do JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR2.16.3

Appendix B4.2: Construction Cost Zone-II (3/13)

Appendix 64.2: C	_			Zone-II (4	
Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
Manhole (Bottom dia. 1.2 m) $1.5 < H < 2.5$ Manhole (Bottom dia. 1.5 m) $2.5 < H < 4.5$	no.	4,078	19,420 69,663		DSR19.11.1.2, 19.12.2, 19.16 DSR19.13.1.2, 19.14.2, 19.17
Manhole (Bottom dia: 1.5 m) 2.5 < H < 4.5	no.	68	92,961	6,333,031	
Drop manhole	no.	1,199	16,287		DSR19.22.2, 19.23.2
) Road restoration					
WBM surface road	m3	10,274	1,167	11,989,229	DSR16.13.2
BT surface road	m3	82,188	2,152		DSR16.13.1
CC surface road	m3	10,274	4,873	50,062,994	DSR16.42
T-t-1 A 2. C t S	. C.L.4		-4 TD 1 8-2	1 297 459 991	
Total cost A-2: Gravity Sewe	r - Sub-tr	unk and Colle	ector IR-1&2	1,286,458,881	
-2: Gravity Sewer - Sub-trunk and Collector TR-38	\$485				
1) Pipe installation (Procurement & Installation)					
1) PE pipe Class SN8 structured double wall polyeh	ylene pip	ing systems a	s per EN:13476	-3	
150 mm dia	m	106,179	294	31,193,974	Market rate (Quotation)
200 mm dia	m	7,390	540	3,990,267	do
250 mm dia	m	5,095	947	4,824,196	
300 mm dia	m	3,739	1,300	4,859,033	
400 mm dia	m	4,332	1,862	8,067,587	
600 mm dia	m	1,339	4,407	5,902,109	
800 mm dia	m	456	7,362	3,357,196	
1000 mm dia 2) RC Pipe NP3 R.C.C. pipe as per I.S.S. 458-1971	m	-	11,565	-	do
1200 mm dia	m		6,443		JSR 1.119, 10.6.2.5
1400 mm dia	m	-	8,576	-	do
2) Civil work for pipe installation		-	0,370	-	40
1) Pavement demolishing					
Demolishing	m3	53,472	497	26,583,574	DSR15.2.2
Disposal of demolished pavement	m3	53,472	223	11,931,520	
2) Trench Excavation (Normal 75%, Rock 25%)					
Excavation up to 4.5m	m3	278,390	450	125,182,581	DSR2.8.1, 2.9.1, 2.11, 2.12
Excavation beyond 4.5 m	m3	-	1,352	-	DSR2.11, DSR2.12
3) Pipe foundation					
Providing coarse sand	m3	64,400	223	14,351,819	JSR5.1.10
4) Pipe Backfilling					
Backfilling up to 4.5 m depth	m3	210,216	143	30,131,022	
Backfilling beyond 4.5m depth	m3	-	227	-	do
5) Disposal of excavated soil in pipe trench	-		107		
Earth upto 5th km	m3	34,087	187 256	6,369,853	
6) Timbering and Shuttering	m3	34,087	230	8,722,872	JSR 3.2
0-1.5 m depth	m2	200,677	108	21 673 150	DSR2.16.1
1.5 m to 2.5 m	m2	200,077	108		DSR2.16.2
2.5 m to 4.5 m	m2	67,484	115		DSR2.16.3
Beyond 4.5m (ave: 6.0 m)	m2	2,702	4,113	11,112,824	
B) Manhole		2,702	.,	11,112,021	
Manhole (Bottom dia. 0.9 m) H < 1.5 m	no.	2,908	12,535	36,455,231	DSR19.9.1.2, 19.10.2, 19.16
Manhole (Bottom dia. 1.2 m) 1.5 < H < 2.5	no.	2,251	19,420		DSR19.11.1.2, 19.12.2, 19.16
Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	no.	419	69,663		DSR19.13.1.2, 19.14.2, 19.17
Manhole (Bottom dia. 1.5 m) 4.5 < H	no.	10	92,961	909,935	do
Drop manhole	no.	429	16,287	6,986,073	DSR19.22.2, 19.23.2
4) Road restoration					
WBM surface road	m3	5,347	1,167		DSR16.13.2
BT surface road	m3	42,778	2,152		DSR16.13.1
CC surface road	m3	5,347	4,873	26,056,876	DSR16.42
			-4 TD 400		
Total cost A-2: Gravity Sewe	r - Sub-tr	unk and Colle	ctor 1R-1&2	591,707,985	
+ +	+				
Pump Station and Rising Main					
R-1	1				
S-1 Pump Facility (Pump station)	Design	Max Flow: 0.	257m3/sec	Pump: 45kW x 3 nos	.(2W+1S)
I) Mechanical Facility				1	
Submersible pump	kW	135	37,840	5,108,400	Market rate
Piping	Ls	1			10% of above
Mechanical Screens including belt conveyor	Each	2	4,748,920		Market rate
Gates (0.8 m X 0.8 m)	Each	4	813,560	3,254,240	
e) Electrical Facility					
Miscellaneous electrical facility	LS	1			Market rate
Cost of HT Panel	Each	1	946,000	946,000	
Cost of Transformer (315KVA)	Each	1	1,191,960	1,191,960	
Cost of LT Panel	Set	1	756,800	756,800	
Cost of cabling	Set	1	473,000	473,000	
Cost of Earthing	Lot	1	208,120	208,120	
		1	5,581,400	5,581,400	do
Cost of DG Sets (315KVA)	Each	1	5,501,100		
Cost of DG Sets (315KVA) 3) Civil and Building Work				1 000 // -	
	m3 m2	76	16,940 8,136		DSR, Standard dwg Market rate

Appendix B4.2: Construction CostZone-II(4/13)

		Appendix B4.2: C	onst	ruction (JOST	Zone-II (5	(15)
		Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
		pering and Shuttering	Ls			1,164,830	
		ndary wall (brick wall) 0.6m3/m	m3	48	3,001		JSR 5.2.10
	Acce	ess road (BT surface road) 1m3/m	m3	20	2,152		DSR16.13.1
C.	I D:	sing Main (DCI pipe line)	D450 I	=1170m	Sub-total	33,544,073	
		stallation (Procurement & Installation)	D450 I	_1170III			
1)1		DCI pipe D450	m	1,170	6,207	7 262 190	DSR 18.72
2) (vork for pipe installation	m	1,170	0,207	7,202,190	D3R 18.72
		ement demolishing					
-/		Demolishing	m3	503.1	497	250.116	DSR15.2.2
		Disposal of demolished pavement	m3	503.1	223		JSR 3.4
2)		ch Excavation (Normal 75%, Rock 25%)				,	
		Excavation up to 4.5m	m3	2,220	450	998,294	DSR2.8.1, 2.9.1, 2.11, 2.12
3)		Backfilling				,	
		Backfilling up to 4.5 m depth	m3	2,034	143	291,553	DSR 2.25, 2.26
4)	Disp	osal of excavated soil in pipe trench					
		Earth upto 5th km	m3	93	187	17,378	JSR 3.2
		Earth beyond 5 km but upto 10 km	m3	93	256	23,797	JSR 3.2
5)		pering and Shuttering					
		0-1.5 m depth	m2	-	108	-	DSR2.16.1
		1.5 m to 2.5 m	m2	3,861	113	436,293	DSR2.16.2
5) F		restoration	2	502	0.150	1.000 (71	DODICION
4) T		urface road	m3	503	2,152	1,082,671	DSR16.13.1
	0 L=3	Crossing Pipe Bridge	<u> </u>				
<i>1</i> 43		Om installation (Procurement & Installation)	<u> </u>				
		DCI pipe D450	m	30	6,207	102 010	DSR 18.72
		ication of girder		30	0,207	180,210	DOK 10.72
		Formwork	m2	108	335	36 126	DSR 5.9.2
		Concrete	m2 m3	108	7,632		DSR 5.2.1
		Re-bar	kg	1.440	67		DSR 5.22.4
		allation (20ton crane)	day	2	11,663		DSR 01-0028, 02-0157
	_	tment	,	-	11,000	20,020	
		Formwork	m2	101	335	33,718	DSR 5.9.2
		Concrete	m3	43	7,632	329,702	DSR 5.2.1
		Re-bar	kg	3,888	67		DSR 5.22.4
		Excavation (rock)	m3	130	595	77,122	DSR 2.6.1
		Backfill	m3	86	143	12,384	DSR 2.25, 2.26
		Soil disposal	m3	43	153	6,623	DSR 1.1.2
	Pier	foundation		-			
		Formwork	m2	24	335		DSR 5.9.2
		Concrete	m3	18	7,632		DSR 5.2.1
		Re-bar	kg	1,620	67		DSR 5.22.4
		Excavation (rock)	m3	54	595		DSR 2.6.1
		Backfill	m3	36	143		DSR 2.25, 2.26
	D'	Soil disposal	m3	18	153	2,759	DSR 1.1.2
	Pier	Formwork		-	225	-	D0D 500
		Concrete	m2 m3	36 14	335		DSR 5.9.2
		Re-bar	kg	1,215	7,632 67		DSR 5.2.1 DSR 5.22.4
		porary works	<u>^s</u>	1,213	0/	80,798	DJR J.22.4
	1.cm	Excavation (rock)	m3	400	595	238 (132	DSR 2.6.1
		Embankment	m3	400	102		DSR 2.38
		Sheet pile (L=4m)	no.	200	4,920	984,000	
		Dewatering	LS	200	.,,20		211,700 Rs./site
		U U			Sub-total	14,242,666	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
S-	2 Pu	mp Facility (Pump station)	Design	Max Flow: 0.		Pump: 45kW x 4 nos	.(3W+1S)
		anical Facility					
		Submersible pump	kW	180	37,840	6,811,200	Market rate
		Piping	Ls	1			10% of above
		Mechanical Screens including belt conveyor	Each	2	5,846,280		Market rate
_		Gates (1.5 m X 1.5 m)	Each	3	1,759,560	5,278,680	do
2) E	lectri	cal Facility					
		Miscellaneous electrical facility	LS	1		1,543,743	
		Cost of HT Panel	Each	1	946,000		Market rate
		Cost of Transformer (750KVA)	Each	1	1,797,400	1,797,400	
		Cost of LT Panel	Set	1	1,324,400	1,324,400	
		Cost of cabling	Set	1	662,200	662,200	
		Cost of Earthing	Set	1	283,800	283,800	
2) /	No.21	Cost of DG Sets (750KVA)	Each	1	8,514,000	8,514,000	d0
5) (nd Building Work	m2	122	16.040	0.005.000	DSD Stondard Jour
		structure (concrete)	m3 m2	132	16,940		DSR, Standard dwg
		ding works ndation pipe (RC precast D400)	m2 m	57 1,419	8,136 2,328		Market rate DSR 20.5.1
	rout	beering and Shuttering	m Ls	1,419	2,328	2,021,466	DSR 20.3.1
	Tim	and Shuttering		-0	2 001		JSR 5.2.10
		ndary wall (brick wall) 0.6m3/m	m2	60			
	Bou	ndary wall (brick wall) 0.6m3/m ess road (BT surface road) 1m3/m	m3 m3	60 30	3,001		
	Bou	ndary wall (brick wall) 0.6m3/m ess road (BT surface road) 1m3/m	m3 m3	60 30	2,152 Sub-total		DSR16.13.1

Appendix B4.2: Construction CostZone-II(5/13)

	Appendix B4.2: (Const	ruction (Cost	Zone-II (6	o/13)
	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
(1) P	ipe installation (Procurement & Installation)					
(0) (DCI pipe D800	m	1,340	14,360	19,242,400	DSR 18.72
	ivil work for pipe installation Pavement demolishing					
1)	Demolishing	m3	710	497	252.076	DSR15.2.2
	Disposal of demolished pavement	m3	710.2	223	158,471	
2)	Trench Excavation (Normal 75%, Rock 25%)				100,171	birtoit
	Excavation up to 4.5m	m3	4,422	450	1,988,426	DSR2.8.1, 2.9.1, 2.11, 2.12
3)	Pipe Backfilling					
	Backfilling up to 4.5 m depth	m3	3,749	143	537,326	DSR 2.25, 2.26
4)	Disposal of excavated soil in pipe trench		227	107	(2.002	100.00
	Earth upto 5th km Earth beyond 5 km but upto 10 km	m3	337 337	187 256		JSR 3.2
5)	Timbering and Shuttering	m3	557	230	80,139	JSR 3.2
5)	0-1.5 m depth	m2	-	108	-	DSR2.16.1
	1.5 m to 2.5 m	m2	5,360	113	605,680	DSR2.16.2
(3) R	oad restoration					
	BT surface road	m3	710	2,152		DSR16.13.1
				Sub-total	24,562,771	
	8 Pump Facility (Manhole pump)	Design	Max Flow: 0.0)25m3/sec	Pump: 2.2kW x 2 nos	3.
(1) N	Aechanical Facility	kW	4.4	27 0 40	100 100	Markat rata
	Manhole pump Piping	KW Ls	4.4	37,840		Market rate 5% of above
(2) F	alectrical Facility	- 23	1		6,323	570 OI 000 VC
	Miscellaneous electrical facility	LS	1		1,090,502	Market rate
	Cost of LT Panel	Set	1	283,800	283,800	
	Cost of cabling	LS	1	113,520	113,520	
	Cost of Earthing	LS	1	85,140	85,140	do
(3) (ivil and Building Work					
	Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	no.	2	69,663		DSR19.13.1.2, 19.14.2, 19.17
	Over flow pipe PE pipe D300mm	m	10	1,300		Market rate
	Timbering and Shuttering	m2	108	125 Sub tatal	13,500	DSR2.16.3
MD	8 Rising Main (DCI pipe line)	D150 I	-7.5m	Sub-total	1,913,605	
	ipe installation (Procurement & Installation)	D150 1	<i></i> 7.5III			
(1)1	DCI pipe D150	m	7.5	1,431	10.733	DSR 18.72
(2) (Evil work for pipe installation		710	1,101	10,755	DOK 10.72
	Pavement demolishing					
	Demolishing	m3	3	497	1,342	DSR15.2.2
	Disposal of demolished pavement	m3	3	223	602	JSR 3.4
2)	Trench Excavation (Normal 75%, Rock 25%)					
	Excavation up to 4.5m	m3	8.1	450	3,642	DSR2.8.1, 2.9.1, 2.11, 2.12
3)	Pipe Backfilling			1.12		
4)	Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench	m3	8	143	1,142	DSR 2.25, 2.26
4)	Earth upto 5th km	m3	0	187	12	JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	0	256		JSR 3.2
5)	Timbering and Shuttering	inc		200	17	35R 5.2
- í	0-1.5 m depth	m2	20	108	2,187	DSR2.16.1
	1.5 m to 2.5 m	m2	0	113	-	DSR2.16.2
(3) R	oad restoration					
	BT surface road	m3	3	2,152		DSR16.13.1
		<u> </u>		Sub-total	25,488	
	4 Pump Facility (Manhole pump)	Design	Max Flow: 0.0	J25m3/sec	Pump: 7.5kW x 2 nos	3.
1) N	Aechanical Facility Manhole pump	kW	15	37,840	567 600	Market rate
_	Piping	Ls	15	37,040		5% of above
(2) F	lectrical Facility		1		20,300	570 01 000 10
	Miscellaneous electrical facility	LS	1		1,090,502	Market rate
		Set	1	283,800	283,800	
	Cost of LT Panel	Set				4.
	Cost of cabling	LS	1	113,520	113,520	
	Cost of cabling Cost of Earthing		1	113,520 85,140	113,520 85,140	
(3) (Cost of cabling Cost of Earthing Yivil and Building Work	LS LS	1	85,140	85,140	do
(3) (Cost of cabling Cost of Earthing žvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H<4.5	LS LS no.	1	85,140 69,663	85,140 139,326	do DSR19.13.1.2, 19.14.2, 19.17
(3) (Cost of cabling Cost of Earthing Yvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm	LS LS no. m	1 2 10	85,140 69,663 1,300	85,140 139,326 12,997	do DSR19.13.1.2, 19.14.2, 19.17 Market rate
(3) (Cost of cabling Cost of Earthing žvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H<4.5	LS LS no.	1	85,140 69,663 1,300 125	85,140 139,326 12,997 13,500	do DSR19.13.1.2, 19.14.2, 19.17
	Cost of cabling Cost of Earthing Xvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering	LS LS no. m m2	1 2 10 108	85,140 69,663 1,300	85,140 139,326 12,997	do DSR19.13.1.2, 19.14.2, 19.17 Market rate
MP-	Cost of cabling Cost of Earthing Yvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm	LS LS no. m m2	1 2 10	85,140 69,663 1,300 125	85,140 139,326 12,997 13,500	do DSR19.13.1.2, 19.14.2, 19.17 Market rate
MP-	Cost of cabling Cost of Earthing Yivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS no. m m2	1 2 10 108	85,140 69,663 1,300 125	85,140 139,326 12,997 13,500	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3
MP- (1) P (2) C	Cost of cabling Cost of Earthing Xvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS no. m m2 D150 I	1 2 10 108 _=650m	85,140 69,663 1,300 125 Sub-total	85,140 139,326 12,997 13,500 2,334,764	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3
MP- (1) P (2) C	Cost of cabling Cost of Earthing Vill and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS no. m m2 D150 I	1 2 10 108 _=650m	85,140 69,663 1,300 125 Sub-total 1,431	85,140 139,326 12,997 13,500 2,334,764	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3
MP- (1) P (2) C	Cost of cabling Cost of Earthing živil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS no. m m2 D150 I m m m3	1 2 10 108 =650m 650 234	85,140 69,663 1,300 125 Sub-total 1,431 497	85,140 139,326 12,997 13,500 2,334,764 930,150 116,333	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2
MP- (1) P (2) C 1)	Cost of cabling Cost of Earthing žvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS no. m m2 D150 I m	1 2 10 108 ==650m	85,140 69,663 1,300 125 Sub-total 1,431	85,140 139,326 12,997 13,500 2,334,764 930,150	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2
MP- (1) P (2) C 1)	Cost of cabling Cost of Earthing Xvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS mo. m m2 D150 I m m m3 m3	1 2 10 108 =650m 	85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 223	85,140 139,326 12,997 13,500 2,334,764 930,150 116,333 52,214	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4
MP- (1) P (2) C 1) 2)	Cost of cabling Cost of Earthing Vill and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS no. m m2 D150 I m m m3	1 2 10 108 =650m 650 234	85,140 69,663 1,300 125 Sub-total 1,431 497	85,140 139,326 12,997 13,500 2,334,764 930,150 116,333	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2
MP- (1) P (2) C 1) 2)	Cost of cabling Cost of Earthing Xvil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	LS LS mo. m m2 D150 I m m m3 m3	1 2 10 108 =650m 	85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 223	85,140 139,326 12,997 13,500 2,334,764 930,150 116,333 52,214 315,666	do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4

Appendix B4.2: Construction Cost Zone-II (6/13)

		Appendix D4.2. C	_			20110-11 (7	,
	-	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	_	Earth up to 5th km	m3	6	187		JSR 3.2
5)	Ti	Earth beyond 5 km but upto 10 km	m3	6	256	1,469	JSR 3.2
5)	11	nbering and Shuttering		1 755	100	100 540	DODALCI
	_	0-1.5 m depth	m2	1,755	108	189,540	
		1.5 m to 2.5 m	m2	0	113	-	DSR2.16.2
(3) I		d restoration					
	BI	'surface road	m3	234	2,152		DSR16.13.1
					Sub-total	2,208,987	
TR-							
		Pump Facility (Manhole pump)	Design	Max Flow: 0.	058m3/sec	Pump: 11kW x 2 nos	
(1)	Mec	hanical Facility					
		Manhole pump	kW	22	37,840	832,480	Market rate
		Piping	Ls	1		41,624	5% of above
(2) I	Elec	trical Facility					
		Miscellaneous electrical facility	LS	1		1,090,502	Market rate
		Cost of LT Panel	Set	1	283,800	283,800	do
		Cost of cabling	LS	1	113,520	113,520	do
		Cost of Earthing	LS	1	85,140	85,140	
3) (Civi	and Building Work					
- / -		anhole (Bottom dia. 1.5 m) $2.5 < \text{H} < 4.5$	no.	2	69,663	139 326	DSR19.13.1.2, 19.14.2, 19.17
		er flow pipe PE pipe D300mm	m	10	1,300		Market rate
		nbering and Shuttering	m2	10	1,500		DSR2.16.3
	111		1112	108			D3N2.10.3
m	2	Dising Main (DCI-i li)	D200 -	-400	Sub-total	2,612,888	
		Rising Main (DCI pipe line)	1 0/200	.=400m			
1) I	ripe	installation (Procurement & Installation)	<u> </u>				
<u>.</u>	<u> </u>	DCI pipe D200	m	400	1,968	787,200	DSR 18.72
		work for pipe installation					
1)	Pa	vement demolishing					
		Demolishing	m3	148	497		DSR15.2.2
	Ľ	Disposal of demolished pavement	m3	148	223	33,024	JSR 3.4
2)	Tr	ench Excavation (Normal 75%, Rock 25%)					
	Γ	Excavation up to 4.5m	m3	476	450	214.041	DSR2.8.1, 2.9.1, 2.11, 2.12
3)	Pir	be Backfilling					
	1	Backfilling up to 4.5 m depth	m3	463	143	66.426	DSR 2.25, 2.26
4)	Di	sposal of excavated soil in pipe trench		105	1.5	00,420	DBR 2.25, 2.26
		Earth upto 5th km	m3	6	187	1 174	JSR 3.2
	-				256		
5)	Ti	Earth beyond 5 km but upto 10 km	m3	6	230	1,607	JSR 3.2
5)	11	nbering and Shuttering		1.120	100		
	_	0-1.5 m depth	m2	1,120	108	120,960	DSR2.16.1
		1.5 m to 2.5 m	m2	-	113	-	DSR2.16.2
(3) I	-	d restoration					
		' surface road	m3	148	2,152	318,496	DSR16.13.1
		r Crossing Pipe Bridge					
020		=30m					
	Piţ	e installation (Procurement & Installation)					
		DCI pipe D200	m	30	1,968	59,040	DSR 18.72
	Fa	blication of girder					
		Formwork	m2	81	335	27.095	DSR 5.9.2
		Concrete	m3	8	7,632		DSR 5.2.1
		Re-bar	kg	810	67		DSR 5.22.4
	In	stallation (20ton crane)	day	2	11,663		DSR 01-0028, 02-0157
		outment	1,		11,005	20,020	
	<u> </u>	Formwork	m2	- 94	335	21 200	DSR 5.9.2
	+	Concrete	m3	32	7,632		DSR 5.9.2
	\vdash		-		· · · · · ·		DSR 5.2.1 DSR 5.22.4
	1	Re-bar	kg	2,916	67		
	1	Excavation (rock)	m3	97	595		DSR 2.6.1
	⊢	Backfill	m3	65	143		DSR 2.25, 2.26
	<u> </u>	Soil disposal	m3	32	153	4,967	DSR 1.1.2
	Pie	r foundation		-			
	1	Formwork	m2	24	335		DSR 5.9.2
	L	Concrete	m3	18	7,632	137,376	DSR 5.2.1
	L	Re-bar	kg	1,620	67	107,730	DSR 5.22.4
	Ľ	Excavation (rock)	m3	54	595	32,134	DSR 2.6.1
_	Γ	Backfill	m3	36	143		DSR 2.25, 2.26
	1	Soil disposal	m3	18	153		DSR 1.1.2
	Pie			-		-	
	1	Formwork	m2	36	335	12.042	DSR 5.9.2
	1	Concrete	m3	14	7,632		DSR 5.2.1
	t	Re-bar	kg	1,215	67		DSR 5.22.4
	To	mporary works	<u>*5</u>	1,215	0/	00,798	DOK J.22.4
	1.6	Excavation (rock)	m ²	-	505	-	DSB 2 6 1
	⊢		m3	400	595		DSR 2.6.1
	1	Embankment	m3	400	102		DSR 2.38
	-	Sheet pile (L=4m)	no.	200	4,920	984,000	
			LS				211,700 Rs./site
	E	Dewatering	1.5				
		Dewatering			Sub-total	4,984,938	
		Dewatering Pump Facility (Pump station)		MaxFlow: 0.		4,984,938 Pump: 45kW x 3 nos	.(2W+1S)
		Dewatering Pump Facility (Pump station) hanical Facility	Design	MaxFlow: 0.		<i>p</i> · · <i>p</i> · · ·	.(2W+1S)
		Dewatering Pump Facility (Pump station)		MaxFlow: 0. 135		Pump: 45kW x 3 nos	.(2W+1S) Market rate

	Appendix B4.2: C	onsti	ruction	Cost	Zone-II (8	(13)
	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	chanical Screens including belt conveyor	Each	2	4,748,920		Market rate
	es (0.8 m X 0.8 m)	Each	3	813,560	2,440,680	do
2) Electrical F						
	cellaneous electrical facility	LS	1		1,205,772	
	t of HT Panel	Each	1	946,000		Market rate
	t of Transformer (315KVA)	Each	1	1,191,960	1,191,960	
	t of LT Panel	Set	1	756,800	756,800	
	t of cabling	Set	1	473,000	473,000	
	t of Earthing	Lot	1	208,120	208,120	
	t of DG Sets (315KVA)	Each	1	5,581,400	5,581,400	do
	Building Work	2		16040	044.104	D0D 0. 1 11
	cture (concrete)	m3	56	16,940		DSR, Standard dwg
Building		m2	24	8,136		Market rate
	on pipe (RC precast D400)	m	599	2,328		DSR 20.5.1
	g and Shuttering	Ls	40	2 001	853,563	
	y wall (brick wall) 0.6m3/m	m3	48	3,001		JSR 5.2.10
Access n	oad (BT surface road) 1m3/m	m3	20	2,152		DSR16.13.1
		D250 I	1545	Sub-total	31,495,253	
S-3 Rising	Main (DCI pipe line)	D330 I	=1545m			
) Pipe install	lation (Procurement & Installation)		1 5 4 5	4 200	6 700 550	DGD 10 72
	pipe D350	m	1,545	4,390	6,782,550	DSR 18.72
	for pipe installation					
	t demolishing		(10	407	207.020	D0D15.2.2
	nolishing	m3	618	497		DSR15.2.2
	boosal of demolished pavement	m3	618	223	137,898	JSR 3.4
	excavation (Normal 75%, Rock 25%)		2.205	450	1.054.020	
	avation up to 4.5m	m3	2,395	450	1,076,839	DSR2.8.1, 2.9.1, 2.11, 2.12
 Pipe Bacl 			2015	1.40		D0D 0 05 0 05
	kfilling up to 4.5 m depth	m3	2,246	143	321,952	DSR 2.25, 2.26
	of excavated soil in pipe trench			107		100 0 0
	h upto 5th km	m3	74	187	13,882	
	h beyond 5 km but upto 10 km	m3	74	256	19,010	JSR 3.2
	g and Shuttering			100		
	5 m depth	m2	-	108	-	DSR2.16.1
	n to 2.5 m	m2	4,790	113	541,214	DSR2.16.2
) Road resto						
BT surfac		m3	618	2,152	1,329,936	DSR16.13.1
) Railway Cr						
	ting of D450 DCI by auger boring L=30m	Ls	1		2,400,000	Market rate (Quotation)
	Vertical Shaft (7395 x 3000 H=6m)		100			
	clearance	m2	100	46		DSR 2.1.1
	avation (Normal) 0-4.5m	m3	108	382	/	DSR 2.6.1
	avation (Normal) 4.5m - 6m	m3	36	1,149	41,364	
	er plate	m	6	208,000		Market rate
	kfill 0-4.5m	m3	108	143		DSR 2.25, 2.26
	kfill 4.5m-6m	m3	20	227	4,540	
	crete (Thrust block)	m3	16	4,408	70,528	DSR 4.1.5
	Vertical Shaft (D3000 H=6m)	Ls	1			
	clearance	m2	50	46		DSR 2.1.1
	avation (Normal) 0-4.5m	m3	32	382		DSR 2.6.1
	avation (Normal) 4.5m - 6m	m3	11	1,149	12,639	
	er plate	m	6	103,000		Market rate
	kfill 0-4.5m	m3	32	143	4,576	DSR 2.25, 2.26
	kfill 4.5m-6m	m3	-	227	-	ditto
Con	crete (Thrust block)	m3	11	4,408	,	DSR 4.1.5
				Sub-total	15,054,479	
R-3						
	Facility (Pump station)	Design	MaxFlow: 0.	419m3/sec	Pump: 55kW x 4 nos	.(3W+1S)
) Mechanica						
_	mersible pump	kW	220	37,840	, ,	Market rate
Pipi		Ls	1			10% of above
	chanical Screens including belt conveyor	Each	2	4,748,920		Market rate
	es (0.8 m X 0.8 m)	Each	5	813,560	4,067,800	do
) Electrical F						
	cellaneous electrical facility	LS	1		1,205,772	
	t of HT Panel	Each	1	946,000		Market rate
	t of Transformer (315KVA)	Each	1	1,191,960	1,191,960	
	t of LT Panel	Set	1	756,800	756,800	
	t of cabling	Set	1	473,000	473,000	
	t of Earthing	Lot	1	208,120	208,120	
	t of DG Sets (315KVA)	Each	1	5,581,400	5,581,400	do
	Building Work					
	cture (concrete)	m3	97	16,940		DSR, Standard dwg
Building		m2	42	8,136		Market rate
	on pipe (RC precast D400)	m	1,044	2,328	2,430,989	DSR 20.5.1
Timberin	g and Shuttering	Ls			1,487,315	
	y wall (brick wall) 0.6m3/m	m3	60	3,001	180,060	JSR 5.2.10
Boundar	y wan (blick wan) 0.000/00					
	oad (BT surface road) 1m3/m	m3	30	2,152	64.560	DSR16.13.1

Appendix B4.2: Construction CostZone-II(8/13)

	Appendix B4.2: C					/13)
_	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	Rising Main (DCI pipe line)	D600 I	=860m			
1) Pi	ipe installation (Procurement & Installation)					
	DCI pipe D600	m	860	9,465	8,139,900	DSR 18.72
	ivil work for pipe installation					
1)	Pavement demolishing					
	Demolishing	m3	404	497	200,948	DSR15.2.2
	Disposal of demolished pavement	m3	404	223	90,192	JSR 3.4
2)	Trench Excavation (Normal 75%, Rock 25%)					
	Excavation up to 4.5m	m3	2,090	450	939,713	DSR2.8.1, 2.9.1, 2.11, 2.12
3)	Pipe Backfilling					
	Backfilling up to 4.5 m depth	m3	1,847	143	264,703	DSR 2.25, 2.26
4)	Disposal of excavated soil in pipe trench				,	
Ź	Earth upto 5th km	m3	122	187	22.708	JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	122	256		JSR 3.2
5)	Timbering and Shuttering				51,057	bortona.
5)	0-1.5 m depth	m2		108		DSR2.16.1
-	1.5 m to 2.5 m	m2	3,096	113	349,848	
D D.	toad restoration	1112	5,070	115	349,040	D3R2.10.2
		2	404		0.00.000	
-	BT surface road	m3	404	2,152		DSR16.13.1
				Sub-total	10,908,947	
	6 Pump Facility (Pump station)	Design	Max Flow: 0.6	556 m3/sec	Pump: 37kW x 4 nos	s.(3W+1S)
) M	Iechanical Facility					
	Submersible pump	kW	148	37,840		Market rate
J	Piping	Ls	1		840,048	10% of above
T	Mechanical Screens including belt conveyor	Each	2	5,846,280	11,692,560	Market rate
Ţ	Gates (1.5 m X 1.5 m)	Each	3	1,759,560	5,278,680	
) E	lectrical Facility		9	, ,	.,	
Ť	Miscellaneous electrical facility	LS	1		1,543,743	
┥	Cost of HT Panel	Each	1	946,000		Market rate
┥	Cost of Transformer (750KVA)	Each	1	1,797,400	1,797,400	
-	Cost of LT Panel		1	1,797,400	1,797,400	
_		Set				
_	Cost of cabling	Set	1	662,200	662,200	
_	Cost of Earthing	Set	1	283,800	283,800	
	Cost of DG Sets (750KVA)	Each	1	8,514,000	8,514,000	do
	ivil and Building Work					
	Civil structure (concrete)	m3	122	16,940	2,058,455	DSR, Standard dwg
	Building works	m2	52	8,136	424,138	Market rate
1	Foundation pipe (RC precast D400)	m	1,307	2,328	3,041,781	DSR 20.5.1
	Timbering and Shuttering	Ls	1,861,007		-	
	Boundary wall (brick wall) 0.6m3/m	m3	60	3,001	180.060	JSR 5.2.10
	Access road (BT surface road) 1m3/m	m3	30	2,152		DSR16.13.1
-	recession (b) surface foud) files in		50	Sub-total	44,252,146	DSICIO.15.1
<u>د د</u>	6 Rising Main (DCI pipe line)	D750 I	.=900m	Sub-total	++,252,140	
	ipe installation (Procurement & Installation)	D750 I				
			000	14 101	10 771 000	
	DCI pipe D750	m	900	14,191	12,771,900	DSR 18.72
	ivil work for pipe installation	m	900	14,191	12,771,900	DSR 18.72
	ivil work for pipe installation Pavement demolishing					
	ivil work for pipe installation Pavement demolishing Demolishing	m m3	468	497	232,666	DSR15.2.2
1)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement				232,666	
1)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%)	m3 m3	468 468	497 223	232,666 104,428	DSR15.2.2 JSR 3.4
1)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m	m3	468	497	232,666 104,428	DSR15.2.2
2)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%)	m3 m3	468 468	497 223	232,666 104,428	DSR15.2.2 JSR 3.4
1)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling	m3 m3	468 468	497 223	232,666 104,428 1,262,664	DSR15.2.2 JSR 3.4
1) 2) 3)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth	m3 m3 m3	468 468 2,808	497 223 450	232,666 104,428 1,262,664	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
1) 2) 3)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench	m3 m3 m3 m3 m3	468 468 2,808	497 223 450 143	232,666 104,428 1,262,664 345,518	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
1) 2) 3)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km	m3 m3 m3 m3 m3 m3	468 468 2,808 2,411 199	497 223 450 143 187	232,666 104,428 1,262,664 345,518 37,132	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2
1) 2) 3) 4)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km	m3 m3 m3 m3 m3	468 468 2,808 2,411	497 223 450 143	232,666 104,428 1,262,664 345,518	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2
1) 2) 3) 4)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering	m3 m3 m3 m3 m3 m3 m3	468 468 2,808 2,411 199	497 223 450 143 187 256	232,666 104,428 1,262,664 345,518 37,132	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2
1) 2) 3) 4)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth	m3 m3 m3 m3 m3 m3 m3 m3 m2	468 468 2,808 2,411 199 199	497 223 450 143 187 256 108	232,666 104,428 1,262,664 345,518 37,132 50,849	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1
1) 2) 3) 4) 5)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m	m3 m3 m3 m3 m3 m3 m3	468 468 2,808 2,411 199	497 223 450 143 187 256	232,666 104,428 1,262,664 345,518 37,132 50,849	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2
1) 2) 3) 4) 5) Re	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration	m3 m3 m3 m3 m3 m3 m3 m2 m2	468 468 2,808 2,411 199 199 199 3,510	497 223 450 143 187 256 108 113	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2
1) 2) 3) 4) 5) Re	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m	m3 m3 m3 m3 m3 m3 m3 m3 m2	468 468 2,808 2,411 199 199	497 223 450 143 187 256 108 113 2,152	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1
1) 2) 3) 4) 5) Re	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road	m3 m3 m3 m3 m3 m3 m2 m2 m2 m2 m3	468 468 2,808 2,411 199 199 	497 223 450 143 187 256 108 113 2,152 Sub-total	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.1 DSR2.16.2 DSR16.13.1
1) 2) 3) 4) 5) R (P-7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m coad restoration BT surface road 7 Pump Facility (Manhole pump)	m3 m3 m3 m3 m3 m3 m2 m2 m2 m2 m3	468 468 2,808 2,411 199 199 199 3,510	497 223 450 143 187 256 108 113 2,152 Sub-total	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.1 DSR2.16.2 DSR16.13.1
1) 2) 3) 4) 5) Ro P-7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road 7 Pump Facility (Manhole pump) Iechanical Facility	m3 m3 m3 m3 m3 m3 m3 m2 m2 m3 m3 Design	468 468 2,808 2,411 199 199 3,510 468 Max Flow: 0.	497 223 450 143 187 256 108 113 2,152 Sub-total 23m3/sec	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2,2kW x 2 nos	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.1 DSR2.16.2 DSR16.13.1
1) 2) 3) 4) 5) Ro P-7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road T Pump Facility (Manhole pump) A surface solution (Manhole pump) Pace Solution (Manhole pump) Demolecement (Manhole pump) Pacility Manhole pump	m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 m3 kW	468 468 2,808 2,411 199 199 - 3,510 468 Max Flow: 0.0	497 223 450 143 187 256 108 113 2,152 Sub-total	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2,2kW x 2 nos 166,496	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate
1) 2) 3) 4) 5) Ro P-7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road 7 Pump Facility (Manhole pump) Iechanical Facility	m3 m3 m3 m3 m3 m3 m3 m2 m2 m3 m3 Design	468 468 2,808 2,411 199 199 3,510 468 Max Flow: 0.	497 223 450 143 187 256 108 113 2,152 Sub-total 23m3/sec	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2,2kW x 2 nos 166,496	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.1 DSR2.16.2 DSR16.13.1
1) 2) 3) 4) 5) 8 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road T Pump Facility (Manhole pump) A surface solution (Manhole pump) Pace Solution (Manhole pump) Demolecement (Manhole pump) Pacility Manhole pump	m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 m3 kW	468 468 2,808 2,411 199 199 - 3,510 468 Max Flow: 0.0	497 223 450 143 187 256 108 113 2,152 Sub-total 23m3/sec	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2,2kW x 2 nos 166,496	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate
1) 2) 3) 4) 5) 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road T Pump Facility (Manhole pump) dechanical Facility Manhole pump Piping lectrical Facility	m3 m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 besign kW	468 468 2,808 2,411 199 199 - 3,510 468 Max Flow: 0.0	497 223 450 143 187 256 108 113 2,152 Sub-total 23m3/sec	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above
1) 2) 3) 4) 5) 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m cad restoration BT surface road T Pump Facility (Manhole pump) Mechanical Facility Manhole pump Piping Dectrical Facility Miscellaneous electrical facility	m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 m3 m3 kW Ls	468 468 2,808 2,411 199 199 199 3,510 468 Max Flow: 0.0 444 1 1	497 223 450 143 187 256 008 113 2,152 Sub-total 023m3/sec 37,840	232,666 104,428 1,262,664 345,518 37,132 50,849 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate
1) 2) 3) 4) 5) 8 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m toad restoration BT surface road T Pump Facility (Manhole pump) fechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel	m3 m3 m3 m3 m3 m3 m3 m2 m2 m2 m2 m2 m2 m2 kW Ls Ls Set	468 468 2,808 2,411 199 199 3,510 468 Max Flow: 0.0 468 4.4 1 1	497 223 450 143 187 256 108 113 2,152 Sub-total 023m3/sec 37,840 283,800	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do
1) 2) 3) 4) 5) 8 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road 7 Pump Facility (Manhole pump) 4 Cost of caling Nanhole pump Piping Lectrical Facility Miscellaneous electrical facility Cost of cabling Cost of cabling	m3 m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 m3 kW Ls LS LS LS	468 468 2,808 2,411 199 199 - 3,510 468 Max Flow: 0.0 444 1 1 1 1	497 223 450 143 187 256 108 113 2,152 Sub-total 023m3/sec 37,840 283,800 113,520	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800 113,520	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do
1) 2) 3) 4) 5) 8 8 8 9 8 9 8 9 8 9 8 9 8 9 8 9 8 9 8	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m coad restoration BT surface road T Pump Facility (Manhole pump) fechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Cabling Cost of Earthing	m3 m3 m3 m3 m3 m3 m3 m2 m2 m2 m2 m2 m2 m2 kW Ls Ls Set	468 468 2,808 2,411 199 199 3,510 468 Max Flow: 0.0 468 4.4 1 1	497 223 450 143 187 256 108 113 2,152 Sub-total 023m3/sec 37,840 283,800	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do
1) 2) 3) 4) 5) P-7 P-7) M 1 1 1 1 1 1 1 1 1 1 1 1 1	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m coad restoration BT surface road T Pump Facility (Manhole pump) Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Earthing Vill and Building Work	m3 m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 kW Ls LS Set LS LS LS	468 468 2,808 2,411 199 199 3,510 468 Max Flow: 0.0 4.4 4.4 1 1 1 1 1 1 1	497 223 450 143 187 256 2,152 Sub-total)23m3/sec 37,840 283,800 113,520 85,140	232,666 104,428 1,262,664 345,518 37,132 50,849 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800 113,520 85,140	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do
1) 2) 3) 4) 5) 1 P-7 P-7 0 M 1 1 1 1 1 1 1 1 1 1 1 1 1	ivil work for pipe installation Pavement demolishing Desposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road 7 Pump Facility (Manhole pump) Aechanical Facility Manhole pump Cost of Earthing Cos	m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 Design kW Ls LS LS LS LS LS n0.	468 468 2,808 2,411 199 199 3,510 468 468 468 468 1 1 1 1 1 1 1 2	497 223 450 143 187 256 2.152 Sub-total 23m3/sec 37,840 283,800 113,520 85,140 69,663	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800 113,520 85,140 - 139,326	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do do DSR19.13.1.2, 19.14.2, 19.17
1) 2) 3) 4) 5) 8 P-7 P-7 (1) 10 10 10 10 10 10 10 10 10 10	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road 7 Pump Facility (Manhole pump) 4 echanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of Carbing Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PEpipe D300mm	m3 m3 m3 m3 m3 m2 m2 m2 m3 Design kW Ls LS LS LS LS LS no. m	468 468 2,808 2,411 199 199 	497 223 450 143 187 256 108 113 2,152 Sub-total 2233800 113,520 85,140 69,663 1,300	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do do DSR19.13.1.2, 19.14.2, 19.17 Market rate
1) 2) 3) 4) 5) 8 7 7 7 7 7 7 7 7 7 7 7 7 7	ivil work for pipe installation Pavement demolishing Desposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road 7 Pump Facility (Manhole pump) Aechanical Facility Manhole pump Cost of Earthing Cos	m3 m3 m3 m3 m3 m3 m2 m2 m2 m3 Design kW Ls LS LS LS LS LS n0.	468 468 2,808 2,411 199 199 3,510 468 468 468 468 1 1 1 1 1 1 1 2	497 223 450 143 187 256 108 113 2,152 Sub-total 023m3/sec 37,840 283,800 113,520 85,140 69,663 1,300 125	232,666 104,428 1,262,664 345,518 37,132 50,849 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do do DSR19.13.1.2, 19.14.2, 19.17
1) 2) 3) 4) 5) Re-7 (P-7 (P-7)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m coad restoration BT surface road T Pump Facility (Manhole pump) Manhole pump Piping lectrical Facility Manhole pump Piping Cost of LT Panel Cost of Earthing Vork Manhole (Bottom dia, 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering	m3 m3 m3 m3 m3 m3 m2 m2 m3 m3 m2 m3 kW Ls LS Set LS LS LS LS LS LS LS LS LS LS LS LS	468 468 2,808 2,411 199 199 3,510 468 Max Flow: 0.0 444 1 1 1 1 1 1 2 10 108	497 223 450 143 187 256 108 113 2,152 Sub-total 2233800 113,520 85,140 69,663 1,300	232,666 104,428 1,262,664 345,518 37,132 50,849 - 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do do DSR19.13.1.2, 19.14.2, 19.17 Market rate
1) 2) 3) 4) 5) R P-7 (C) (C) (C) (C) (C) (C) (C) (C)	ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth Disposal of excavated soil in pipe trench Earth upto 5th km Earth beyond 5 km but upto 10 km Timbering and Shuttering 0-1.5 m depth 1.5 m to 2.5 m oad restoration BT surface road 7 Pump Facility (Manhole pump) 4 echanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of Carbing Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PEpipe D300mm	m3 m3 m3 m3 m3 m2 m2 m2 m3 Design kW Ls LS LS LS LS LS no. m	468 468 2,808 2,411 199 199 3,510 468 Max Flow: 0.0 444 1 1 1 1 1 1 2 10 108	497 223 450 143 187 256 108 113 2,152 Sub-total 023m3/sec 37,840 283,800 113,520 85,140 69,663 1,300 125	232,666 104,428 1,262,664 345,518 37,132 50,849 396,630 1,007,136 16,208,923 Pump: 2.2kW x 2 nos 166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500	DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2 JSR 3.2 DSR2.16.1 DSR2.16.2 DSR16.13.1 S. Market rate 5% of above Market rate do do do DSR19.13.1.2, 19.14.2, 19.17 Market rate

Appendix B4.2: Construction CostZone-II(9/13)

	Appendix B4.2: C	onstr	uction C	cost	Zone-II (1	0/13)
	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	vork for pipe installation					
	ement demolishing					
	Demolishing	m3	3	497		DSR15.2.2
	Disposal of demolished pavement ch Excavation (Normal 75%, Rock 25%)	m3	3	223	562	JSR 3.4
			7.56	450	2 200	DSD2 0 1 2 0 1 2 11 2 12
	Excavation up to 4.5m Backfilling	m3	/.50	450	3,399	DSR2.8.1, 2.9.1, 2.11, 2.12
	Backfilling up to 4.5 m depth	m3	7	143	1.066	DSR 2.25, 2.26
	osal of excavated soil in pipe trench	IID	,	145	1,000	DSR 2.23, 2.20
	Earth upto 5th km	m3	0.1	187	12	JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	0.1	256		JSR 3.2
	bering and Shuttering				10	0011312
	0-1.5 m depth	m2	19	108	2.041	DSR2.16.1
	1.5 m to 2.5 m	m2	0	113	-	DSR2.16.2
B) Road r	restoration					
BT s	urface road	m3	3	2,152	5,423	DSR16.13.1
				Sub-total	23,789	
R-4						
	ump Facility (Manhole pump)	Design	MaxFlow: 0.0)23m3/sec	Pump: 7.5kW x 2 nos	3.
	anical Facility					
	Manhole pump	kW	15	37,840		Market rate
	Piping	Ls	1		28,380	5% of above
	cal Facility	1.0				
	Miscellaneous electrical facility	LS	1	a0a or -	1,090,502	
	Cost of LT Panel	Set	1	283,800		Market rate
	Cost of cabling	LS	1	113,520	113,520	
	Cost of Earthing nd Building Work	LS	1	85,140	85,140	ao
		-	2	<i>co.cco</i>	100.005	DED10 12 1 2 10 14 2 10 17
	hole (Bottom dia. 1.5 m) 2.5 < H< 4.5 r flow pipe PE pipe D300mm	no. m	10	<u>69,663</u> 1,300		DSR19.13.1.2, 19.14.2, 19.17
	bering and Shuttering	m2	108	1,300		Market rate
TIMO		1112	108	Sub-total	2,334,764	DSR2.16.3
D 5 Di	ising Main (DCI pipe line)	D150 I	.=630m	Sub-total	2,334,704	
	stallation (Procurement & Installation)	D150 1	030III			
·	DCI pipe D150	m	630	1,431	001 530	DSR 18.72
	work for pipe installation	m	0.50	1,451	901,550	D3K 18.72
	ement demolishing	-				
	Demolishing	m3	227	497	112 754	DSR15.2.2
	Disposal of demolished pavement	m3	227	223		JSR 3.4
	ch Excavation (Normal 75%, Rock 25%)	IID	227	223	50,007	J3K 5.4
	Excavation up to 4.5m	m3	680	450	305,953	DSR2.8.1, 2.9.1, 2.11, 2.12
	Backfilling	mo	000	450	505,755	D3R2.0.1, 2.9.1, 2.11, 2.12
	Backfilling up to 4.5 m depth	m3	669	143	95 929	DSR 2.25, 2.26
	osal of excavated soil in pipe trench	me	007	115	,5,72)	DSR 2.23, 2.20
	Earth upto 5th km	m3	6	187	1 040	JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	6	256		JSR 3.2
	bering and Shuttering				1,121	UDIT SIL
	0-1.5 m depth	m2	1,701	108	183,708	DSR2.16.1
	1.5 m to 2.5 m	m2	0	113		DSR2.16.2
	restoration					
BT s	urface road	m3	227	2,152	488,074	DSR16.13.1
				Sub-total		
5-5 Pu	mp Facility (Pump station)	Design	MaxFlow: 0.2	278m3/sec	Pump: 60kW x 3 nos	.(2W+1S)
) Mecha	anical Facility					
	Submersible pump	kW	180	37,840	6,811,200	Market rate
	Piping	Ls	1			10% of above
	Mechanical Screens including belt conveyor	Each	2	4,748,920	9,497,840	Market rate
	Gates (0.8 m X 0.8 m)	Each	5	813,560	4,067,800	do
	cal Facility					
	Miscellaneous electrical facility	LS	1		1,205,772	
	Cost of HT Panel	Each	1	946,000	946,000	Market rate
	Cost of Transformer (315KVA)	Each	1	1,191,960	1,191,960	
	Cost of LT Panel	Set	1	756,800	756,800	
\perp	Cost of cabling	Set	1	473,000	473,000	
	Cost of Earthing	Lot	1	208,120	208,120	
	Cost of DG Sets (315KVA)	Each	1	5,581,400	5,581,400	do
	nd Building Work					
	structure (concrete)	m3	79	16,940		DSR, Standard dwg
	ling works	m2	34	8,136		Market rate
	ndation pile (RC precast D400)	m	851	2,328		DSR 20.5.1
	bering and Shuttering	Ls			1,211,486	
	ndary wall (brick wall) 0.6m3/m	m3	48	3,001		JSR 5.2.10
Acce	ess road (BT surface road) 1m3/m	m3	20	2,152		DSR16.13.1
11000				Sub-total	36,415,866	
	sing Main (DCI pipe line)	D450 I	=950			
S-5 Ris						
S-5 Ri s) Pipe in	stallation (Procurement & Installation)					
S-5 Ris		m	950	6,207	5,896,650	DSR 18.72

Appendix B4.2: Construction Cost Zone-II (10/13)

		onsu			```	1/13)
_	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	Demolishing	m3	409	497		DSR15.2.2
	Disposal of demolished pavement	m3	409	223	91,151	JSR 3.4
2)	Trench Excavation (Normal 75%, Rock 25%)		1 902	450	010 500	D0D201 201 211 212
2)	Excavation up to 4.5m Pipe Backfilling	m3	1,803	450	810,580	DSR2.8.1, 2.9.1, 2.11, 2.12
- 3)	Backfilling up to 4.5 m depth		1.652	143	226 721	DSR 2.25, 2.26
4	Disposal of excavated soil in pipe trench	m3	1,052	145	230,731	DSR 2.23, 2.20
	Earth upto 5th km	m3	76	187	14 110	JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	76	256		JSR 3.2
5)	Timbering and Shuttering	110	70	2.50	19,323	J3K 3.2
	0-1.5 m depth	m2		108		DSR2.16.1
	1.5 m to 2.5 m	m2	3,135	113	354 255	DSR2.16.2
(3) F	to ad restoration	1112	5,155	115	554,255	D3R2.10.2
(3)1	BT surface road	m3	409	2,152	870.002	DSR16.13.1
-		ind	402	Sub-total	8,504,978	D3K10.15.1
TR-	5			Sub-total	8,304,278	
	1 Pump Facility (Manhole pump)	Design	MaxFlow: 0.0	005m3/sec	Pump: 1.5kW x 2 nos	
DN	Aechanical Facility	Design		505112/ 5 CC	unp: non n2 not	
(-)	Manhole pump	kW	3	37,840	113 520	Market rate
-	Piping	Ls	1	57,040		5% of above
(2) F	lectrical Facility	-	1		5,570	
<u> </u>	Miscellaneous electrical facility	LS	1		1,090,502	
-	Cost of LT Panel	Set	1	283.800		Market rate
-	Cost of cabling	LS	1	113,520	113,520	
-	Cost of Earthing	LS	1	85,140	85,140	
3) (Eivil and Building Work		1	05,140	05,140	
-/-	Manhole (Bottom dia. 1.5 m) $2.5 < H < 4.5$	no.	2	69,663	139 326	DSR19.13.1.2, 19.14.2, 19.17
	Over flow pipe PE pipe D300mm	m	10	1,300		Market rate
-	Timbering and Shuttering	m2	108	1,300		DSR2.16.3
-			100	Sub-total	1,857,980	
MP-	1 Rising Main (DCI pipe line)	D150 I	=710m	Sub-total	1,057,700	
	ipe installation (Procurement & Installation)					
-/-	DCI pipe D150	m	710	1,431	1 016 010	DSR 18.72
2) (Evil work for pipe installation			-,	1,010,010	DOITIONE
	Pavement demolishing					
/	Demolishing	m3	256	497	127 072	DSR15.2.2
	Disposal of demolished pavement	m3	256	223		JSR 3.4
2)	Trench Excavation (Normal 75%, Rock 25%)	mo	250	223	57,054	J3K 3.4
-/	Excavation up to 4.5m	m3	767	450	344 804	DSR2.8.1, 2.9.1, 2.11, 2.12
3)	Pipe Backfilling			150	544,004	D3R2.0.1, 2.9.1, 2.11, 2.12
5)	Backfilling up to 4.5 m depth	m3	754	143	108 111	DSR 2.25, 2.26
4)	Disposal of excavated soil in pipe trench	mo	754	145	100,111	D3R 2.23, 2.20
-1)	Earth upto 5th km	m3	6	187	1 172	JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	6	256		JSR 3.2
5)	Timbering and Shuttering	mo	0	250	1,005	J3K 5.2
5)	0-1.5 m depth	m2	1,917	108	207.036	DSR2.16.1
	1.5 m to 2.5 m	m2	0	113	207,030	DSR2.16.2
3) F	to ad restoration	1112	0	115	-	D3R2.10.2
5)1	BT surface road	m3	256	2,152	550.051	DSR16.13.1
-	Di sundo loud		200	Sub-total	2.412.894	D5K10.15.1
MD	2 Pump Facility (Manhole pump)	Design	Max Flow: 0.0		Pump: 11kW x 2 nos	
	Aechanical Facility	Design	Maxi low. 0.	320112/300	ump. 11kt/ x21105	
1)1	Manhole pump	kW	22	37,840	832 480	Market rate
_	Piping	Ls	1	57,040		5% of above
			1			570 01 a00 VC
2) F					41,024	
2) E	lectrical Facility	IS	1			
2) F	lectrical Facility Miscellaneous electrical facility	LS	1	282 800	1,090,502	
2) E	lectrical Facility Miscellaneous electrical facility Cost of LT Panel	Set	1	283,800 113 520	1,090,502 283,800	Market rate
2) E	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling	Set LS	1	113,520	1,090,502 283,800 113,520	Market rate do
	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing	Set	1		1,090,502 283,800	Market rate do
	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Yil and Building Work	Set LS LS	1	113,520 85,140	1,090,502 283,800 113,520 85,140	Market rate do do
	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Yil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5	Set LS LS no.	1 1 1 2	113,520 85,140 69,663	1,090,502 283,800 113,520 85,140 139,326	Market rate do do DSR19.13.1.2, 19.14.2, 19.17
	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Yivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm	Set LS LS no. m	1 1 2 10	113,520 85,140 69,663 1,300	1,090,502 283,800 113,520 85,140 139,326 12,997	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate
	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Yil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5	Set LS LS no.	1 1 1 2	113,520 85,140 69,663 1,300 125	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500	Market rate do do DSR19.13.1.2, 19.14.2, 19.17
3) C	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Cabling Cost of Earthing Sivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300nm Timbering and Shuttering	Set LS LS no. m m2	1 1 2 10 108	113,520 85,140 69,663 1,300	1,090,502 283,800 113,520 85,140 139,326 12,997	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate
3) C	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Earthing Cost of Earthing Yul and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	Set LS LS no. m m2	1 1 2 10	113,520 85,140 69,663 1,300 125	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate
3) C	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) Vipe installation (Procurement & Installation)	Set LS no. m m2 D150 I	1 1 2 10 108 ==600m	113,520 85,140 69,663 1,300 125 Sub-total	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3
3) C / IP- 1) P	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Yivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) ipe installation (Procurement & Installation) DCI pipe D150	Set LS LS no. m m2	1 1 2 10 108	113,520 85,140 69,663 1,300 125	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate
3) C VIP- 1) P 2) C	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H<4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) Tipe installation (Procurement & Installation) DCI pipe D150 Vil work for pipe installation	Set LS no. m m2 D150 I	1 1 2 10 108 ==600m	113,520 85,140 69,663 1,300 125 Sub-total	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3
3) C / IP- 1) P 2) C	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering Rishing Main (PCI pipe line) Ipe installation (Procurement & Installation) DCI pipe D150 Vil work for pipe installation Pavement demolishing	Set LS LS	1 1 1 2 10 108 ==600m	113,520 85,140 69,663 1,300 125 Sub-total 1,431	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600	Market rate do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72
3) C VIP- 1) P 2) C	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) ipe installation (Procurement & Installation) DCI pipe D150 Vil work for pipe installation Pavement demolishing Demolishing	Set LS LS no. m m2 D150 I m m3	1 1 1 2 10 108 =600m 600 216	113,520 85,140 69,663 1,300 125 Sub-total 1,431 497	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2
3) C (IIP- 1) P 2) C 1)	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) ipe installation (Procurement & Installation) DCI pipe D150 Yil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement	Set LS LS	1 1 1 2 10 108 ==600m	113,520 85,140 69,663 1,300 125 Sub-total 1,431	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384	Market rate do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72
3) C (IIP- 1) P 2) C 1)	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Cabling Cost of Earthing Yil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) ipe installation (Procurement & Installation) DCI pipe D150 Yil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%)	Set LS no. m m2 D150 I m m m m m m m m	1 1 1 2 10 108 ==600m 600 600 216 216	113,520 85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 223	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384 48,197	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4
3) C 1) P 2) C 1) 2)	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of LT Panel Cost of Earthing Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) tipe installation (Procurement & Installation) DCI pipe D150 Vil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m	Set LS LS no. m m2 D150 I m m3	1 1 1 2 10 108 =600m 600 216	113,520 85,140 69,663 1,300 125 Sub-total 1,431 497	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4
3) C 1) P 2) C 1) 2)	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of LT Panel Cost of Earthing Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering Rimbering and Shuttering Dipe installation (Procurement & Installation) DCI pipe D150 Vil work for pipe installation Pavement demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling	Set IS IS mo. m m2 D150 I m m3 m3 m3	1 1 1 2 10 108 =600m 	113,520 85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 223 450	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384 48,197 291,384	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
3) C 3) C 1) P 2) C 1) 2) 3)	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) ipe installation (Procurement & Installation) DCI pipe D150 Vil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth	Set LS no. m m2 D150 I m m m m m m m m	1 1 1 2 10 108 ==600m 600 600 216 216	113,520 85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 223	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384 48,197	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
3) C 3) C 1) P 2) C 1) 2) 3)	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) ipe installation (Procurement & Installation) DCI pipe D150 ivil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation up to 4.5 m depth Disposal of excavated soil in pipe trench	Set LS LS mo. m m2 D150 I m3 m3 m3 m3 m3	1 1 1 2 100 108 600m 600m 600m 600m 600 60	113,520 85,140 69,663 1,300 125 Sub-total 1,431 497 223 450 450	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384 48,197 291,384 91,361	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26
3) C 3) C 1) P 2) C 1) 2) 3)	lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering 2 Rising Main (DCI pipe line) ipe installation (Procurement & Installation) DCI pipe D150 Vil work for pipe installation Pavement demolishing Demolishing Disposal of demolished pavement Trench Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m Pipe Backfilling Backfilling up to 4.5 m depth	Set IS IS mo. m m2 D150 I m m3 m3 m3	1 1 1 2 10 108 =600m 	113,520 85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 223 450	1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 2,612,888 858,600 107,384 48,197 291,384 91,361 990	Market rate do do DSR19.13.1.2, 19.14.2, 19.17 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12

Appendix B4.2: Construction Cost Zone-II (11/13)

	Appendix D4.2. C					
0.1	Description5 m depth	Unit m2	Quantity 1,620	Rate (Rs.) 108	Amount (Rs.)	Remarks DSR2.16.1
	into 2.5 m	m2	1,620	108	1/4,960	DSR2.16.1 DSR2.16.2
3) Road rest		1112		115	-	D3R2.10.2
	ace road	m3	216	2,152	464.832	DSR16.13.1
	ssing Pipe Bridge			, -		
0150 L=30m						
	tallation (Procurement & Installation)					
DC	CI pipe D150	m	30	1,431	42,930	DSR 18.72
	tion of girder					
	rmwork	m2	69	335		DSR 5.9.2
	ncrete	m3	7	7,632		DSR 5.2.1
	-bar	kg	720	67		DSR 5.22.4
	tion (20ton crane)	day	2	11,663	23,325	DSR 01-0028, 02-0157
Abutme			-	225	52,102	D0D 5 0 2
	rmwork ncrete	m2 m3	156 54	335 7,632		DSR 5.9.2
	-bar	kg	4,860	7,032		DSR 5.2.1 DSR 5.22.4
	cavation (rock)	m3	4,800	595		DSR 3.22.4 DSR 2.6.1
	ckfill	m3	102	143		DSR 2.25, 2.26
	il disposal	m3	54	143		DSR 2.23, 2.20 DSR 1.1.2
Pier four			- 54	133	0,270	250K 1.1.2
	rmwork	m2	12	335	4.014	DSR 5.9.2
	ncrete	m3	9	7,632	,	DSR 5.2.1
	-bar	kg	810	67		DSR 5.22.4
	cavation (rock)	m3	27	595		DSR 2.6.1
Bac	ckfill	m3	18	143		DSR 2.25, 2.26
	il disposal	m3	9	153		DSR 1.1.2
Pier			-		-	
	rmwork	m2	30	335	10,035	DSR 5.9.2
	ncrete	m3	11	7,632		DSR 5.2.1
	-bar	kg	1,013	67	67,331	DSR 5.22.4
	ary works		-		-	
	cavation (rock)	m3	300	595		DSR 2.6.1
	ibankment	m3	300	102		DSR 2.38
	eet pile (L=4m)	no.	150	4,920	738,000	
De	watering	LS				211,700 Rs./site
		Desire	Mar Flam, O	Sub-total	5,030,936	
	p Facility (Manhole pump)	Design	Max Flow: 0.	02/m5/sec	Pump: 7.5kW x 2 no:	s
) Mechanic	anhole pump	kW	15	37,840	567 600	Market rate
	bing	Ls	15	57,840		5% of above
) Electrical		Lo	1		20,300	5% 01 above
	iscellaneous electrical facility	LS	1		1,090,502	
	st of LT Panel	Set	1	283,800		Market rate
	est of cabling	LS	1	113,520	113,520	
	st of Earthing	LS	1	85,140	85,140	
	Building Work			,	,	
	le (Bottom dia. 1.5 m) 2.5 < H< 4.5	no.	2	69,663	139,326	DSR19.13.1.2, 19.14.2, 19.17
	ow pipe PE pipe D300mm	m	10	1,300		Market rate
	ng and Shuttering	m2	108	125		DSR2.16.3
				Sub-total	2,334,764	
	ng Main (DCI pipe line)	D150 I	=350m			
	allation (Procurement & Installation)					
	I pipe D200	m	350	1,431	500,850	DSR 18.72
() (k for pipe installation					
	nt demolishing					
	molishing	m3	126	497	62,641	
	sposal of demolished pavement	m3	126	223	28,115	JSR 3.4
	Excavation (Normal 75%, Rock 25%)		270	450	1/0.071	DED2 0 1 20 1 2 11 2 12
	cavation up to 4.5m	m3	378	450	169,974	DSR2.8.1, 2.9.1, 2.11, 2.12
3) Pipe Bac			372	143	53.294	DSR 2.25, 2.26
	ckfilling up to 4.5 m depth al of excavated soil in pipe trench	m3	572	143	53,294	DSK 2.23, 2.20
	rth upto 5th km	m3	3	187	578	JSR 3.2
	rth beyond 5 km but upto 10 km	m3	3	256	791	JSR 3.2 JSR 3.2
	ng and Shuttering	10	5	250	/91	0.011.014
	.5 m depth	m2	945	108	102,060	DSR2.16.1
	5 m to 2.5 m	m2	0	113		DSR2.16.2
	toration					
Road rest		m3	126	2,152	271,152	DSR16.13.1
BT surfa				Sub-total	1,189,455	
	act four				-,,100	
		ost B: Pur	np Station and	Rising Main	358,914,533	
		st B: Pur	np Station and	Rising Main	358,914,533	
BT surfa		ost B: Pur	np Station and	l Rising Main	358,914,533	
BT surfa	Total co	ost B: Pur	np Station and	l Rising Main	358,914,533	
BT surfa	Total co 2 Treatment Plant	m3/d	np Station and	Rising Main		Market rate (Quotation)
BT surfa	Total co e Treatment Plant atment Plant					Market rate (Quotation)

Appendix B4.2: Construction CostZone-II(12/13)

Description Land development	Unit	Quantity	Dote (Dc.)	Amount (Dc.)	Domorke
	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
Surface excavation	m2	51,431	46	2,365,826	DSR 2.1
Masonry retaining wall	m3	422	2,479		JSR 10.4.9
			,		
Backfill	m3	301	143		DSR 2.25, 2.26
Drainage (RCC precast drain)	m	4,602	8,245		A verage of DPR
Boundary wall (Brick 0.6m3/m)	m3	602	3001		JSR 5.2.10
Road works (BT surface)	m3	2,249	2,152		DSR16.13.1
			Sub-total	48,045,844	
Outlet facilities					
Pipe installation (Procurement & Installation)					
RC pipe D1200	m	200	6,442	1,288,400	JSR 1.119, 10.6.2.5
Civil work for pipe installation					
Excavation	m3	1,278	450	574.674	DSR2.8.1, 2.9.1, 2.11, 2.12
Backfill	m3	684	143		DSR 2.25, 2.26
Soil disposal	m3	594	187		JSR 3.2
Base gravel	m3	83	389		DSR 16.4
Levelling concrete	m3	33	4,408		DSR 4.1.5
	m3	360	335		DSR 5.9.2
Formwark	-				
Concrete (Base and Slab)	m3	368	6,865		DSR 5.1.1
Re-bat	kg	33,120	67	2,202,480	DSR 5.22.4
Outfall structures				-	
Exacavtion (Rock)	m3	128	595	76,170	DSR 2.6.1
Gabion	m3	72	1,086	78,192	JSR 10.7.35, JSR 10.7.41
Base gravel	m3	10	389		DSR 16.4
Levelling concrete	m3	4	4,408	,	DSR 4.1.5
	-		-		
Formwark	m2	78	335		DSR 5.9.2
Concrete (Base and Slab)	m3	14	6,865		DSR 5.1.1
Concrete (Wall)	m3	10	7,632	74,794	DSR 5.2.1
Re-bar	kg	2,133	67	141,845	DSR 5.22.4
	T		Sub-total	7,469,962	
Tots	l cost C	Sewerage Tre		1,190,935,806	
100	I COST C.	beweruge III	cathkint I faint	1,170,755,000	
Di Hanna Camaratian	-				
D: House Connection	_				
South-West Area	_				
Installation of inspection chamber and connection	p no	18,700	8,899	166,411,300	Market rate
	Tota	al cost D: Hous	e Connection	166,411,300	
North East Area					
Installation of inspection chamber and connection	p no	9,966	8,899	88,687,434	Market rate
	Tota	al cost D: Hous	e Connection	88,687,434	
	1				
E Drainage Facility					
	-				
South-West Area	-	20 4 0 4 2	0.045		
1) RCC precast drain	m	296,843	8,245		Average of DPR
2) Culvert	m	4,617	15,701	72,490,938	
3) Piping	m	1,207	13,255	15,998,694	do
4) Dismantling existing drains & shifting of utilities (109	6 LS			253,601,157	
5) Pavement demolishing					
Demolishing	m3				
	-	6 210	497	3 086 494	DSR
Disposal of demolished concrete	m2	6,210	497 187	3,086,494	
Disposal of demolished concrete	m3	6,210 6,210	497 187		DSR JSR
6) Road restoration		6,210	187	1,160,497	JSR
6) Road restoration BT surface road	m3	6,210 6,210	187 2,152	1,160,497 13,361,974	JSR
6) Road restoration	m3	6,210 6,210	187 2,152	1,160,497	JSR
6) Road restoration BT surface road Total cost E: E	m3	6,210 6,210	187 2,152	1,160,497 13,361,974	JSR
6) Road restoration BT surface road Total cost E: E North East Area	m3	6,210 6,210	187 2,152	1,160,497 13,361,974 2,807,221,688	JSR DSR
6) Road restoration BT surface road Total cost E: E North East Area 1) RCC precast drain	m3 Drainage m	6,210 6,210 Facility (Sout 207,265	187 2,152 h West Area) 8,245	1,160,497 13,361,974 2,807,221,688 1,708,935,814	JSR DSR Average of DPR
6) Road restoration BT surface road Total cost E: E North East Area 1) RCC precast drain 2) Culvert	m3 Drainage m m	6,210 6,210 Facility (Sout 207,265 3,223	187 2,152 h West Area) 8,245 15,701	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919	JSR DSR Average of DPR do
6) Road restoration BT surface road Total cost E: E Vorth East Area 1) RCC precast drain 2) Culvert 3) Piping	m3 Drainage m m m	6,210 6,210 Facility (Sout 207,265	187 2,152 h West Area) 8,245	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901	JSR DSR Average of DPR do
6) Road restoration BT surface road Total cost E: E North East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109	m3 Drainage m m m	6,210 6,210 Facility (Sout 207,265 3,223	187 2,152 h West Area) 8,245 15,701	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919	JSR DSR Average of DPR do
6) Road restoration BT surface road Total cost E: E Sorth East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing	m3 Drainage m m m % LS	6,210 6,210 Facility (Sout 207,265 3,223 843	187 2,152 h West Area) 8,245 15,701 13,255	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363	JSR DSR Average of DPR do do
6) Road restoration BT surface road Total cost E: D North East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Demolishing Demolishing	m3 Drainage m m m LS m3	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096	JSR DSR Average of DPR do do DSR
6) Road restoration BT surface road Total cost E: E forth East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing	m3 Drainage m m m % LS	6,210 6,210 Facility (Sout 207,265 3,223 843	187 2,152 h West Area) 8,245 15,701 13,255	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096	JSR DSR Average of DPR do do
6) Road restoration BT surface road Total cost E: D Sorth East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Demolishing Disposal of demolished concrete	m3 Drainage m m m LS m3	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096	JSR DSR Average of DPR do do DSR
6) Road restoration BT surface road Total cost E: E Sorth East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Demolishing Disposal of demolished concrete 6) Road restoration	m3 Drainage m m m LS m3	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096	JSR DSR Average of DPR do do DSR
S) Road restoration BT surface road Total cost E: E Sorth East Area Total cost E: E Cost	m3 m3 minage m m m 6 LS m3 m3 m3 m3 m3	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789	JSR DSR Average of DPR do do DSR JSR
S) Road restoration BT surface road Total cost E: E Sorth East Area Total cost E: E Cost	m3 m3 minage m m m 6 LS m3 m3 m3 m3 m3	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 1177,071,363 2,155,096 810,299	JSR DSR Average of DPR do do DSR JSR
Soad restoration BT surface road Total cost E: I forth East Area DRCC precast drain DRCC precast drain Decreast drain Dispond from the subscript of utilities (109 Dispond from the subscript of the subscript	m3 m3 minage m m m 6 LS m3 m3 m3 m3 m3	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789	JSR DSR Average of DPR do do DSR JSR
5) Road restoration BT surface road Total cost E: E iorth East Area D RCC precast drain Culvert D Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Disposal of demolished concrete D isposal of demolished concrete S) Road restoration BT surface road Total cost E: Social Development	m3 prainage m m m 6 LS m3 m3 m3 Drainage	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 e Facility (Nor	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area)	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182	JSR DSR A verage of DPR do do DSR JSR DSR
5) Road restoration BT surface road Total cost E: I orth East Area D RCC precast drain Culvert D Piping Dismantling existing drains & shifting of utilities (109 Pavement demolishing Disposal of demolished concrete S) Road restoration BT surface road Total cost E:	m3 rainage m m m m M LS m3 m3 m3 m3 Drainag	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 4,336 4,336 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area)	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000	JSR DSR A verage of DPR do do DSR JSR DSR
f) Road restoration BT surface road Total cost E: E forth East Area J) RCC precast drain D) RCC precast drain D) Cluvert D) Dismantling existing drains & shifting of utilities (109 D) Pavement demolishing Disposal of demolished concrete D) Road restoration BT surface road Total cost E: Social Development	m3 rainage m m m m M LS m3 m3 m3 m3 Drainag	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 e Facility (Nor	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area)	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182	JSR DSR A verage of DPR do do DSR JSR DSR
6) Road restoration BT surface road Total cost E: D Sorth East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Demolishing Demolishing Disposal of demolished concrete 6) Road restoration BT surface road Total cost E: 5: Social Development	m3 rainage m m m m M LS m3 m3 m3 m3 Drainag	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 4,336 4,336 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area)	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000	JSR DSR A verage of DPR do do DSR JSR DSR
6) Road restoration BT surface road Total cost E: D Total cost	m3 rainage m m m m M LS m3 m3 m3 m3 Drainag	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 4,336 4,336 4,336	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area)	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000	JSR DSR A verage of DPR do do DSR JSR DSR
6) Road restoration BT surface road Total cost E: E Sorth East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Demolishing Demolishing Disposal of demolished concrete 6) Road restoration BT surface road Construction of public toilet Construction of public toilet BT surface Sewerage Facilities 3) Potential Construction Severage Facilities 5)	m3 rainage m m m m for LS m3 m3 m3 m3 Drainage m3 Drainage	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 e Facility (Nor cost F: Social	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 cht East Area) 4,777,000 Development	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000	JSR DSR Average of DPR do do DSR JSR DSR DSR R MC rate
6) Road restoration BT surface road Total cost E: D Storth East Area Total cost E: D Storth E: D Stort	m3 rainage m m m m 6 LS m3 m3 m3 Drainag Drainag Total no Total	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,40 4,00 4,00 4,00 4,00 4,00 4,00 4,00 4,000 4	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area) 4,777,000 Development 3,700	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000 8,140,000	JSR DSR Average of DPR do do DSR JSR DSR DSR RMC rate
i) Road restoration BT surface road Total cost E: I orth East Area i) RCC precast drain 2) Culvert b) Piping b) Dismantling existing drains & shifting of utilities (109 b) Pavement demolishing Disposal of demolished concrete 5) Road restoration BT surface road Construction of public toilet Construction of public toilet i: Decentralized Sewerage Facilities Installation of spection chamber and connection	m3 rainage m m m m m m3 m3 m3 m3 Drainage no Total	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 e Facility (Nor cost F: Social 2,200 2,200	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area) 4,777,000 Development 3,700 8,899	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000 19,577,800	JSR DSR Average of DPR do do DSR JSR DSR DSR R MC rate
i) Road restoration BT surface road Total cost E: I orth East Area i) RCC precast drain 2) Culvert b) Piping b) Dismantling existing drains & shifting of utilities (109 b) Pavement demolishing Disposal of demolished concrete 5) Road restoration BT surface road Construction of public toilet Construction of public toilet i: Decentralized Sewerage Facilities Installation of spection chamber and connection	m3 rainage m m m m m m3 m3 m3 m3 Drainage no Total	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,40 4,00 4,00 4,00 4,00 4,00 4,00 4,00 4,000 4	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area) 4,777,000 Development 3,700 8,899	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000 8,140,000	JSR DSR Average of DPR do do DSR JSR DSR DSR RMC rate
i) Road restoration BT surface road Total cost E: I orth East Area i) RCC precast drain 2) Culvert b) Piping b) Dismantling existing drains & shifting of utilities (109 b) Pavement demolishing Disposal of demolished concrete 5) Road restoration BT surface road Construction of public toilet Construction of public toilet i: Decentralized Sewerage Facilities Installation of spection chamber and connection	m3 rainage m m m m m m3 m3 m3 m3 Drainage no Total	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 e Facility (Nor cost F: Social 2,200 2,200	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area) 4,777,000 Development 3,700 8,899	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000 19,577,800	JSR DSR Average of DPR do do DSR JSR DSR DSR RMC rate
6) Road restoration BT surface road Total cost E: D North East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Demolishing Disposal of demolished concrete 6) Road restoration BT surface road Total cost E: 5: Social Development Construction of public toilet 3: Decentralized Sewerage Facilities Installation of septic tank Installation of inspection chamber and connection Total cost G	m3 rainage m m m m m m3 m3 m3 m3 Drainage no Total	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 e Facility (Nor cost F: Social 2,200 2,200	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area) 4,777,000 Development 3,700 8,899	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000 19,577,800	JSR DSR Average of DPR do do DSR JSR DSR DSR RMC rate
6) Road restoration BT surface road Total cost E: I North East Area 1) RCC precast drain 2) Culvert 3) Piping 4) Dismantling existing drains & shifting of utilities (109 5) Pavement demolishing Disposal of demolished concrete 6) Road restoration BT surface road F: Social Development Construction of public toilet F: Social Development Construction of septic tank Installation of septic tank Installation of inspection chamber and connection i Installation of inspection chamber and connection i H: Public Outreach Program	m3 rainage m m m m m m3 m3 m3 Drainage no Total	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 e Facility (Nor cost F: Social 2,200 2,200	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area) 4,777,000 Development 3,700 8,899	1,160,497 13,361,974 2,807,221,688 1,708,935,814 50,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000 19,577,800	JSR DSR Average of DPR do do DSR JSR DSR DSR RMC rate
6) Road restoration BT surface road Total cost E: I Sorth East Area D) RCC precast drain C) Culvert D) RCC precast drain RCC Precast drain RCC Precast RC	m3 rainage m m m m m m m3 m3 m3 m3 m3	6,210 6,210 Facility (Sout 207,265 3,223 843 4,336 4,336 4,336 4,336 e Facility (Nor cost F: Social 2,200 2,200	187 2,152 h West Area) 8,245 15,701 13,255 497 187 2,152 th East Area) 4,777,000 Development 3,700 8,899 age Facilities	1,160,497 13,361,974 2,807,221,688 1,708,935,814 5,0,603,919 11,173,901 177,071,363 2,155,096 810,299 9,329,789 1,960,080,182 191,080,000 191,080,000 191,080,000 8,140,000 19,577,800 27,717,800	JSR DSR Average of DPR do do DSR JSR DSR DSR RMC rate

Appendix B4.2: Construction CostZone-II(13/13)

Appendix B4.2: (Jonsu	ruction v	LOSI .	Zone-III&IV	/ (1/7)
Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
one-III&IV					
-1: Gravity Sewer - Trunk					
) Pipe installation (Procurement & Installation			l	NL1247C 2	
1) PE pipe Class SN8 structured double wa					Martatanta (Orantatian)
150 mm dia 200 mm dia	m	800 690	294 540	235,030	Market rate (Quotation) do
250 mm dia	m	1,180	947	1,117,266	
300 mm dia	m	600	1,300	779,810	
350 mm dia	m	600	1,500	948.625	do
400 mm dia	m	1,950	1,862	3,631,678	
450 mm dia	m	-	2,499	-	do
500 mm dia	m	-	3,135	-	do
600 mm dia	m	-	4,407	-	do
700 mm dia	m	400	5,884	2,353,800	do
800 mm dia	m	1,700	7,362	12,515,611	do
900 mm dia	m	3,280	9,464	31,041,212	do
1000 mm dia	m	-	11,565	-	do
2) RC Pipe NP3 R.C.C. pipe as per I.S.S. 458					
1100 mm dia	m	2,560	5,906	15,118,095	JSR 1.119, 10.6.2.5
1200 mm dia	m	-	6,442	-	do
) Civil work for pipe installation	+				
1) Pavement demolishing	-	= 00=	407	0.050.500	D0D15.2.2
Demolishing Disposal of demolished payament	m3	7,987	497		DSR15.2.2
Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 25	m3	7,987	223	1,782,099	JSK 3.4
Excavation up to 4.5m	m3	100,755	450	15 206 207	DSR2.8.1, 2.9.1, 2.11, 2.12
Excavation up to 4.5m Excavation beyond 4.5 m	m3	9,216	1,352		DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12
3) Pipe foundation	10	7,210	1,332	12,437,390	DON2.11, DON2.12
Providing coarse sand	m3	15,878	223	3,538,401	JSR5.1.10
4) Pipe Backfilling	10	15,070	1	5,550,401	
Backfilling up to 4.5 m depth	m3	82,267	143	11.791.575	DSR 2.25, 2.26
Backfilling beyond 4.5m depth	m3	5,863	227	1,329,386	do
5) Disposal of excavated soil in pipe trench		ĺ.		, ,	
Earth upto 5th km	m3	10,921	187	2,040,787	JSR 3.2
Earth beyond 5 km but upto 10 km	m3	10,921	256	2,794,652	JSR 3.2
6) Timbering and Shuttering					
0-1.5 m depth	m2	1,512	108	163,296	DSR2.16.1
1.5 m to 2.5 m	m2	8,664			DSR2.16.2
2.5 m to 4.5 m	m2	52,318	125		DSR2.16.3
Beyond 4.5m (ave: 6.0 m)	m2	43,392	4,113	178,491,198	T-4
) Manhole			10.505		
Manhole (Bottom dia. 0.9 m) H < 1.5 m	no.	22	12,535	274,671	DSR19.9.1.2, 19.10.2, 19.16
Manhole (Bottom dia. 1.2 m) $1.5 < H < 2.5$		94	19,420		DSR19.11.1.2, 19.12.2, 19.1
Manhole (Bottom dia. 1.5 m) $2.5 < H < 4.5$ Manhole (Bottom dia. 1.5 m) $4.5 < H$	no. no.	325	54,229 92,961		DSR19.13.1.2, 19.14.2, 19.1 do
Drop manhole	no.	482	16,287	14,615,133	DSR19.22.2, 19.23.2
) Road restoration	110.	402	10,207	7,032,974	DSR17.22.2, 17.23.2
WBM surface road	m3		1,167		DSR16.13.2
BT surface road	m3	6,789		14 609 093	DSR16.13.1
CC surface road	m3	1,198	4,873		DSR16.42
River Crossing Pipe bridge		-,->0	.,575	-,,-	
R-2 D400 L=30m					
Pipe installation (Procurement & Installa	tion)				
DCI pipe D400	m	30	5,369	161,070	DSR 18.72
Fablication of girder					
Formwork	m2	168	335		DSR 5.9.2
Concrete	m3	23			DSR 5.2.1
Re-bar	kg	2,280			DSR 5.22.4
Installation (20ton crane)	day	2	11,663	23,325	DSR 01-0028, 02-0157
Abutment					D0D 50 5
Formwork	m2	202			DSR 5.9.2
Concrete	m3	86	· · · · · ·		DSR 5.2.1
Re-bar Excavation (rock)	kg	7,776			DSR 5.22.4
Backfill	m3 m3	259			DSR 2.6.1
Backfill Soil disposal		173	143	24,768	
Temporary works	m3	86	153	13,245	DSR 1.1.2
Excavation (rock)	m3	200	595	110.014	DSR 2.6.1
Embankment	m3	200			DSR 2.6.1 DSR 2.38
Sheet pile (L=4m)	no.	200		492,000	
Dewatering	LS	100	4,920		211,700 Rs./site
		A-1: Gravity	l Sewer - Trunk	425,400	211,700 NS./SILC
	- 544 000			101,223,003	
2: Gravity Sewer - Sub-trunk and Collecto	or				
Pipe installation (Procurement & Installation					
1) PE pipe Class SN8 structured double wa		vlene piping s	vstems as per l	EN:13476-3	
150 mm dia	m	115,235			Market rate (Quotation)
	-				
200 mm dia	m	13,087	540	7,066,624	do

Appendix B4.2: Construction Cost Zone-III&IV (1/7)

			JOST A		
Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
300 mm dia	m	8,428	1,300	10,953,955	
400 mm dia	m	4,244	1,862	7,903,644	
600 mm dia	m	2,349	4,407	10,349,931	
800 mm dia	m	-	7,362	-	do
1000 mm dia	m	-	11,565	-	do
2) RC Pipe NP3 R.C.C. pipe as per I.S.S. 458-			6 110		IGD 1 110 10 C 2 5
(2) Civil work for pipe installation	m	-	6,442	-	JSR 1.119, 10.6.2.5
1) Pavement demolishing					
Demolishing	m3	64,050	497	21 842 407	DSB15.2.2
Disposal of demolished pavement	m3	64,050	223	31,842,407 14,291,845	
2) Trench Excavation (Normal 75%, Rock 25%		04,030	223	14,291,043	J3K 3.4
Excavation up to 4.5m	m3	350,658	450	157 670 219	DSR2.8.1, 2.9.1, 2.11, 2.12
Excavation up to 4.5 m	m3	330,038	1,352	157,079,518	DSR2.8.1, 2.9.1, 2.11, 2.12 DSR2.11, DSR2.12
3) Pipe foundation	ms	-	1,552	-	DSR2.11, DSR2.12
Providing coarse sand	m3	78,881	223	17,578,940	ISD5 1 10
4) Pipe Backfilling	ШЭ	/0,001	223	17,578,940	J3K3.1.10
Backfilling up to 4.5 m depth	m3	267,105	143	20 205 111	DSR 2.25, 2.26
Backfilling beyond 4.5m depth	m3	207,105	227	56,265,111	
5) Disposal of excavated soil in pipe trench	no	-	221	-	do
Earth upto 5th km		41,776	187	7,806,856	ICD 2 2
	m3		256	10,690,702	
Earth beyond 5 km but upto 10 km 6) Timbering and Shuttering	m3	41,776	230	10,090,702	JOR 3.2
	m2	217,793	108	22 521 670	DSP2 16 1
0-1.5 m depth	m2 m2		108	23,521,679	
1.5 m to 2.5 m		258,229	113	29,179,899	DSR2.16.2 DSR2.16.3
2.5 m to 4.5 m	m2	103,500	4,113		
Beyond 4.5m (ave: 6.0 m) (3) Manhole	m2	2,818	4,113	11,592,981	T-1(1), T-3
	no	2155	10 505	20 564 525	DED10.0.1.2.10.10.2.10.15
Manhole (Bottom dia. 0.9 m) H < 1.5 m Manhole (Bottom dia. 1.2 m) 1.5 < H < 2.5	no. no.	3,156	12,535		DSR19.9.1.2, 19.10.2, 19.16
		1	19,420		DSR19.11.1.2, 19.12.2, 19.16
Manhole (Bottom dia. 1.5 m) $2.5 < H < 4.5$	no.	643	69,663		DSR19.13.1.2, 19.14.2, 19.17
Manhole (Bottom dia. 1.5 m) 4.5 < H	no.	10	92,961	949,251	
Drop manhole	no.	653	16,287	10,636,254	DSR19.22.2, 19.23.2
(4) Road restoration		c 105	1.1.07	5 15 1 600	DODICION
WBM surface road	m3	6,405	1,167		DSR16.13.2
BT surface road	m3	51,240	2,152	110,268,307	
CC surface road	m3	6,405	4,873	31,211,516	DSR16.42
Total cost A-2: Gra	nty Sew	er - Sub-trunk	and Collector	733,296,194	
B: Pump Station and Rising Main	<u> </u>				
TR-1	-				
PS-1 Pump Facility (Pump station)	Design	MaxFlow: 0.	1/15m3/sec Pi	ump: 55kW x 3 nos.(2W+1S)
(1) Mechanical Facility	Design	Maxilow. 0.	145115/300 1	ump. 55kw x51103.(200 + 13)
Submersible pump	kW	165	37,840	6 243 600	Market rate
Piping	Ls	105	57,840		10% of above
Mechanical Screens including belt	Each	2	4,748,920		Market rate
Gates (0.8 m X 0.8 m)	Each	3	813,560	2,440,680	
(2) Electrical Facility	Laci	5		2,440,000	00
Miscellaneous electrical facility					
	TC	1		1 205 772	
I I Cost of HT Donal	LS	1	046.000	1,205,772	Markat rata
Cost of HT Panel Cost of Transformer (315KVA)	Each	1	946,000	946,000	Market rate
Cost of Transformer (315KVA)	Each Each	1	1,191,960	946,000 1,191,960	do
Cost of Transformer (315KVA) Cost of LT Panel	Each Each Set	1 1 1	1,191,960 756,800	946,000 1,191,960 756,800	do do
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling	Each Each Set Set	1 1 1 1	1,191,960 756,800 473,000	946,000 1,191,960 756,800 473,000	do do do
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing	Each Each Set Set Lot	1 1 1 1 1	1,191,960 756,800 473,000 208,120	946,000 1,191,960 756,800 473,000 208,120	do do do do
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA)	Each Each Set Set	1 1 1 1	1,191,960 756,800 473,000	946,000 1,191,960 756,800 473,000	do do do do
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work	Each Each Set Lot Each	1 1 1 1 1 1	1,191,960 756,800 473,000 208,120 5,581,400	946,000 1,191,960 756,800 473,000 208,120 5,581,400	do do do do
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete)	Each Each Set Lot Each m3	1 1 1 1 1 1 57	1,191,960 756,800 473,000 208,120 5,581,400 16,940	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773	do do do do do DSR, Standard dwg
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works	Each Each Set Lot Each m3 m2	1 1 1 1 1 1 57 25	1,191,960 756,800 473,000 208,120 5,581,400 16,940 8,136	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407	do do do do DSR, Standard dwg Market rate
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Cathing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400)	Each Each Set Lot Each m3 m2 m	1 1 1 1 1 1 57	1,191,960 756,800 473,000 208,120 5,581,400 16,940	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079	do do do do do DSR, Standard dwg
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering	Each Each Set Lot Each m3 m2 m Ls	1 1 1 1 1 57 25 614	1,191,960 756,800 473,000 208,120 5,581,400 16,940 8,136 2,328	946,000 1,191,960 756,800 208,120 5,581,400 967,773 199,407 1,430,079 874,944	do do do do DSR, Standard dwg Market rate DSR 20.5.1
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m	Each Each Set Lot Each m3 m2 m Ls m3	1 1 1 1 1 1 1 57 25 614 48	1,191,960 756,800 473,000 208,120 5,581,400 16,940 8,136 2,328 3,001	946,000 1,191,960 756,800 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048	do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering	Each Each Set Lot Each m3 m2 m Ls	1 1 1 1 1 57 25 614	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040	do do do do DSR, Standard dwg Market rate DSR 20.5.1
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Cathing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m	Each Each Set Lot Each m3 m2 m Ls m3 m3	1 1 1 1 1 1 1 57 25 614 48 20	1,191,960 756,800 473,000 208,120 5,581,400 16,940 8,136 2,328 3,001	946,000 1,191,960 756,800 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048	do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of cabling Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line)	Each Each Set Lot Each M3 m2 m Ls m3 m3 m3	1 1 1 1 1 1 1 57 25 614 48 20	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040	do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m Access road (BT surface road) 1m3/m (1) Pipe installation (Procurement & Installation	Each Each Set Lot Each m3 m2 m M2 m3 m3 m3 m3 D350 I	1 1 1 1 1 1 1 1 57 25 614 48 20 =1900	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total	946,000 1,191,960 756,800 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822	do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation (Procurement & Installation DCI pipe D350	Each Each Set Lot Each M3 m2 m Ls m3 m3 m3	1 1 1 1 1 1 1 57 25 614 48 20	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152	946,000 1,191,960 756,800 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822	do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of cabling Cost of Garthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation (Procurement & Installation DCI pipe D350 (2) Civil work for pipe installation	Each Each Set Lot Each m3 m2 m M2 m3 m3 m3 m3 D350 I	1 1 1 1 1 1 1 1 57 25 614 48 20 =1900	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total	946,000 1,191,960 756,800 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822	do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Carthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation (Procurement & Installation DCI pipe D350 (2) Civil work for pipe installation 1) Pavement demolishing	Each Each Set Lot Each M3 m2 m3 m3 m3 D350 I n) M	1 1 1 1 1 1 57 25 614 48 20 =1900 1,900	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000	do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR 18.72
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) O.6m3/m Access road (BT surface road) Im3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation IDCI pipe D350 (2) Civil work for pipe installation I) Pavement demolishing Demolishing	Each Each Set Lot Each m3 m2 m m3 m3 m3 D350 I n) m m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,191,960 756,800 208,120 208,120 5,581,400 8,136 2,3328 3,001 2,152 Sub-total 4,390	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834	do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR 18.72 DSR 18.72
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) O.6m3/m Access road (BT surface road) Im3/m PS-1 Rising Main<(DCI pipe line)	Each Each Set Lot Each m3 m2 Ls m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 57 25 614 48 20 =1900 1,900	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834	do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR 18.72
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) O.6m3/m Access road (BT surface road) Im3/m PS-1 Rising Main DI pipe D350 (2) Civil work for pipe installation I) Pavement demolishing Demolishing Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 25%	Each Each Set Lot Each M3 m3 m3 m3 m3 m3 m3 m3 b350 I n) m m3 m3 m3 c)	1 1 1 1 1 1 57 25 614 48 20 -=1900 -=1900 760 760	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390 4,390 497 223	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834 169,583	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 15.2.2 JSR 3.4
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation (Procurement & Installation DCI pipe D350 (2) Civil work for pipe installation 1) Pavement demolishing Demolishing Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 259 Excavation up to 4.5m	Each Each Set Lot Each m3 m2 Ls m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,191,960 756,800 208,120 208,120 5,581,400 8,136 2,3328 3,001 2,152 Sub-total 4,390	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 15.2.2 JSR 3.4
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Carthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation (Procurement & Installation DCI pipe D350 (2) Civil work for pipe installation 1) Pavement demolishing Demolishing Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 25% Excavation up to 4.5m 3) Pipe Backfilling	Each Each Set Lot Each m3 m3 m3 m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390 4,390 4,390	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834 169,583 1,324,268	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR 18.72 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) O.6m3/m Access road (BT surface road) Im3/m PS-1 Rising Main DCI pipe D350 (2) Civil work for pipe installation I) Pavement demolishing Demolishing Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 25% Si Pipe Backfilling Backfilling up to 4.5 m depth	Each Each Set Lot Each M3 m3 m3 m3 m3 m3 m3 m3 b350 I n) m m3 m3 m3 c)	1 1 1 1 1 1 57 25 614 48 20 -=1900 -=1900 760 760	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390 4,390 497 223	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834 169,583 1,324,268	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 15.2.2 JSR 3.4
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) O.6m3/m Access road (BT surface road) Im3/m PS-1 Rising Main DCI pipe D350 (2) Civil work for pipe installation 1) Pavement demolishing Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 25% Exavation up to 4.5m 3) Pipe Backfilling Backfilling up to 4.5 m depth 4) Disposal of excavated soil in pipe trench	Each Each Set Lot Each M3 m2 m3 m3 m3 D350 I m3 m3 m3 m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390 497 2223 450 497	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834 169,583 1,324,268 395,928	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 16.13.1 DSR 18.72 DSR 18.72 DSR 3.4 DSR 2.25, 2.26
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of cabling Cost of Carthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation (Procurement & Installation DCI pipe D350 (2) Civil work for pipe installation 1) Pavement demolishing Demolishing Demolishing Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 25% Excavation up to 4.5 m 3) Pipe Backfilling up to 4.5 m depth 4) Disposal of exavated soil in pipe trench Earth upto 5th km	Each Each Set Lot Each M3 m3 m3 m3 D350 I m3 m3 m3 m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390 497 223 450 497 497 497 223	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 18.72 DSR 18.72 DSR 18.72 JSR 3.4 DSR 2.25, 2.26 JSR 3.2
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of cabling Cost of Earthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) O.6m3/m Access road (BT surface road) Image: Image Iman	Each Each Set Lot Each M3 m2 m3 m3 m3 D350 I m3 m3 m3 m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390 497 2223 450 497	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 8,341,000 377,834 169,583 1,324,268 395,928	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 18.72 DSR 18.72 DSR 18.72 JSR 3.4 DSR 2.25, 2.26 JSR 3.2
Cost of Transformer (315KVA) Cost of LT Panel Cost of cabling Cost of cabling Cost of Carthing Cost of DG Sets (315KVA) (3) Civil and Building Work Civil structure (concrete) Building works Foundation pipe (RC precast D400) Timbering and Shuttering Boundary wall (brick wall) 0.6m3/m Access road (BT surface road) 1m3/m PS-1 Rising Main (DCI pipe line) (1) Pipe installation (Procurement & Installation DCI pipe D350 (2) Civil work for pipe installation 1) Pavement demolishing Demolishing Demolishing Disposal of demolished pavement 2) Trench Excavation (Normal 75%, Rock 25% Excavation up to 4.5 m 3) Pipe Backfilling up to 4.5 m depth 4) Disposal of exavated soil in pipe trench Earth upto 5th km	Each Each Set Lot Each M3 m3 m3 m3 D350 I m3 m3 m3 m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	1,191,960 756,800 473,000 208,120 5,581,400 8,136 2,328 3,001 2,152 Sub-total 4,390 497 223 450 497 497 497 223	946,000 1,191,960 756,800 473,000 208,120 5,581,400 967,773 199,407 1,430,079 874,944 144,048 43,040 32,828,822 	do do do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 18.72 DSR 18.72 DSR 18.72 JSR 3.4 DSR 2.25, 2.26 JSR 3.2

Appendix B4.2: Construction Cost Zone-III&IV (2/7)

	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
	1.5 m to 2.5 m	m2	5,890	113	665,570	DSR2.16.2
	l restoration	2	7.0	2.1.52	1 (25 520	DODICION
ВІ	sufface road	m3	760	2,152 Sub-total	1,635,520	DSR16.13.1
S-2 F	Pump Facility (Pump station)	Design	Max Flow: 0.2		ump: 90kW x 3 nos.	(2W+1S)
	hanical Facility	Design	Max110w. 0.	250115/300 1	ump. 90kw x5110s.	200 + 15)
1) 1100	Submersible pump	kW	270	37,840	10 216 800	Market rate
	Piping	Ls	1			10% of above
	Mechanical Screens including belt	Each	2	4,748,920		Market rate
	Gates (0.8 m X 0.8 m)	Each	4	813,560	3,254,240	do
2) Elect	trical Facility					
	Miscellaneous electrical facility	LS	1		1,205,772	
	Cost of HT Panel	Each	1	946,000	,	Market rate
	Cost of Transformer (315KVA)	Each	1	1,191,960	1,191,960	
_	Cost of LT Panel	Set	1	756,800	756,800	
	Cost of cabling	Set	1	473,000	473,000	
_	Cost of Earthing	Lot	1	208,120 5,581,400	208,120 5,581,400	
3) Civil	Cost of DG Sets (315KVA) and Building Work	Each	1	5,581,400	5,581,400	do
	vil structure (concrete)	m3	73	16,940	1 239 875	DSR, Standard dwg
	ilding works	m2	31	8,136		Market rate
	undation pipe (RC precast D400)	m	787	2,328		DSR 20.5.1
	nbering and Shuttering	Ls	.57	2,020	1,120,946	
-	undary wall (brick wall) 0.6m3/m	m3	60	3,001		JSR 5.2.10
	cess road (BT surface road) 1m3/m	m3	30	2,152		DSR16.13.1
				Sub-total	39,046,689	
	Rising Main (DCI pipe line)		=2700m			
1) Pipe	installation (Procurement & Installation					
	DCI pipe D450	m	2,700	6,207	16,758,900	DSR 18.72
	work for pipe installation					
1) Pav	vement demolishing	-	1.1.61	107	595 101	DODICOO
_	Demolishing	m3	1,161 1161	497 223		DSR15.2.2
2) Ter	Disposal of demolished pavement ench Excavation (Normal 75%, Rock 25%	m3	1161	223	259,061	JSR 3.4
2) 116	Excavation up to 4.5m	m3	5,123	450	2 202 755	DSR2.8.1, 2.9.1, 2.11, 2.12
3) Pin	be Backfilling	IID	5,125	450	2,303,733	DSK2.0.1, 2.9.1, 2.11, 2.12
5)110	Backfilling up to 4.5 m depth	m3	4,694	143	672 814	DSR 2.25, 2.26
4) Dis	sposal of excavated soil in pipe trench	iii	4,004	145	072,014	DSR 2.23, 2.20
., 2.	Earth upto 5th km	m3	215	187	40 103	JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	215	256		JSR 3.2
5) Tir	nbering and Shuttering				0 10/17	UDIC 0.2
-	0-1.5 m depth	m2	-	108	-	DSR2.16.1
	1.5 m to 2.5 m	m2	8,910	113	1,006,830	DSR2.16.2
3) Road	1 restoration					
BT	'surface road	m3	1,161	2,152	2,498,472	DSR16.13.1
				Sub-total	24,172,042	
	Pump Facility (Pump station)	Design	MaxFlow: 1.	11m3/sec Pu	mp: 90kW x6nos.(4	W+2S)
) Mec	hanical Facility					
	Submersible pump	kW	540	37,840		Market rate
+	Piping Mashaniaal Samana in shadina hati	Ls	1	C 045 202		10% of above
_	Mechanical Screens including belt	Each	2	5,846,280		Market rate
	Gates (1.5 m X 1.5 m) trical Facility	Each	5	1,759,560	8,797,800	ao
		LS	1		1,543,743	<u> </u>
	Miscellaneous electrical facility Cost of HT Panel	Each	1	946,000	, ,	Market rate
	Cost of Transformer (750KVA)	Each	1	1,797,400	1,797,400	
+	Cost of LT Panel	Set	1	1,797,400	1,324,400	
	Cost of cabling	Set	1	662,200	662,200	
	Cost of Earthing	Set	1	283,800	283.800	
	Cost of DG Sets (750KVA)	Each	1	8,514,000	8,514,000	
3) Civil	and Building Work			.,,	.,,,	
	vil structure (concrete)	m3	158	16,940	2,677,632	DSR, Standard dwg
	ilding works	m2	68	8,136	, ,	Market rate
	undation pipe (RC precast D400)	m	1,700	2,328		DSR 20.5.1
	nbering and Shuttering	Ls			2,420,792	
	undary wall (brick wall) 0.6m3/m	m3	60	3,001		JSR 5.2.10
Ac	cess road (BT surface road) 1m3/m	m3	30	2,152		DSR16.13.1
				Sub-total	67,890,366	
	Rising Main (DCI pipe line)		=2000m			
l) Pipe	installation (Procurement & Installation					
	DCI pipe D900	m	2,000	17,331	34,662,000	DSR 18.72
	work for pipe installation	L				
	vement demolishing	L				
		m3	1,140	497	566,751	DSR15.2.2
	Demolishing					
1) Pa	Disposal of demolished pavement	m3	1140	223	254,375	JSR 3.4
1) Pa	Disposal of demolished pavement ench Excavation (Normal 75%, Rock 25%	m3				
1) Pav 2) Tre	Disposal of demolished pavement	m3	1140 7,770	223 450	254,375 3,493,910	DSR2.8.1, 2.9.1, 2.11, 2.12

Appendix $D4.2$: Constituction Cost $Lone-int \alpha i \gamma$	Appendix B4.2:	Construction Cost	Zone-III&IV
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	Appendix B4.2: C				Lone-III&I	
	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
4) Disj	posal of excavated soil in pipe trench	2	(2)	107	110.022	10D 2 2
_	Earth up to 5th km	m3	636 636	187 256	118,823	
5) Tim	Earth beyond 5 km but upto 10 km bering and Shuttering	m3	030	250	162,716	JSR 3.2
5) 1 111	0-1.5 m depth	m2		108		DSR2.16.1
	1.5 m to 2.5 m	m2	8,400	103	949 200	DSR2.16.2
) Road	restoration	1112	0,400	115	242,200	D3K2.10.2
	surface road	m3	1,140	2,152	2 453 280	DSR16.13.1
	Crossing Pipe Bridge		· · · · ·	_,	_,,	
900 L=						
Pipe	e installation (Procurement & Installati	on)				
	DCI pipe D900	m	120	17,331	2,079,720	DSR 18.72
Fab	lication of girder					
	Formwork	m2	672	335		DSR 5.9.2
	Concrete	m3	173	7,632	<i>, , ,</i>	DSR 5.2.1
<u> </u>	Re-bar	kg	17,280	67		DSR 5.22.4
	tallation (20ton crane)	day	2	11,663	23,325	DSR 01-0028, 02-0157
Abı	utment		-			
	Formwork	m2	173	335		DSR 5.9.2
	Concrete	m3	115	7,632		DSR 5.2.1
	Re-bar	kg m ²	10,368	67 505		DSR 5.22.4
_	Excavation (rock) Backfill	m3	346	595		DSR 2.6.1
+	Backfill Soil disposal	m3 m3	230 115	143 153	,	DSR 2.25, 2.26 DSR 1.1.2
Pior	r foundation	шb	115	153	17,000	DoK 1.1.2
1 101	Formwork	m2	- 48	335	16.056	DSR 5.9.2
+	Concrete	m3	36	7,632		DSR 5.2.1
+	Re-bar	kg	3,240	7,032		DSR 5.22.4
	Excavation (rock)	m3	108	595		DSR 2.6.1
	Backfill	m3	72	143		DSR 2.25, 2.26
	Soil disposal	m3	36	153		DSR 1.1.2
Pier	r		-		-	
	Formwork	m2	96	335	32,112	DSR 5.9.2
	Concrete	m3	36	7,632	274,752	DSR 5.2.1
	Re-bar	kg	3,240	67	215,460	DSR 5.22.4
Ten	nporary works		-		-	
	Excavation (rock)	m3	600	595	357,048	DSR 2.6.1
	Embankment	m3	600	102		DSR 2.38
	Sheet pile (L=4m)	no.	300	4,920	1,476,000	
	Dewatering	LS	1			211,700 Rs./site
		-		Sub-total	54,544,208	
	ump Facility (Pump station)	Design	Max Flow: 0.6	52/m3/sec P	ump: 30kW x4nos.(3W+1S)
) Mech	nanical Facility	1 1 1 1				
_	Submersible pump	kW Ls	120	37,840	, ,	Market rate
_	Piping Mashaniaal Samana in shadin a halt	Each	1	5.946.290		10% of above
-	Mechanical Screens including belt Gates (1.5 m X 1.5 m)	Each	2	5,846,280 1,759,560	5,278,680	Market rate
Flects	rical Facility	Each	3	1,759,500	5,278,080	do
Liceu	Miscellaneous electrical facility	LS	1		1,543,743	
+	Cost of HT Panel	Each	1	946.000		Market rate
+	Cost of Transformer (750KVA)	Each	1	1,797,400	1,797,400	
	Cost of LT Panel	Set				
	Cost of cabling		1	1 324 400	1 324 400	do
		Set	1	1,324,400 662,200	1,324,400 662,200	
-		Set Set	1	662,200	662,200	do
F	Cost of Earthing Cost of DG Sets (750KVA)	Set Set Each				do do
) Civil a	Cost of Earthing	Set	1	662,200 283,800	662,200 283,800	do do
_	Cost of Earthing Cost of DG Sets (750KVA)	Set	1	662,200 283,800	662,200 283,800 8,514,000	do do
Civi	Cost of Earthing Cost of DG Sets (750KVA) and Building Work	Set Each	1 1 1	662,200 283,800 8,514,000	662,200 283,800 8,514,000 2,012,441	do do do
Civi Buil	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete)	Set Each m3	1 1 1 119	662,200 283,800 8,514,000 16,940	662,200 283,800 8,514,000 2,012,441 414,657	do do do DSR, Standard dwg
Civi Buil Fou	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) Iding works	Set Each m3 m2	1 1 1 119 51	662,200 283,800 8,514,000 16,940 8,136	662,200 283,800 8,514,000 2,012,441 414,657	do do do DSR, Standard dwg Market rate
Civi Buil Fou Tim	Cost of Earthing Cost of DGSets (750KVA) and Building Work il structure (concrete) Iding works Indation pipe (RC precast D400)	Set Each m3 m2 m	1 1 1 119 51	662,200 283,800 8,514,000 16,940 8,136	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407	do do do DSR, Standard dwg Market rate
Civi Buil Fou Tim Bou	Cost of Earthing Cost of DGSets (750KVA) and Building Work il structure (concrete) Iding works Indation pipe (RC precast D400) ibering and Shuttering	Set Each m3 m2 m Ls	1 1 119 51 1,277	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560	do do do DSR, Standard dwg Market rate DSR 20.5.1
Civi Buil Fou Tim Bou Acc	Cost of Earthing Cost of DG Sets (750KVA) and Building Work listructure (concrete) lding works undation pipe (RC precast D400) abering and Shuttering undary wall (brick wall) 0.6m3/m zess road (BT surface road) 1m3/m	Set Each m3 m2 m Ls m3 m3 m3	1 1 1 1 1 1 1 1 1 2 77 60 30	662,200 283,800 8,514,000 16,940 8,136 2,328 	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10
Civi Buil Fou Tim Bou Acc	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) liding works indation pipe (RC precast D400) abering and Shuttering indary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line)	Set Each m3 m2 m Ls m3 m3 m3 D700 I	1 1 119 51 1,277 60	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10
Civi Buil Fou Tim Bou Acc	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) Iding works Indation pipe (RC precast D400) ubering and Shuttering Indary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation	Set Each m3 m2 m Ls m3 m3 m3 m3 m3	1 1 119 51 1,277 60 30 =400m	662,200 283,800 8,514,000 8,136 2,328 3,001 2,152 Sub-total	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) lding works undation pipe (RC precast D400) bering and Shuttering undary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation [DCI pipe D700	Set Each m3 m2 m Ls m3 m3 m3 D700 I	1 1 1 1 1 1 1 1 1 2 77 60 30	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i	Cost of Earthing Cost of DG Sets (750KVA) and Building Work listructure (concrete) liding works undation pipe (RC precast D400) abering and Shuttering undary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m cess road (BT surface road) 1m3/m installation (Procurement & Installation DCI pipe D700 work for pipe installation	Set Each m3 m2 m Ls m3 m3 m3 m3 m3	1 1 119 51 1,277 60 30 =400m	662,200 283,800 8,514,000 8,136 2,328 3,001 2,152 Sub-total	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i	Cost of Earthing Cost of DG Sets (750KVA) and Building Work listructure (concrete) Iding works undation pipe (RC precast D400) abering and Shuttering undary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m cess road (BT surface road) 1m3/m installation (Procurement & Installation IDCI pipe D700 work for pipe installation rement demolishing	Set Each m3 m2 m Ls m3 m3 D700 I n) m	1 1 19 51 1,277 60 30 -=400m 400	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) lding works undation pipe (RC precast D400) abering and Shuttering undary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation DCI pipe D700 work for pipe installation rement demolishing Demolishing	Set Each m3 m2 m Ls m3 m3 D700 I n) m m m3	1 1 119 51 1,277 60 30 =400m 400 204	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828 497	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 18.72
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i) Civil v 1) Pav	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) lding works indation pipe (RC precast D400) ibering and Shuttering indary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation IDCI pipe D700 work for pipe installation rement demolishing Demolishing Disposal of demolished pavement	Set Each m3 m2 m3 m3 m3 D700 I 1) m m3 m3 m3	1 1 19 51 1,277 60 30 -=400m 400	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i 0 Civil v 1) Pav	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) Iding works indation pipe (RC precast D400) bering and Shuttering indary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation DCI pipe D700 work for pipe installation rement demolishing Demolishing Disposal of demolished pavement nch Excavation (Normal 75%, Rock 25%	Set Each m3 m2 m3 m3 m3 D700 I n) m m m m3 m3 m3	1 1 19 51 1.277 60 30 =400m 400 400 204 204	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828 11,828 497 223	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419 45,520	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR16.13.1 DSR 18.72 DSR15.2.2 JSR 3.4
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i) Civil v 1) Pav	Cost of Earthing Cost of DG Sets (750KVA) and Building Work listructure (concrete) lding works undation pipe (RC precast D400) bering and Shuttering undary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m cess road (BT surface road) 1m3/m issing Main (DCI pipe line) installation (Procurement & Installation DCI pipe D700 work for pipe installation rement demolishing Demolishing Disposal of demolished pavement nch Excavation (Normal 75%, Rock 25% Excavation up to 4.5m	Set Each m3 m2 m3 m3 m3 D700 I 1) m m3 m3 m3	1 1 119 51 1,277 60 30 =400m 400 204	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828 497	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR16.13.1 DSR 18.72 DSR15.2.2 JSR 3.4
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i) Civil v 1) Pav	Cost of Earthing Cost of DG Sets (750KVA) and Building Work listructure (concrete) Iding works undation pipe (RC precast D400) abering and Shuttering undary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m cess road (BT surface road) 1m3/m cess road (BT surface road) 1m3/m installation (Procurement & Installation DCI pipe D700 work for pipe installation rement demolishing Demolishing Demolishing Disposal of demolished pavement nch Excavation (Normal 75%, Rock 25%) Excavation up to 4.5m e Backfilling	Set Each m3 m2 Ls m3 m3 D700 I n) m m m3 m3 c) m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	662,200 283,800 8,514,000 8,136 2,328 3,001 2,152 Sub-total 11,828 497 2223 497	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419 45,520 529,707	do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 18.72 DSR 18.72 DSR 15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
Civi Buil Fou Tim Bou Acc G-4 Ri Pipe i OCivil v 1) Pav	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) Iding works Indation pipe (RC precast D400) abering and Shuttering Indary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation IDCI pipe D700 work for pipe installation rement demolishing Demolishing Disposal of demolished pavement nch Excavation up to 4.5m depth	Set Each m3 m2 m3 m3 m3 D700 I n) m m m m3 m3 m3	1 1 19 51 1.277 60 30 =400m 400 400 204 204	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828 11,828 497 223	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419 45,520 529,707	do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR16.13.1 DSR 18.72 DSR15.2.2 JSR 3.4
Civi Buil Fou Bou Acc 5-4 Ri 9 Pipe i 9 Civil v 1) Pav	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) lding works indation pipe (RC precast D400) bering and Shuttering indary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation DCI pipe D700 work for pipe installation ement demolishing Demolishing Demolishing Disposal of demolished pavement nch Excavation up to 4.5m e Backfilling up to 4.5 m depth posal of excavated soil in pipe trench	Set Each m3 m2 m3 m3 m3 D700 I n) m m3 m3 b) m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828 497 223 450 450	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419 45,520 529,707 146,793	do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 16.13.1 DSR 18.72 DSR 18.72 JSR 3.4 DSR 2.25, 2.26
Civi Buil Fou Tim Bou Acc 5-4 Ri) Pipe i) Civil v 1) Pav 2) Tren 3) Pipe	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) Iding works undation pipe (RC precast D400) bering and Shuttering undary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation DCI pipe D700 work for pipe installation rement demolishing Disposal of demolished pavement nch Excavation (Normal 75%, Rock 25% Excavation up to 4.5 m depth posal of excavated soil in pipe trench Earth upto 5th km	Set Each m3 m2 m3 m3 m3 D700 I D700 I D700 I m3 m3 m3 m3 m3 m3 m3	1 1 1 1 1 1 1 1 51 1,277 60 30 30 -400m 400 -	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828 11,828 497 223 450 497 223 450	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419 45,520 529,707 146,793 144,376	do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR16.13.1 DSR16.13.1 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2
Civit Givit Civit Givit Civit Givit	Cost of Earthing Cost of DG Sets (750KVA) and Building Work il structure (concrete) lding works indation pipe (RC precast D400) bering and Shuttering indary wall (brick wall) 0.6m3/m cess road (BT surface road) 1m3/m ising Main (DCI pipe line) installation (Procurement & Installation DCI pipe D700 work for pipe installation ement demolishing Demolishing Demolishing Disposal of demolished pavement nch Excavation up to 4.5m e Backfilling Dackfilling up to 4.5 m depth posal of excavated soil in pipe trench	Set Each m3 m2 m3 m3 m3 D700 I n) m m3 m3 b) m3 m3	1 1 1 1 1 1 1 1 1 1 1 1 1 1	662,200 283,800 8,514,000 16,940 8,136 2,328 3,001 2,152 Sub-total 11,828 497 223 450 450	662,200 283,800 8,514,000 2,012,441 414,657 2,973,787 1,819,407 180,060 64,560 44,502,575 4,731,200 101,419 45,520 529,707 146,793 144,376	do do do DSR, Standard dwg Market rate DSR 20.5.1 JSR 5.2.10 DSR 16.13.1 DSR 16.13.1 DSR 18.72 DSR 15.2.2 JSR 3.4 DSR 2.25, 2.26

Appendix B4.2: Construction Cost Zone-III&IV (4/7)

						(5/7)
20.5	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
- () P	1.5 m to 2.5 m toad restoration	m2	1,520	113	171,760	DSR2.16.2
	BT surface road	m3	204	2,152	439.008	DSR16.13.1
	Di sullate loud		201	Sub-total	/	DBRI0.13.1
PS-5	5 Pump Facility (Pump station)	Design	MaxFlow: 0.		ump: 22kW x4nos.	3W+1S)
	Iechanical Facility					
	Submersible pump	kW	88	37,840		Market rate
	Piping	Ls	1			10% of above
	Mechanical Screens including belt	Each	2	5,846,280		Market rate
0) F	Gates (1.5 m X 1.5 m)	Each	3	1,759,560	5,278,680	do
2) E	lectrical Facility	IC	1		1 542 742	
	Miscellaneous electrical facility Cost of HT Panel	LS Each	1	946,000	1,543,743	Market rate
	Cost of Transformer (750KVA)	Each	1	1,797,400	1.797.400	
	Cost of LT Panel	Set	1	1,797,400	,,	
	Cost of cabling	Set	1	662,200	· · · · · ·	
	Cost of Earthing	Set	1	283,800		
	Cost of DG Sets (750KVA)	Each	1	8,514,000		
	ivil and Building Work					
	Civil structure (concrete)	m3	111	16,940	1,888,248	DSR, Standard dwg
	Building works	m2	48	8,136		Market rate
	Foundation pipe (RC precast D400)	m	1,199	2,328		DSR 20.5.1
	Timbering and Shuttering	Ls	10		1,707,126	IGD 5 0 10
	Boundary wall (brick wall) 0.6m3/m	m3	48	3,001		JSR 5.2.10
	Access road (BT surface road) 1m3/m	m3	20	2,152 Sub_total	/	DSR16.13.1
25-4	5 Rising Main (DCI pipe line)	D650 1	L=580m	Sub-total	42,667,491	
	ipe installation (Procurement & Installation					
.,.	DCI pipe D650	m	580	10,646	6 174 680	DSR 18.72
2) C	ivil work for pipe installation		2.50		0,174,000	
1)	Pavement demolishing					
	Demolishing	m3	284	497	141,290	DSR15.2.2
	Disposal of demolished pavement	m3	284	223	63,415	JSR 3.4
2)	Trench Excavation (Normal 75%, Rock 25%					
	Excavation up to 4.5m	m3	1,556	450	699,614	DSR2.8.1, 2.9.1, 2.11, 2.12
3)	Pipe Backfilling					
4	Backfilling up to 4.5 m depth	m3	1,363	143	195,433	DSR 2.25, 2.26
4)	Disposal of excavated soil in pipe trench	2	06	107	15.054	YOD A A
	Earth up to 5th km	m3	96 96	187 256		JSR 3.2
5)	Earth beyond 5 km but upto 10 km Timbering and Shuttering	m3	90	230	24,613	JSR 3.2
5)	0-1.5 m depth	m2		108	_	DSR2.16.1
	1.5 m to 2.5 m	m2	2,146	113	242.498	DSR2.16.2
3) R	load restoration		_,		212,190	Dortentois
	BT surface road	m3	284	2,152	611,598	DSR16.13.1
				Sub-total	8,171,116	
FR-2						
	1 Pump Facility (Manhole pump)	D				
		Design	Max Flow: 0.	014m3/sec I	ump: 2.2kW x 2 nos.	
	Iechanical Facility					
	Iechanical Facility Manhole pump	kW	4	014m3/sec F 37,840	166,496	Market rate
1) N	Iechanical Facility Manhole pump Piping				166,496	Market rate 5% of above
1) N	Iechanical Facility Manhole pump Piping Iectrical Facility	kW Ls	4		<u>166,496</u> 8,325	
1) N	Aechanical Facility Manhole pump Piping Jectrical Facility Miscellaneous electrical facility	kW Ls LS	4	37,840	166,496 8,325 1,090,502	5% of above
1) N	Aechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel	kW Ls LS Set	4 1 1 1	37,840	166,496 8,325 1,090,502 283,800	5% of above Market rate
1) N	Aechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling	kW Ls LS Set LS	4 1 1 1 1 1	37,840 283,800 113,520	166,496 8,325 1,090,502 283,800 113,520	5% of above Market rate do
1) M 2) E	Aechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing	kW Ls LS Set	4 1 1 1	37,840	166,496 8,325 1,090,502 283,800 113,520	5% of above Market rate do
1) N 2) E 3) C	Aechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling	kW Ls LS Set LS	4 1 1 1 1 1	37,840 283,800 113,520	166,496 8,325 1,090,502 283,800 113,520 85,140	5% of above Market rate do do
1) N 2) E 3) C	Aechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H < 4.5 Over flow pipe PE pipe D300mm	kW Ls LS Set LS LS	4 1 1 1 1 1	283,800 113,520 85,140 69,663	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326	5% of above Market rate do do
1) N 2) E 3) C	Aechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Yill and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H<4.5	kW Ls LS Set LS LS no.	4 1 1 1 1 1 2	283,800 113,520 85,140 69,663	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1
1) M 2) E 3) C	Acchanical Facility Manhole pump Piping Actrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Carthing Total and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H<4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering	kW Ls LS Set LS LS LS m no. m m2	4 1 1 1 1 1 1 2 10 108	37,840 283,800 113,520 85,140 69,663 1,300	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate
1) M 2) E 3) C	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing ivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H<4.5	kW Ls LS Set LS LS no. m m2 D150 1	4 1 1 1 1 1 1 2 10	37,840 283,800 113,520 85,140 69,663 1,300 125	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate
1) M 2) E 3) C	Aechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing Vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5 Over flow pipe PE pipe D300mm Timbering and Shuttering I Rising Main (DCI pipe line) ipe installation (Procurement & Installation	kW Ls LS Set LS LS m m2 D150 1	4 1 1 1 1 1 1 2 10 108 =700m	283,800 113,520 85,140 69,663 1,300 125 Sub-total	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3
1) M 2) E 3) C 4 P -1	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of cabling Cost of Earthing ivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls LS Set LS LS no. m m2 D150 1	4 1 1 1 1 1 1 2 10 108	283,800 113,520 85,140 69,663 1,300 125 Sub-total	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate
1) M 2) E 3) C 4 P -1 1) P 2) C	Mechanical Facility Manhole pump Piping Betrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Eathing Cost of Eathing vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls LS Set LS LS m m2 D150 1	4 1 1 1 1 1 1 2 10 108 =700m	283,800 113,520 85,140 69,663 1,300 125 Sub-total	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3
1) M 2) E 3) C 4 P -1 1) P 2) C	Mechanical Facility Manhole pump Piping Jectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing viil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls LS Set LS LS no. m m2 D150 1 n) m	4 1 1 1 1 1 1 1 1 2 100 108 ≈700m 700	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3 DSR 18.72
1) M 2) E 3) C 4 P -1 1) P 2) C	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Earthing York of abling Vork Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS no. m m2 D150 1 n) m m3	4 1 1 1 1 1 2 100 108 =700m 700 252	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 497	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2
1) N 2) E 3) C 1) P 2) C 1)	Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Eathing Cost of Eathing ivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS mo. m m2 D150 1 n) m m3 m3	4 1 1 1 1 1 1 1 1 2 100 108 ≈700m 700	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3 DSR 18.72
1) M 2) E 3) C 1) P 2) C 1)	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Eathing Tost of Eathing vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS LS M m2 D150 1 n) m m3 m3	4 1 1 1 1 1 1 1 1 1 1 1 1 1	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 497 223	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1' Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4
1) M 2) E 3) C 3) C 1) P 1) P 2) C 1) 2)	Mechanical Facility Manhole pump Piping Jectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing viil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS mo. m m2 D150 1 n) m m3 m3	4 1 1 1 1 1 2 100 108 =700m 700 252	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 497 223	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2
1) M 2) E 3) C 3) C 1) P 1) P 2) C 1) 2)	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Cabling Cost of Earthing ivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS D150 10 m m3 m3 m3 m3	4 1 1 1 1 1 1 1 1 1 1 1 1 1	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 2223 450	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230 339,948	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
1) M 2) E 2) E 3) C 1) P 2) C 1) 2) C 1) 2) C 3)	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Earthing York of abling Cost of Earthing York of Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS LS M m2 D150 1 n) m m3 m3	4 1 1 1 1 2 10 108 =700m 700 252 252 252 252 255	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 497 223	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12
1) M 2) E 2) E 3) C 1) P 2) C 1) 2) C 1) 2) C 3)	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing ivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS D150 10 m m3 m3 m3 m3	4 1 1 1 1 2 10 108 =700m 700 252 252 252 252 255	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 2223 450	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230 339,948	5% of above Market rate do do DSR19.13.1.2, 19.14.2, 19.1 Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.8.1, 2.9.1, 2.11, 2.12
1) M 2) E 3) C 1) P 2) C 1) 2) C 1) 2) C 3)	Manhole pump Piping Letrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Earthing Tost of Earthing vil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls LS Set LS LS no. m m2 D150 J m m3 m3 m3 m3	4 1 1 1 1 1 1 1 1 1 1 1 1 1	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 497 2223 450 450	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230 339,948 106,588 1,155	5% of above Market rate do do DSR19,13,1.2, 19,14.2, 19,1' Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2
1) M 2) E 3) C 3) C 1) P 1) P 2) C 1) 1) 2) 2) 3) 4)	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of Cabling Cost of Earthing viil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS LS D150 1 D150 1 m m m m m m m m m m m m m m m m m m m	4 1 1 1 1 2 100 108 	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 1,431 497 223 450 450 143 143	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230 339,948 106,588 1,155	5% of above Market rate do do DSR19,13,1.2, 19,14.2, 19,1' Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2
1) M 2) E 3) C 3) C 1) P 	Mechanical Facility Manhole pump Piping lectrical Facility Miscellaneous electrical facility Cost of LT Panel Cost of cabling Cost of Earthing ivil and Building Work Manhole (Bottom dia. 1.5 m) 2.5 < H< 4.5	kW Ls Set LS LS LS D150 1 D150 1 m m m m m m m m m m m m m m m m m m m	4 1 1 1 1 1 1 1 1 1 1 1 1 1	37,840 283,800 113,520 85,140 69,663 1,300 125 Sub-total 1,431 497 223 450 450 143	166,496 8,325 1,090,502 283,800 113,520 85,140 139,326 12,997 13,500 1,913,605 1,001,700 125,282 56,230 339,948 106,588 1,155 1,582 204,120	5% of above Market rate do do DSR19,13,1.2, 19,14.2, 19,1' Market rate DSR2.16.3 DSR 18.72 DSR15.2.2 JSR 3.4 DSR2.8.1, 2.9.1, 2.11, 2.12 DSR 2.25, 2.26 JSR 3.2

Appendix B4.2: Construction Cost Zone-III&IV (5/7)

	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	
BT	surface road	m3	252	2,152	542,304	DSR16.13.1
D 1				Sub-total	2,378,909	
R-3	ump Facility (Pump station)	Docian	Max Flow: 0.	115m ² /soc E	Pump: 18.5kW x 3 no:	(2W 18)
	hanical Facility	Design	Max110w. 0.	III Shib/sec I	ump. 18.5Kw x 5 110.	5.(211713)
	Submersible pump	kW	55.5	37,840	2.100.120	Market rate
	Piping	Ls	1			10% of above
	Mechanical Screens including belt	Each	2	4,748,920		Market rate
	Gates (0.8 m X 0.8 m)	Each	3	813,560	2,440,680	do
2) Electi	rical Facility					
	Miscellaneous electrical facility	LS	1		1,205,772	
	Cost of HT Panel	Each	1	946,000	946,000	Market rate
	Cost of Transformer (315KVA)	Each	1	1,191,960	1,191,960	
	Cost of LT Panel	Set	1	756,800	756,800	
_	Cost of cabling	Set	1	473,000	473,000	
_	Cost of Earthing	Lot	1	208,120	208,120	
	Cost of DG Sets (315KVA)	Each	1	5,581,400	5,581,400	do
	and Building Work			16040	0.01.0.02	D0D 0. 1 11
	il structure (concrete)	m3	51	16,940		DSR, Standard dwg
	ilding works	m2	22	8,136		Market rate
	Indation pipe (RC precast D400) abering and Shuttering	m Ls	547	2,328	1,2/3,5/6	DSR 20.5.1
	undary wall (brick wall) 0.6m3/m	m3	48	3,001		JSR 5.2.10
	cess road (BT surface road) 1m3/m	m3	48	2,152	,	DSR16.13.1
ACC		in:	20	2,152 Sub-total	27.891.008	LON10.13.1
S-6 P	l Sising Main (DCI pipe line)	D300 I	=500	Sub-total	27,071,000	
	installation (Procurement & Installation		- 500			
	DCI pipe D300	m	500	3,410	1,705.000	DSR 18.72
2) Civil	work for pipe installation			-,	1,700,000	
	ement demolishing					
	Demolishing	m3	195	497	96,944	DSR15.2.2
	Disposal of demolished pavement	m3	195	223	43,512	JSR 3.4
2) Tre	nch Excavation (Normal 75%, Rock 25%	5)				
	Excavation up to 4.5m	m3	713	450	320,388	DSR2.8.1, 2.9.1, 2.11, 2.12
3) Pip	e Backfilling					
	Backfilling up to 4.5 m depth	m3	677	143	97,062	DSR 2.25, 2.26
4) Dis	posal of excavated soil in pipe trench					
	Earth upto 5th km	m3	18	187		JSR 3.2
	Earth beyond 5 km but upto 10 km	m3	18	256	4,520	JSR 3.2
5) Tin	bering and Shuttering					
_	0-1.5 m depth	m2	1,500	108	162,000	DSR2.16.1
	1.5 m to 2.5 m	m2		113	-	DSR2.16.2
<u> </u>	restoration		107			
	surface road	m3	195	2,152	419,640	DSR16.13.1
4) River 0300 L=	r Crossing Pipe Bridge					
		(n)				
Рір	e installation (Procurement & Installati DCI pipe D300	m (n	70	3.410	220 700	DOD 10 70
Fab	Delication of girder	m	70	3,410	238,700	DSR 18.72
1.40	Formwork	m2	304	335	101 554	DCD 5.0.2
	Concrete	m2 m3	<u> </u>	335		DSR 5.9.2 DSR 5.2.1
	Re-bar	kg	44	7,632		DSR 5.2.1 DSR 5.22.4
Inc	tallation (20ton crane)	day	4,416	11,663		DSR 5.22.4 DSR 01-0028, 02-0157
	utment	uay	2	11,005	25,325	LISIX 01-0026, 02-0137
AU	Formwork	m2	269	335	80.01/	DSR 5.9.2
	Concrete	m3	115	7,632		DSR 5.2.1
	Re-bar	kg	10,368	67		DSR 5.22.4
	Excavation (rock)	m3	346	595		DSR 3.22.4 DSR 2.6.1
	Backfill	m3	230	143		DSR 2.25, 2.26
	Soil disposal	m3	115	143		DSR 2.23, 2.20 DSR 1.1.2
Pier	r foundation			155	17,000	
	Formwork	m2	24	335	8.028	DSR 5.9.2
	Concrete	m3	18	7,632		DSR 5.2.1
		kg	1,620	67	,	DSR 5.22.4
	Re-bar	R _E				
		m3	54	595	32,134	DSR 2.6.1
	Re-bar	v		595 143		DSR 2.0.1 DSR 2.25, 2.26
	Re-bar Excavation (rock)	m3	54			DSR 2.25, 2.26
Pier	Re-bar Excavation (rock) Backfill Soil disposal	m3 m3	54 36	143	5,160	DSR 2.25, 2.26
Pier	Re-bar Excavation (rock) Backfill Soil disposal	m3 m3	54 36	143	5,160 2,759	DSR 2.25, 2.26
Pier	Re-bar Excavation (rock) Backfill Soid disposal	m3 m3 m3	54 36 18	143 153	5,160 2,759 - 32,112	DSR 2.25, 2.26 DSR 1.1.2
Pier	Re-bar Excavation (rock) Backfill Soil disposal r Formwork	m3 m3 m3 m2	54 36 18 - 96	143 153 335	5,160 2,759 - 32,112 274,752	DSR 2.25, 2.26 DSR 1.1.2 DSR 5.9.2
	Re-bar Excavation (rock) Backfill Soil disposal r Formwork Concrete	m3 m3 m3 m2 m3	54 36 18 - 96 36	143 153 335 7,632	5,160 2,759 - 32,112 274,752	DSR 2.25, 2.26 DSR 1.1.2 DSR 5.9.2 DSR 5.2.1
	Re-bar Excavation (rock) Backfill Soil disposal r Formwork Concrete Re-bar	m3 m3 m3 m2 m3	54 36 18 - 96 36	143 153 335 7,632	5,160 2,759 - 32,112 274,752 215,460	DSR 2.25, 2.26 DSR 1.1.2 DSR 5.9.2 DSR 5.2.1
	Re-bar Excavation (rock) Backfill Soid disposal Formwork Concrete Re-bar mporary works	m3 m3 m3 m2 m3 kg	54 36 18 - 96 36 3,240 -	143 153 335 7,632 67	5,160 2,759 - 32,112 274,752 215,460 - 238,032	DSR 2.25, 2.26 DSR 1.1.2 DSR 5.9.2 DSR 5.2.1 DSR 5.2.2.4
	Re-bar Exeavation (rock) Backfill Soid disposal f Formwork Concrete Re-bar mporary works Excavation (rock)	m3 m3 m3 m2 m3 kg m3	54 36 18 - 96 36 3,240 - 400	143 153 335 7,632 67 595	5,160 2,759 	DSR 2.25, 2.26 DSR 1.1.2 DSR 5.9.2 DSR 5.2.1 DSR 5.2.4 DSR 2.6.1 DSR 2.38
	Re-bar Excavation (rock) Backfill Soil disposal r Formwork Concrete Re-bar morary works Excavation (rock) Embankment	m3 m3 m3 m2 m3 kg m3 m3 m3	54 36 18 - 96 36 3,240 - 400 400	143 153 335 7,632 67 595 102	5,160 2,759 	DSR 2.25, 2.26 DSR 1.1.2 DSR 5.9.2 DSR 5.2.1 DSR 5.2.4 DSR 2.6.1 DSR 2.38 T-1(0)
	Re-bar Excavation (rock) Backfill Soil disposal r Formwork Concrete Re-bar mporary works Excavation (rock) Embankment Sheet pile (L=4m)	m3 m3 m3 m2 m3 kg m3 m3 m3 no.	54 36 18 96 36 3,240 - 400 400 200	143 153 335 7,632 67 595 102	5,160 2,759 	DSR 2.25, 2.26 DSR 1.1.2 DSR 5.9.2 DSR 5.2.1 DSR 5.2.4 DSR 2.6.1 DSR 2.38 T-1(0)

Appendix B4.2: Construction Cost Zone-III&IV (6/7)

Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)	Remarks
C: Sewerage Treatment Plant					
Sewage Treatment Plant					
Sewage treatment plant	m3/d	53,000	12,970		Market rate (Quotation)
			Sub-total	687,410,000	
Power receiving works	Ls	1		20,000,000	
Land development					
Surface excavation	m2	31,696	46	1,458,009	DSR 2.1
Masonry retaining wall	m3	260	2,479	644,713	JSR 10.4.9
Backfill	m3	186	143	26,588	DSR 2.25, 2.26
Drainage (RCC precast drain)	m	2,836	8,245	23,384,270	Average of DPR
Boundary wall (Brick 0.6m3/m)	m3	371	3001		JSR 5.2.10
Road works (BT surface)	m3	1,386	2,152	2,982,697	
		<i>p</i>	Sub-total	29,609,648	
Outlet facilities					
Pipe installation (Procurement & Installation	on)				
RC pipe D1800	m	123	6,442	794 014	JSR 1.119, 10.6.2.5
Civil work for pipe installation		120	0,112	774,014	JOR 1.117, 10.0.2.5
Excavation	m3	788	450	354 160	DSR2.8.1, 2.9.1, 2.11, 2.12
Backfill	m3	422	143		DSR 2.25, 2.26
Soil disposal	m3	366	143		JSR 3.2
Base gravel	m3	51	389		DSR 16.4
Levelling concrete	m3	20	4,408		DSR 4.1.5
Formwark	m3	222	335		DSR 5.9.2
Concrete (Base and Slab)	m3	227	6,865		DSR 5.1.1
Re-bat	kg	20,411	67		DSR 5.22.4
Outfall structures	**5	,			
Exacavtion (Rock)	m3	79	595	46 942	DSR 2.6.1
Gabion	m3	44	1,086		JSR 10.7.35, JSR 10.7.41
Base gravel	m3		389		DSR 16.4
Levelling concrete	m3	2	4,408		DSR 10.4
			,		
Formwark	m2	48	335		DSR 5.9.2
Concrete (Base and Slab)	m3	9	6,865		DSR 5.1.1
Concrete (Wall)	m3	6	7,632		DSR 5.2.1
Re-bar	kg	1,315	67		DSR 5.22.4
			Sub-total	4,603,581	
Tota	l cost C	: Sewerage Ti	reatment Plant	741,623,229	
D: House Connection					
Installation of inspection chamber and con		28,666	8,899		Market rate
	Tot	al cost D: Hou	se Connection	255,098,734	
E: Drainage Facility					
1) RCC precast drain	m	239,820	9,006	2,159,802,498	Average of DPR
2) Culvert	m	2,470	19,938	49,246,019	do
3) Piping	m	1,940	6,851	13,290,338	do
(4) Dismantling existing drains & shifting of util	_			222,233,886	
5) Pavement demolishing				_,,300	
Demolishing	m3	5,137	497	2,552,990	DSR
Disposal of demolished concrete	m3	5,137	187	959,904	
6) Road restoration		5,157	10/	,57,704	
BT surface road	m2	5,137	2 152	11,052,339	DSP
DI SUITACE IOAU	m3		2,152		Nor
	10	nai cost E: Dra	ainage Facility	2,459,137,973	
F: Social Development				101 000 /	D) (G)
	no	40	4,777,000	191,080,000	KMC rate
Construction of public toilet	I Tots	al cost F: Socia	d Development	191,080,000	
Construction of public toilet	104				
	104				
	104				
	no	900	3,700	3,330,000	RMC rate
G: Decentralized Sewerage Facilities	no	900 900	3,700 8,899	3,330,000 8,009,100	RMC rate RMC rate
3: Decentralized Sewerage Facilities Installation of septic tank Installation of inspection chamber and con	no no	900	,		
G: Decentralized Sewerage Facilities Installation of septic tank Installation of inspection chamber and con	no no	900	8,899	8,009,100	
3: Decentralized Sewerage Facilities Installation of septic tank Installation of inspection chamber and con Total cost G	no no	900	8,899	8,009,100	
G: Decentralized Sewerage Facilities Installation of septic tank Installation of inspection chamber and con Total cost C H: Public Outreach Program	no no : Decen	900 ntralized Sewer	8,899	8,009,100 11,339,100	
Decentralized Sewerage Facilities Installation of septic tank Installation of inspection chamber and con	no no Decen Ls	900 atralized Sewer	8,899	8,009,100	

Appendix B4.2: Construction Cost Zone-III&IV (7/7)

					US \$	= yen	101.6
					INR	= yen	1.69
							Combined
			Foreign	Portion	Local P	ortion	Total
			(Ye	en)	INF	2	
	Unit	Qty.	Rate	Amount	Rate	Amount	('000)
				('000)		('000)	Yen
A Remuneration							
1 Professional (A)	M/M	158	2,895,000	457,410	0	0	457,410
2 Professional (B)	M/M	311	0	0	342,000	106,362	179,752
3 Supporting Staffs	M/M	648	0	0	100,000	64,800	109,512
Subtotal of A				457,410		171,162	746,674
B Direct Cost							
1 International Airfare		50	423.000	21,150		0	21.150
2 Domestic Airfare		79	,	0	25,000	1,975	3,338
3 Accommodation Allowance	Month	158	300,000	47,400		0	47,400
	Month	311		0	75.000	23.325	39,419
4 Vehicle Rental	Month	156		0	78.000	12,194	20,608
5 Office Rental	M/M	75		0	130,000	9,750	16,478
6 International Communications	M/M	75	20,000	1,500		0	1,500
7 Domestic Communications	M/M	75		0	10,000	750	1,268
8 Office Supply	M/M	75		0	30,000	2,250	3,803
9 Office Furniture and Equipment	Ls	1		0	600,000	600	1,014
10 Report Preparation	Month	75		0	10,000	750	1,268
11 Subletting survey and Design works	Ls	1			40,000,000		
Subtotal of B				70,050		51,594	157,244
Total				527,460		222,756	903,918

Appendix B4.3: Cost Estimate of Engineering Service Consultant

Source: JICA Study Team

Appendix B4.4: Cost Estimate of Capacity Development Consultant

					US \$	= yen	101.6
					INR	= yen	1.69
							Combined
			Foreign Portion		Local Portion		Total
		-	(Yen)		INR		
	Unit	Qty.	Rate	Amount	Rate	Amount	('000)
				('000)		('000)	Yen
A Remuneration							
1 Professional (A)	M/M	83	2,895,000	240,285	0	0	240,285
2 Professional (B)	M/M	246	0	0	342,000	84,132	142,183
3 Supporting Staffs	M/M	161	0	0	100,000	16,100	27,209
Subtotal of A				240,285		100,232	409,677
B Direct Cost							
1 International Airfare		59	423,000	24,957		0	24,957
2 Domestic Airfare		25		0	25,000	625	1.056
3 Accommodation Allowance	Month	83	300,000	24,900		0	24,900
	Month	246		0	75,000	18,450	31,181
4 Vehicle Rental	Month	110		0	78,000	8,554	14,456
5 Office Rental	M/M	87		0	130,000	11,310	19,114
6 International Communications	M/M	87	20,000	1,740		0	1,740
7 Domestic Communications	M/M	87		0	10,000	870	1,470
8 Office Supply	M/M	87		0	30,000	2,610	4,411
9 Office Furniture and Equipment	Ls	1		0	600,000	600	1,014
10 Report Preparation	Month	87		0	10,000	870	1,470
Subtotal of B				51,597		43,889	125,769
Total				291,882		144,121	535,446

Appendix B4.5: Project Cost

Base Year for Cost Estimation:	Jun,	2014				FC & Tot	al: million	I JPY																								
Exchange Rates		= Yen	1.69			LC	million I	INR																								
Price Escalation:	FC:	2.0%	LC:	4.2%	0																											
Physical Contingency	5%																															
Physical Contingency for Consultant	5%																															
Item		Total			2014			2015			2016			2017			2018			2019		2020			2021			2022			2023	
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	
IGIBLE PORTION																																
Procurement / Construction	2,761				2	0 0) () (0 0	0	C) () (0 0	0	010		4,805	683	2,550		1.5.5			1			0	0	0	(0
P-1: STP, PS and RM	1,048	930	2,619)	0 0)C) (0	0) () (0 0	0	262	232	655	262	232					232	655		0	0	0		0
CP-2: Gravity Sewer, Drainage Facility, and HC [S	787	4,191	7,871)	0 () () (0 0	0) () (0 0	0	197	1,048	1,968	197	1,048					1,048	1,968		0	0	0		0
CP-3: Gravity Sewer, Drainage Facility, and HC [N	478	2,544	4,778)	0 0) () (0 0	0) () (0 0	0	119	636	1,194	119	636	1,194 119	636	1,194	119	636	1,194	0	0	0	0		0
CP-4: Social Development	32	172	323	s ()	0 0)C) (0 0	0		0) (0 0	0	8	43	81	8	43	81 8	3 43	81	8	43	81	0	0	0	0		0
CP-5: Decentralized Sewerage Facilities	5	25	47)	0 () (0 (0 0	0) (0 0	0 0	0	1	6	12	1	6	12 1	1 6	12		6	12	0	0	0	0		0
CP-6: Public Outreach Program	8	45	85	6 (C	0 (0 0) (0 0	0	0) () (0 0	0	2	11	21	2	11		2 11	21		11	21	-	0	0	0	(0
Base cost for JICA financing	2,358	7,907	15,722) 	0 ()C	0	0	0		0) (0 0	0	589	1,977	3,930	589	1,977			3,930		1,977	3,930		0	0	0		0
Price escalation	272	2,018	3,683		D	0 0	C	0 (0	0		0 (0 0	0 0	0	49	354	646	61	452		4 554	1		660	1,203		0	0	0	(0
Physical contingency	131	496	970		2	0 0	0 0) (0 0	0	C) () (0 0	0	32	117	229	33	121		121	247		132	257		0	0	0	(0
Consulting services (Engineering Service)	599	280	1,072		D	0 (46	6 14			62			-	125	72	40	140	66	39					61			1	9	8	1	1
Base cost	527	223	904		כ	0 (43	3 13	8 65	142	54			19	110	64	32	118	57	30		5 29	106	-	43	150		1	7	6	1	1
Price escalation	43	44	117		2	0 (1	1 1	2	6	5	5 14		3	9	5	6	15	6	7	17 7	7 8	21	11	14	36		0	2	1	(0
Physical contingency	29	13	51		0	0 (2	2 1	3	7	3	3 12	-	1	6	3	2	7	3	2	6 3	3 2	6	4	3	9	0	0	0	0	(0
Consulting services (Capacity Development)	330	183	639		0	0 (51	1 9	65	83	35	5 141		26	83	33	15	59	33	18	63 34	4 29	83	-	35	92	25		51	0	(0
Base cost	292	144	535	6 (C	0 0	47	7 8	8 61	76	30) 127	7 35	5 22	72	29	12	50	29	14	52 28	3 22	65		25	69	21	10	38	0	(0
Price escalation	23	30	73	8 (0	0 () 1	1 (2	3	3	3 7	7 2	3	7	2	2	6	3	3	8 4	4 6	14	4	8	18	4	4	10	0	(0
Physical contingency	16	9	30) (C	0 () 2	2 () 3	4	2	2 7	7 2	2 1	4	2	1	3	2	1	3 2	2 1	4	2	2	4	1	1	2	0	(0
al (I + II + III)	3,691	10,884	22,086	6 (0	0 (97	7 23	3 136	238	96	6 401	1 125	6 49	208	776	2,502	5,005	782	2,606	5,187 797	2,725	5,403	835	2,865	5,676	33	16	60	8	1	1
ION ELIGIBLE PORTION																																
Procurement / Construction	0	0	0) (כ	0 (0 0) (0 0	0	C) () (0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
																																_
Base cost for JICA financing	0	0	0) (C	0 0) () (0 0	0	C) () (0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Price escalation	0	0	0) (0	0 (0 0) (0 0	0	0) () (0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Physical contingency	0	0	0	0 ()	0 0	0 0) (0	0) () (0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Land Acquisition	0	370	625		0	0 (0 0	370			0) () (0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Base cost	0	338	571)	0 (, c	338		0	C) (0	0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Price escalation	0	14	24		0	0 (0 0	14	4 24	0	0	0 0	0 0	0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Physical contingency	0	18	30	0 0	0	0 0	0 0	18	3 30	0	0	0 (0 0	0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Administration cost	0	269	454		0	0 0	0 0	9 9	9 15	0	5	6 8	3 (2	4	0	59	100	0	61		64			67			1	1	0	(0
VAT	0	1,569	2,651	(0	0 (0 0	0 6	9	0	19	9 32	2 (9	15	0	362	611	0	375		389			408	690		1	1	0	1	1
Import Tax	0	49	83	s (J	0 (0) (0	0	C) (0 0	0 0	0	0	12	20	0	12		12	21		13	21	0	0	0	0	(0
al (a+b+c+d+e)	0	2,256	3,813	8 (0	0 0	0 0	384			24		0 0	12	20	0	433	731	0	448		465			488	825		1	2	0	1	1
TAL (A+B)	3,691	13,141	25,898	s (J	0 (97	7 407	7 785	238	120	9 441	1 125	61	228	776	2,935	5,736	782	3,055	5,945 797	7 3,191	6,190	835	3,353	6,501	33	18	63	8	2	2
						_	L																									
nterest during Construction	151	0	151		D	0 0	0 0) (0 0	0	C) (0 0	0 0	0	15	0	15	30	0	30 45	-	45	-	0	61	-	0	0	0	(0
Interest during Construction(Const.)	150	0	150) (D	0 (0 0) (0 0	0	C	0 () (0 0	0	14	0	14	29	0	29 45	5 0	45	61	0	61		0	0	0	(0
Interest during Construction (Consul.)	1	0	1	(D	0 0	0 0) (0 0	0	C	0 0) (0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
Front End Fee	44	0	44	44	4	0 44	4 C) (0 0	0	C) () (0 0	0	0	0	0	0	0	0 0	0 0	0	0	0	0	0	0	0	0	(0
AND TOTAL (A+B+C+D)	3,886	13,141	26,093	8 44	4	0 44	97	7 407	7 785	238	120) 441	1 125	61	228	790	2,935	5,751	812	3,055	5,974 842	2 3,191	6,235	896	3,353	6,563	33	18	63	8	2	2
																																T
IICA finance portion (A)	3,691	10,884	22,086	6 (C	0 () 97	7 23	3 136	238	96	6 401	1 125	49	208	776	2,502	5,005	782	2,606	5,187 797	7 2,725	5,403	835	2,865	5,676	33	16	60	8	1	1

Administration Cost = 2.0%

VAT=	12% of the expenditure in local currency of the eligible portion

Impo	ort Tax= 3%																			
Price Escalation			2014		2015		2016	2017	,	2018		2019		2020		2021		2022	2023	
Price Escale			1	1	1.02 1.0	42	1.0404 1.085764	1.061208	3 1.131366	1.082432 1.1788	383 1.	104081 1.228397		1.126162 1.279989	1.	148686 1.333749	9	1.171659 1.389766	1.195093 1.44813	6
d Price Escal			0	0	0.02 0.0	42	0.0404 0.085764	0.061208	0.131366	0.082432 0.1788	883 0.	104081 0.228397		0.126162 0.279989	0.	148686 0.333749	9	0.171659 0.389766	0.195093 0.44813	6
Loan interest during const. Financing Rate Interest rate for YEN loan	100.00% 0.30%																			
Temporaly allocation			0	0	0	0	0	0 0)	0 4,805	4,805	4,993	4,993		5,187	5,390	5,390			
Debt at the end of term			0		0		0	0)	4,805		9,798		14,985		20,375				
Interest during const			0		0		0	()	14		29		45		61				
Loan interest during const. (Consul.) Financing Rate Interest rate for YEN loan	100.00% 0.01%																			
Temporaly allocation			0	0	136	136	101	401 208		208 199	199	195	195		216	286	286		60 10	10
Debt at the end of term			0		136		536	745	5	944		1,138		1,354		1,641		1,701	1,711	
Interest during const			0		0		0	()	0		0		0		0		0	0	
Front End Fee	100.00% 0.20%																			
Balance of yen loan	22,086	22,086	22,086	22,086																
Commitment Charge		22,000	44	44																

Source: JICA Study Team

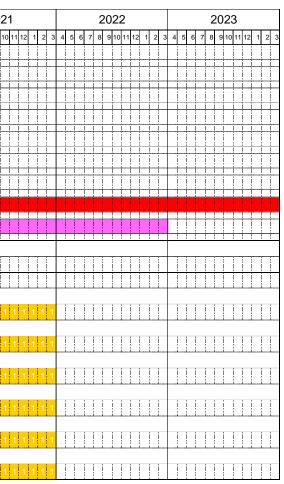
Appendix B5

CHAPTER B5 IMPLEMENTATION AND CONSTRUCTION PLAN

Appendix B5.1: Implementation Schedule

			201	4				20)15				2	2016	6				201	17				20	18				201	9				202	20			2	202 ⁻	1
	4 5	67	8 9 10	11 12	1 2	3 4	56	789	9 10 11	12 1	2 3	4 5 6	678	9 10	11 12	1 2	3 4 5	67	891	10 11 12	2 1 2	34	567	89	10 11 12	2 1 2	3 4	567	8 9 10	0 11 12	1 2 3	4 5	567	8 9 1	0 11 12	1 2 3	4 5	678	8 9 10	1
Pledge		++											<u> </u>																										++	ļ
Signing of Loan Agreement						4																										\square							$\frac{1}{1}$	T
Selection of Consultant																																								ļ
Consulting Services (Engineering Service)																																								Ì
Review of DPR																																								Ī
Detail design and cost estimate																																							++-	t t
Tender assistance																																								Ť
Construction Supervision including DLP																																								Ļ
Consulting Services (Capacity Development)																				11																			P	ļ
Land Acquisition																																								T
Construction																																Ħ								t
CP-1: STP, PS and RM																						1 1	1 1 1	1 1	1 1 1	1 1	1 1	1 1	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1	ļ
CP-2: Gravity Sewer, Drainage Facility, and HC [South-West Area]																						1 -	1 1 1	1 1	1 1 1	1 1	1 1	11	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1	-
CP-3: Gravity Sewer, Drainage Facility, and HC [North-East Area]											-											1 -	1 1 1	1 1	1 1 1	1 1	1 1	1 1	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1	1 1	1 1 1	1 1	1 1 1	1 1	-
CP-4: Social Development													·									1	1 1 1	1 1	1 1 1	1 1	1 1	1 1	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1	11	1 1 1	11	1 1 1	1 1	-
CP-5: Decentralized Sewerage Facilities		- 11 -																				1	1 1 1	1 1	1 1 1	1 1	1 1	1 1	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1	1 1	1 1 1	1 1	1 1 1	1 1	-
CP-6: Public Outreach Program																						1	1 1 1	1 1	1 1 1	1 1	1 1	11	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1 1	1 1	1 1 1	1 1	1 1 1	1 1	-

Source: JICA Study Team



Appendix B6

CHAPTER B6 PROCUREMENT PLAN

Appendix B6.1: Draft TOR of Engineering Service Consultant

Terms of Reference for Engineering Service Consultant under Ranch Sewerage Project

1. Background of the Project

(1) Background

Ranchi City, the capital city of Jharkhand State, is located in the eastern part of India and has a population of 1,100,000, as of 2011. Ranchi City has not yet been provided with a public sewerage system consisting of sewerage pipe reticulation and sewage treatment plant, except for U-drains provided along the streets that are being used for discharging both rainwater and wastewater into downstream rivers.

With an increase in population of Ranchi City, water consumption has been increasing along with the provision of new water supply facilities, resulting in the increase in generation of sewage water being discharged into the streams and rivers. Thus, the pollution load in rivers has increased, bringing about environmental deterioration as well as health damages to the residents. Therefore, the establishment of a public sewerage system is urgently required.

In 2005, RMC entrusted the preparation of DPR of a sewerage and drainage project to Meinhardt. The DPR was prepared from 2006 to 2007. The project area of DPR covers the entire RMC jurisdictional area of 175 km2, consisting of four zones (Zone-I to Zone IV: refer to Attachment-1). RMC submitted the DPR to CPHEEO for application to the JNNURM scheme in 2012. Subsequent to the observation by CPHEEO in February 2013, the DPR was revised by RMC in August 2013.

In parallel with the above, the Central Government of India requested Japan International Corporation Agency (JICA) for implementation of the Project in June 2013. As a result of the discussion between the Indian Government and JICA, it was decided that Zone-I was to be implemented under JNNURM scheme, while Zone-II, III & IV were the candidate area of the JICA fund project.

As a result of the project preparation study "Preparatory Survey on Ranchi Sewerage Project" conducted by JICA in 2014, it was decided that Zone-II area was the target area of the JICA fund project (the Project) and the revised DPR for Zone-II was prepared in September 2014 and approved by CPHEEO in October 2014.

(2) Project Objective

The objective of the Project is to establish proper and stable sewerage service in Ranch city

through provision of sewerage and drainage facilities and enhancement of capacity of RMC in sewerage service, thereby contributing to improvement of the living environment of the residents of Ranch city including poverty group.

(3) Project Area and Target Population

As mentioned above the project area is the Zone-II (70.8km2) which is located in the central part of the city and has the largest population and highest population density as of 2011 census. The population of Zone-II is 592,304 in 2011 and projected to be 949,869 in 2046.

(4) Project Scope

The project scope consists of 1) Facility Construction and 2) Capacity Development of RMC.

- 1) Facility Construction
- Construction of sewerage and drainage facility
- Provision of public toilet
- Provision of septic tank where the sewerage facility is not constructed

The proposed project facility is presented in Attachment-2.

2) Capacity Development of RMC

In addition to the above facility construction, the capacity development service is to be provided to RMC. The capacity development is to assist RMC in implementation of the "Organization Strengthening Action Plan" (Action Plan) proposed in the "Preparatory Survey on Ranchi Sewerage Project"

2. The Consulting Service

2.1 Objective of the Consulting Service

The consulting services shall be provided by an international consulting firm (the Consultant) selected in compliance with Guidelines for the Employment of Consultants under Japanese ODA Loans, April 2012. As mentioned above, the project scope consists of 1) Facility Construction and 2) Capacity Development of RMC. Accordingly, the two consulting service, i.e. 1) Engineering Service and 2) Capacity Development, will be provided by two separate consultants. This TOR is for procurement of the Engineering Service Consultant.

The main objective of the engineering services is to provide RMC with the services required for the efficient and proper implementation of Ranch Sewerage Project through the following works:

- 1) Review of DPR
- 2) Site survey
- 3) Detail Design

- 4) Construction Plan and Cost Estimation
- 5) Preparation of Pre-qualification Documents and Tender Documents
- 6) Pre-Construction Service
- 7) Construction Supervision
- 2.2 Scope of the Consulting Service
 - (1) Review of DPR

The Consultant shall review the DPR prepared by RMC. Items to be reviewed shall include:

- 1) Areas to be covered by the sewerage system
- 2) Design criteria;
- 3) Wastewater generation forecast
- 4) The route of the sewer lines (roads where the sewers will be laid)
- 5) Overall hydraulic design of the sewer lines
- 6) Hydraulic design of drainage facility
- 7) Design influent and effluent qualities of the WWTP
- 8) Treatment process and general hydraulic plan of the WWTP
- 9) Type of major WWTP equipment
- 10) Layout plan of the WWTP
- 11) Way of final disposal (or recycle) of the generated sludge
- 12) Type of trenchless method to be applied in the project
- 13) Typical design of structure of sewer and drain ditch
- 14) Typical design and intervals of the manholes
- 15) Construction cost
- 16) Consideration of required measures for power receiving
- 17) Implementation schedule of the construction works
- 18) Project Implementation Program such as contract packaging and schedule
- (2) Site Survey

The Consultant shall conduct the following site survey for preparation of the detail design of the project facility.

- 1) Topographic survey: (Site of STP and pump station, Route of sewer and drain ditch)
- 2) Geological survey: (Site of STP and pump station)
- (3) Detail Design

The Consultant shall conduct the following works to complete the detail design of the project facility.

- 1) STP, Pump station and Rising Main
 - Process design and hydraulic design

- Mechanical and Electrical design
- Civil and Building design
- Preparation of drawings
- Preparation of BQ and technical specification
- 2) Gravity Sewer, House Connection, and Drainage facility
 - Hydraulic design
 - Civil design
 - Preparation of drawings
 - Preparation of BQ and technical specification
- 3) Public Toilet and Septic Tank
 - Civil design
 - Preparation of drawings
 - Preparation of BQ and technical specification
- (4) Construction Plan and Cost Estimation

The Consultant shall conduct the following works based on the detail design:

- 1) Finalization of contract packaging
- 2) Preparation of project implementation schedule
- 3) Finalization of BQ and cost estimation
- (5) Preparation of Pre-qualification Documents and Tender Documents

The Consultant shall prepare pre-qualification documents and bidding documents for the above contract packages. The tender documents for ICB packages shall be prepared in conformity with the "Standard Bidding Documents under the Japanese ODA Loan".

(6) Pre-Construction Service

The Consultant shall assist the Client in:

- 1) Pre-qualification stage
 - Pre-qualification advertisement and pre-qualification meeting
 - P/Q evaluation
- 2) Tender stage
 - Pre-tender conference and site visit
 - Tender clarification
 - Issuing addendum
 - Tender opening
 - Tender evaluation
 - Contract negotiation and preparation of contract documents
- (7) Construction Supervision

The Consultant shall perform his duties during the contract implementation period of the contracts to be executed by the Employer and the Contractor. FIDIC MDB Harmonized Edition (2010) complemented with the Specific Provisions as included in the Standard Bidding Documents under Japanese ODA Loans for Procurement of Works will be applied to the civil works of the Project. In this context, the Consultant shall:

- 1) Act as the Engineer to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by the Employer;
- Provide assistance to the Employer concerning variations and claims which are to be ordered/issued at the initiative of the Employer. Advise the Employer on resolution of any dispute with the Contractor;
- 3) Issue instructions, approvals and notices as appropriate;
- 4) Provide recommendation to the Employer for acceptance of the Contractor's performance security, advance payment security and required insurances;
- 5) Provide commencement order to the Contractor;
- 6) Assess adequacy of all inputs such as materials, labor and equipment provided by the Contractor;
- 7) Check and approve the Contractor's method of work, including site organization, program of performance, quality assurance system, safety plan and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;
- Regularly monitor physical and financial progress, and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected by the Contractor;
- 9) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions. Issue further drawings and give instructions to the Contractor for any works which may not be sufficiently detailed in the contract documents, if any;
- 10) Review and approve the Contractor's working drawings, shop drawings and drawings for temporary works. Also review and approve, if any, design prepared by the Contractor for any part of the permanent works;
- 11) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;
- 12) Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the contract;
- Organize, as necessary, management meetings with the Contractor to review the arrangements for future work. Prepare and deliver minutes of such meetings to the Employer and the Contractor;

- 14) Supervise the works so that all the contractual requirements are met by the Contractor, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractor is duly assigned at the project site;
- 15) Supervise field tests, sampling and laboratory test to be carried out by the Contractor;
- 16) Inspect the construction method, equipment to be used, workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the specifications;
- 17) Survey and measure the work output performed by the Contractor verify statements submitted by the Contractor and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;
- 18) Coordinate the works among different contractors employed for the Project;
- 19) Modify the designs, technical specifications and drawings, relevant calculations and cost estimates as may be necessary in accordance with the actual site conditions, and issue variation orders (including necessary actions in relation to the works performed by other contractors working for other projects, if any);
- 20) Carry out timely reporting to the Employer for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;
- 21) Inspect, verify and fairly determine claims issued by the parties to the contract (i.e. the Employer and Contractor) in accordance with the civil works contract;
- 22) Perform the inspection of the works, including Test on Completion, and to issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the contract;
- 23) Supervise commissioning and carry out tests during the commissioning, if applicable;
- 24) Provide periodic and/or continuous inspection services during defects liability period and if any defects are noted, instruct the Contractor to rectify;
- 25) Prepare as-build drawings for the parts of the works constructed in accordance with the design provided by the Employer. Check and certify as-built drawings for the parts of the works designed by the Contractor, if any; and
- 26) Prepare an operation and maintenance manual for the works constructed in the Project.

3. Expected Time Schedule

The total duration of consulting service shall be 99 months including 24 months of defects liability period. The expected implementation schedule is as shown the table below.

Procedure	Period
Conclusion of L/A	March 2015
Selection of Consultant	April 2015 - December 2015
Consulting Service (Engineering Service)	January 2016 - March 2024
Review of DPR	January 2016 – March 2016

Detail Design (including site survey, cost estimate, and	April 2016 – March 2017
preparation of P/Q and Tender Document)	
Pre-construction Service (Tender Assistance)	April 2017 – March 2018
Construction Supervision	April 2018 – March 2022
Selection of Contractor	April 2017 – March 2018
Land Acquisition	April 2015 - March 2016
Construction	April 2018 – March 2022
Defects Liability Period	April 2022 – March 2024
Consulting Service (Capacity Development)	January 2016 - March 2023

4. Staffing

(1) Required Input of Expertise

The Consultant shall assign following experts for conducting the consulting service.

	Design Phase (Design and	Construction Phase	Defects Liability	Total M/M
Professional (A)	Tendering)		Period	
1. Project Manager	21	44	2	67
2. Sewerage/Civil Engineer	17	16	0	33
3. Drainage Engineer	6	0	0	6
4. Sewage Treatment Plant Expert	10	5	2	17
5. Mechanical & Electrical Engineer	6	6	0	12
6. SCADA Engineer	5	3	0	8
7. Cost Estimate and Tender	14	1	0	15
Expert				
Total of Professional (A)	79	75	4	158
Professional (B)				
1. Co-Project Manager	23	43	2	68
2. Sewerage/Civil Engineer	22	43	0	65
3. Pipeline Engineer (1)	10	0	0	10
4. Pipeline Engineer (2)	10	0	0	10
5. Pipeline Engineer (3)	10	0	0	10
6. Drainage Engineer (1)	8	0	0	8
7. Drainage Engineer (2)	8	0	0	8
8. Sewage Treatment Process	7	7	0	14
Engineer				
9. Mechanical Engineer	7	7	0	14
10. Electrical Engineer	7	7	0	14
11. Topographic Surveyor	7	2	0	9
12. Quantity Surveyor (1)	15	44	0	59
13. Quantity Surveyor (2)	11	11	0	22
Total of Professional (B)	145	164	2	311

In addition to the above, the following local support staff shall be assigned:

- Office manager
- Secretary
- CAD operator
- Inspector
- Translator/Interpreter
- (2) Qualification and Tasks of the Key Team Members

The required qualification and task of the key team member is shown in the table below.

Professional (A)	
1. Project Manager	
Qualification	Must be a Sewerage and Drainage Engineer with bachelor degree in Civil Engineering and more than 20 years of overall experience of which about 5 years should be in similar projects as a Team Leader or Sub Leader
Tasks	 Manage overall engineering service Assist RMC in selection of contractors Assist RMC in coordination with concerned authorities for project implementation Assist RMC in commissioning and reception of the completed work Assist RMC in communication with and reporting to JICA Preparation and submission of reports regarding engineering service
2. Sewerage/Civil Engin	eer
Qualification	Must be a Sewerage and Civil Engineer with bachelor degree in Civil Engineering and more than 15 years of overall experience of which about 5 years should be in similar projects as sewerage/civil engineer
Tasks	 Review of DPR Plan and implement supplemental topographic survey and geotechnical survey Prepare detail design and tender documents Assist RMC in selection of contractors Undertake construction supervision Attend commissioning test and preparation/compilation of O&M manual Preparation of progress reports regarding engineering service
3. Drainage Engineer	
Qualification	Must be a Drainage Engineer with bachelor degree in Civil Engineering and more than 8 years of overall experience of which about 2 years should be in similar projects as drainage/civil engineer
Tasks	 Review of DPR Plan and implement supplemental topographic survey and geotechnical survey Prepare detail design and tender document of drainage

4. Sewage Treatment Plant E Qualification Tasks	Must be a Sewage Treatment Plant Expert with bachelor degree in Civil Engineering and more than 10 years of overall experience of which about 5 years should be in similar projects as Sewage Treatment Plant Expert - Review of DPR
	degree in Civil Engineering and more than 10 years of overall experience of which about 5 years should be in similar projects as Sewage Treatment Plant Expert - Review of DPR
Tasks	- Review of DPR
	 Prepare detail design and tender document of sewerage treatment plant Undertake construction supervision Attend commissioning test and preparation/compilation of O&M manual Preparation of progress reports regarding engineering service
5. Mechanical & Electrical E	ngineer
Qualification	Must be a Mechanical & Electrical Engineer with bachelor degree in Mechanical/Electrical Engineering and more than 15 years of overall experience of which about 5 years should be in similar projects as Mechanical & Electrical Engineer
Tasks	 Review of DPR Prepare detail design and tender document of Mechanical & Electrical facility Undertake construction supervision Attend commissioning test and preparation/compilation of O&M manual Preparation of progress reports regarding engineering
6 SCADA Engineer	service
6. SCADA Engineer Qualification	Must be a SCADA Engineer with bachalor degree in
Quannearion	Must be a SCADA Engineer with bachelor degree in Mechanical/Electrical Engineering and more than 10 years of overall experience of which about 5 years should be in similar projects as SCADA Engineer
Tasks	 Review of DPR Prepare detail design and tender document of SCADA system Undertake construction supervision Attend commissioning test and preparation/compilation of O&M manual Preparation of progress reports regarding engineering service
7. Cost Estimate and Tender	Expert
Qualification	Must be a Cost Estimate and Tender Expert with bachelor degree in Civil Engineering and more than 10 years of overall experience of which about 5 years should be in similar projects as SCADA Engineer
Tasks	 Review of DPR Prepare cost estimate and tender documents Undertake construction supervision Preparation of progress reports regarding engineering service
Professional (B)	

1. Co-Project Manager	
Qualification	Must be a Sewerage and Drainage Engineer with bachelor degree in Civil Engineering and more than 15 years of overall experience of which about 5 years should be in similar projects as a Team Leader or Sub Leader
Tasks	 Assist Project Manager in overall engineering service Assist RMC in coordination with concerned authorities for project implementation Assist RMC in commissioning and reception of the completed work Preparation and submission of reports regarding engineering service
2. Sewerage/Civil Engine	er
Qualification	Must be a Sewerage and Civil Engineer with bachelor degree in Civil Engineering and more than 10 years of overall experience of which about 3 years should be in similar projects as sewerage/civil engineer
Tasks	- Assist Professional (A) Sewerage/Civil Engineer in overall engineering service
3. 4. 5. Pipeline Engineer	(1),(2),(3)
Qualification	Must be a Pipeline Engineer with bachelor degree in Civil Engineering and more than 5 years of overall experience of which about 2 years should be in similar projects as pipeline engineer
Tasks	- Assist Professional (A) Sewerage/Civil Engineer in preparation of detail design of sewer pipeline
6.7. Drainage Engineer (1), (2)
Qualification	Must be a Drainage Engineer with bachelor degree in Civil Engineering and more than 5 years of overall experience of which about 2 years should be in similar projects as drainage engineer
Tasks	- Assist Professional (A) Drainage Engineer in preparation of detail design of drainage facility
8. Sewage Treatment Pro	cess Engineer
Qualification	Must be a Sewage Treatment Process Engineer with bachelor degree in Civil Engineering and more than 5 years of overall experience of which about 2 years should be in similar projects as Sewage Treatment Process Engineer
Tasks	 Assist Professional (A) Sewage Treatment Plant Expert in overall engineering service Undertake construction supervision Attend commissioning test and preparation/compilation of O&M manual
9. Mechanical Engineer	
Qualification	Must be a Mechanical Engineer with bachelor degree in Mechanical Engineering and more than 5 years of overall experience of which about 2 years should be in similar projects as mechanical engineer
Tasks	- Assist Professional (A) Mechanical and Electrical Engineer in overall engineering service

10. Electrical Engineer	
Qualification	Must be a Electrical Engineer with bachelor degree in
	Electrical Engineering and more than 5 years of overall
	experience of which about 2 years should be in similar
	projects as mechanical engineer
Tasks	- Assist Professional (A) Mechanical and Electrical Engineer in overall engineering service
11. Topographic Surveyor	
Qualification	Must be a Topographic Surveyor with bachelor degree in
	Civil Engineering and more than 10 years of overall
	experience of which about 5 years should be in similar
	projects as Topographic Surveyor
Tasks	- Plan and implement supplemental topographic survey
12. 13. Quantity Surveyor (1), (2)
Qualification	Must be a Quantity Surveyor with bachelor degree in Civil
	Engineering and more than 8 years of overall experience of
	which about 5 years should be in similar projects as Quantity
	Surveyor
Tasks	- Assist Professional (A) Cost Estimate and Tender Expert in cost estimation
	- Assist Professional (A) Sewerage and Civil Engineer in
	construction supervision and preparation of progress report

5. Reporting

The Consultant shall prepare the following reports and documents and submit to RMC, in sufficient numbers depending on the type of reports, both in hard and soft copies.

- 1) Inception Report
- 2) Monthly Progress Report (Design Phase)
- 3) DPR Review Report
- 4) Detail Design Report
- 5) Construction Plan and Cost Estimate Report
- 5) Pre-Qualification Documents
- 6) Tender Documents
- 7) Tender Evaluation Report
- 8) Monthly Progress Report (Construction Phase)
- 9) Completion Report

6. Obligation of the Executing Agency

A certain range of arrangements and services will be provided by the Executing Agency to the Consultant for smooth implementation of the Consulting Services. In this context, the Executing Agency will:

- Make available to the Consultant existing reports and data related to the Project
- > Appoint counterpart officials, agent and representative as may be necessary for

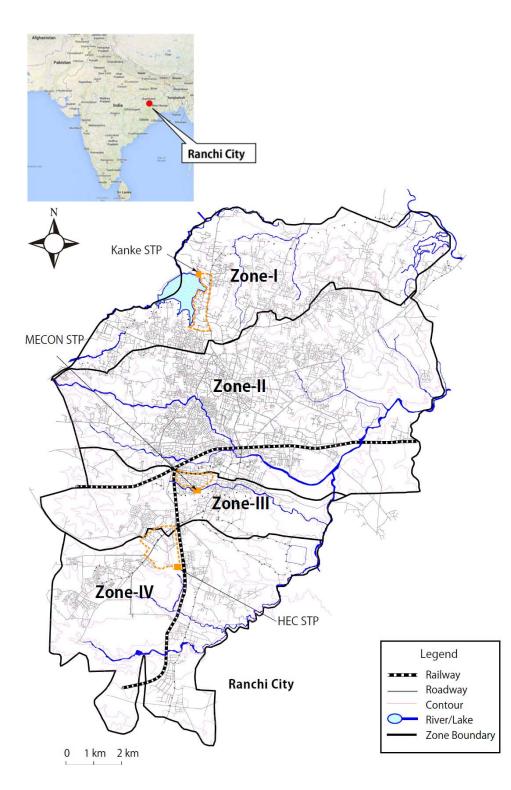
effective implementation of the Consulting Services;

- Use its best efforts to ensure that the assistance and exemption, as described in the Standard Request for Proposal issued by JICA, will be provided to the Consultant, in relation to
 - work permit and such other documents;
 - entry and exit visas, residence permits, exchange permits and such other documents
 - clearance through customs;
 - instructions and information to officials, agent and representatives of the Borrower's Government;
 - exemption from any requirement for registration to practice their profession;
 - privilege pursuant to the applicable law in the Borrower's Country.

Attachments

Attachment-1: Location MapAttachment-2: Proposed Project FacilityAttachment-3: Organization Chart of RMCAttachment-4: Implementation Schedule

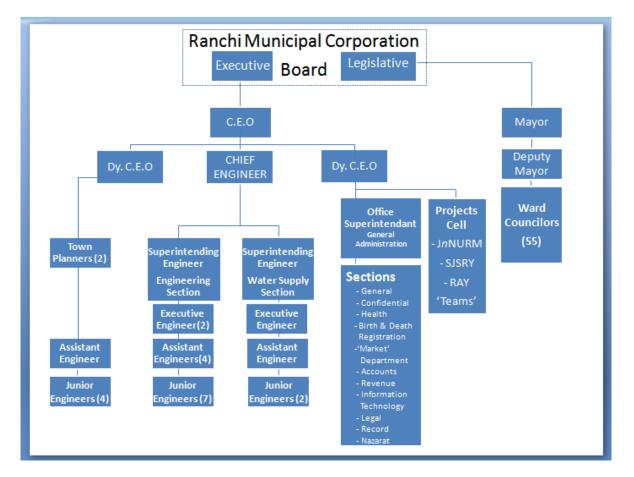
Attachment-1: Location Map



Attachment-2: Proposed Project Facility

A: Gravity Sewer		
A-1: Trunk	Polyethylene Pipe (Corrugate pipe)	
		D250 $L = 3,835 \text{ m}$, D300 $L = 3,525 \text{ m}$,
		, D450 $L = 1,080 \text{ m}$, D500 $L = 200 \text{ m}$,
		, D800 L= 1,750 m, D1000 L= 3,663 m
	RC Pipe	
		a, D1400 L= 243 m
A-2: Sub-trunk	River Crossing: 4 nos. Polyethylene Pipe (Corrugate pipe)	
and Collector		n, D250 L= $13,310$ m, D300 L = $12,638$ m,
and Lateral	D400 L = 10,534 m, $D600 L = 21,423 m$	
B: Pump Station and I		
Pump Station	Pump Station (Inlet gate, Sand trap, Screen,	Pump well, Control room): 6 nos.
· · · · · · · · ·		450 $L = 1,170 \text{ m}$ River crossing: 1 no.
	45 kW x 4 (3W +1S) Rising main DCI D	
	45 kW x 3 (2W +1S) Rising main DCI D	
		Pipe jacking tunnel (auger type) $L = 30 \text{ m}$
	55 kW x 4 (3W + 1S) Rising main DCI E	
	60 kW x 3 (2W + 1S) Rising main DCI E	
	$37kW \times 4 (3W + 1S)$ Rising main DCI E Manhole (Dia = 1.52 m, Average depth: 4.5	
Manhole Pump	1.5 kW x 2, Rising main DCI D150 L = $\frac{1}{2}$	
	11 kW x 2, Rising main DCI D150 L = $11 kW x 2$, Rising main DCI D150 L =	600 m River Crossing: 1 no.
	11 kW x 2, Rising main DCI D200 $L =$	
	7.5 kW x 2, Rising main DCI D150 $L =$	
	7.5 kW x 2, Rising main DCI D150 $L =$	630 m
	7.5 kW x 2, Rising main DCI D150 $L =$	
	2.2 kW x 2, Rising main DCI D150 $L =$	
~ ~ ~ ~	2.2 kW x 2, Rising main DCI D150 L =	7.5 m
C: Sewerage Treatmen		
	Design Conseiture 86 (100 m ² /dest	
Sewage Treatment	Design Capacity: 86,000 m3/day	
Plant	Treatment Method: Conventional Activated	Sludge Method
	Treatment Method: Conventional Activated Major Facility:	-
	Treatment Method: Conventional Activated	Sludge Method W = 1.2 m W = 1.2 m, $L = 15 m$
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen	W = 1.2 m W = 1.2 m, $L = 15 mW = 2 m$
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S)
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S) 120 kW x 2 (2W)
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S) 120 kW x 2 (2W) D = 23 m, H = 3.5 m 8 nos. 3.7 kW x 6(4W+2S)
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S) 120 kW x 2 (2W) D = 23 m, H = 3.5 m 8 nos. 3.7 kW x 6(4W+2S) W = 8 m, L = 70 m, H = 1.5 m, 8 nos.
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S) 120 kW x 2 (2W) D = 23 m, H = 3.5 m 8 nos. 3.7 kW x 6(4W+2S) W = 8 m, L = 70 m, H = 1.5 m, 8 nos. 160 m3/min x 220kW x 2 (1W+1S)
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S) 120 kW x 2 (2W) D = 23 m, H = 3.5 m 8 nos. 3.7 kW x 6(4W+2S) W = 8 m, L = 70 m, H = 1.5 m, 8 nos. 160 m3/min x 220kW x 2 (1W+1S) 80 m3/min x 140kW x 2 (2W)
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S) 120 kW x 2 (2W) D = 23 m, H = 3.5 m 8 nos. 3.7 kW x 6(4W+2S) W = 8 m, L = 70 m, H = 1.5 m, 8 nos. 160 m3/min x 220kW x 2 (1W+1S) 80 m3/min x 140kW x 2 (2W) D = 25 m, H = 3.5 m 8 nos. 15kW x 16 (12W+4S) W = 2.0 m, L = 140 m, H = 2 m, 4 nos. D1200
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity)	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$ $D1200$ $D = 12 m, H = 4.0 m 4 nos.$
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe	W = 1.2 m W = 1.2 m, L = 15 m W = 2 m 250 kW x 2 (1W+1S) 120 kW x 2 (2W) D = 23 m, H = 3.5 m 8 nos. 3.7 kW x 6(4W+2S) W = 8 m, L = 70 m, H = 1.5 m, 8 nos. 160 m3/min x 220kW x 2 (1W+1S) 80 m3/min x 140kW x 2 (2W) D = 25 m, H = 3.5 m 8 nos. 15kW x 16 (12W+4S) W = 2.0 m, L = 140 m, H = 2 m, 4 nos. D1200
	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$ $D1200$ $D = 12 m, H = 4.0 m 4 nos.$ $66 kW x 4 (3W+1S)$ $33 kV x 2,500 kVA x 2 (1W+1S)$ $6.6 kV x 1,875 kVA$
Plant	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$ $D1200$ $D = 12 m, H = 4.0 m 4 nos.$ $66 kW x 4 (3W+1S)$ $33 kV x 2,500 kVA x 2 (1W+1S)$ $6.6 kV x 1,875 kVA$ $SCADA System$
Plant Land Development	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$ $D1200$ $D = 12 m, H = 4.0 m 4 nos.$ $66 kW x 4 (3W+1S)$ $33 kV x 2,500 kVA x 2 (1W+1S)$ $6.6 kV x 1,875 kVA$ $SCADA System$ II, access road and internal road
Plant Land Development Outlet Facilities	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal Outlet Pipe D1400 L = 100 m x 2, Outfa	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$ $D1200$ $D = 12 m, H = 4.0 m 4 nos.$ $66 kW x 4 (3W+1S)$ $33 kV x 2,500 kVA x 2 (1W+1S)$ $6.6 kV x 1,875 kVA$ $SCADA System$ Il, access road and internal road Il Structure
Plant Plant Land Development Outlet Facilities D: House Connection	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$ $D1200$ $D = 12 m, H = 4.0 m 4 nos.$ $66 kW x 4 (3W+1S)$ $33 kV x 2,500 kVA x 2 (1W+1S)$ $6.6 kV x 1,875 kVA$ $SCADA System$ Il, access road and internal road Il Structure
Plant Land Development Outlet Facilities	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal Outlet Pipe D1400 L = 100 m x 2, Outfa Inspection chamber and PVC pipe D160 I	$W = 1.2 \text{ m}$ $W = 1.2 \text{ m}, L = 15 \text{ m}$ $W = 2 \text{ m}$ $250 \text{ kW x 2 (1W+1S)}$ 120 kW x 2 (2W) $D = 23 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $3.7 \text{ kW x 6(4W+2S)}$ $W = 8 \text{ m}, L = 70 \text{ m}, H = 1.5 \text{ m}, 8 \text{ nos.}$ $160 \text{ m3/min x 220 \text{ kW x 2 (1W+1S)}}$ $80 \text{ m3/min x 140 \text{ kW x 2 (2W)}}$ $D = 25 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $15 \text{ kW x 16 (12W+4S)}$ $W = 2.0 \text{ m}, L = 140 \text{ m}, H = 2 \text{ m}, 4 \text{ nos.}$ $D1200$ $D = 12 \text{ m}, H = 4.0 \text{ m 4 nos.}$ $66 \text{ kW x 4 (3W+1S)}$ $33 \text{ kV x 2,500 \text{ kVA x 2 (1W+1S)}}$ $6.6 \text{ kV x 1,875 \text{ kVA}}$ $SCADA \text{ System}$ $II, access road and internal road$ $II \text{ Structure}$ $L = 10 \text{ m } 28,666 \text{ nos.}$
Plant Plant Land Development Outlet Facilities D: House Connection	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal Outlet Pipe D1400 L = 100 m x 2, Outfa Inspection chamber and PVC pipe D160 I	$W = 1.2 \text{ m}$ $W = 1.2 \text{ m}, L = 15 \text{ m}$ $W = 2 \text{ m}$ $250 \text{ kW x 2 (1W+1S)}$ 120 kW x 2 (2W) $D = 23 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $3.7 \text{ kW x 6(4W+2S)}$ $W = 8 \text{ m}, L = 70 \text{ m}, H = 1.5 \text{ m}, 8 \text{ nos.}$ $160 \text{ m3/min x 220 \text{ kW x 2 (1W+1S)}}$ $80 \text{ m3/min x 140 \text{ kW x 2 (2W)}}$ $D = 25 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $15 \text{ kW x 16 (12W+4S)}$ $W = 2.0 \text{ m}, L = 140 \text{ m}, H = 2 \text{ m}, 4 \text{ nos.}$ $D1200$ $D = 12 \text{ m}, H = 4.0 \text{ m 4 nos.}$ $66 \text{ kW x 4 (3W+1S)}$ $33 \text{ kV x 2,500 \text{ kVA x 2 (1W+1S)}}$ $6.6 \text{ kV x 1,875 \text{ kVA}}$ $SCADA \text{ System}$ $II, access road and internal road$ $II \text{ Structure}$ $L = 10 \text{ m } 28,666 \text{ nos.}$
Plant Plant Land Development Outlet Facilities D: House Connection E: Drainage Facility	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal Outlet Pipe D1400 L = 100 m x 2, Outfa Inspection chamber and PVC pipe D160 I	W = 1.2 m $W = 1.2 m, L = 15 m$ $W = 2 m$ $250 kW x 2 (1W+1S)$ $120 kW x 2 (2W)$ $D = 23 m, H = 3.5 m 8 nos.$ $3.7 kW x 6(4W+2S)$ $W = 8 m, L = 70 m, H = 1.5 m, 8 nos.$ $160 m3/min x 220kW x 2 (1W+1S)$ $80 m3/min x 140kW x 2 (2W)$ $D = 25 m, H = 3.5 m 8 nos.$ $15kW x 16 (12W+4S)$ $W = 2.0 m, L = 140 m, H = 2 m, 4 nos.$ $D1200$ $D = 12 m, H = 4.0 m 4 nos.$ $66 kW x 4 (3W+1S)$ $33 kV x 2,500 kVA x 2 (1W+1S)$ $6.6 kV x 1,875 kVA$ $SCADA System$ II, access road and internal road II Structure L = 10 m $28,666 nos.$ $D0, W500 x H700 W600 x H750$
Plant Plant Land Development Outlet Facilities D: House Connection E: Drainage Facility RCC Precast Drain	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal Outlet Pipe D1400 L = 100 m x 2, Outfa Inspection chamber and PVC pipe D160 I W300 x H200, W350 x H400, W450 x H50 Total Length: 504.1 km W300 x H200, W350 x H400, W450 x H55 Total Length: 7.8 km RC Pipe D	$W = 1.2 \text{ m}$ $W = 1.2 \text{ m}, L = 15 \text{ m}$ $W = 2 \text{ m}$ $250 \text{ kW x 2 (1W+1S)}$ 120 kW x 2 (2W) $D = 23 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $3.7 \text{ kW x 6(4W+2S)}$ $W = 8 \text{ m}, L = 70 \text{ m}, H = 1.5 \text{ m}, 8 \text{ nos.}$ $160 \text{ m3/min x 220 \text{ kW x 2 (1W+1S)}}$ $80 \text{ m3/min x 140 \text{ kW x 2 (2W)}}$ $D = 25 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $15 \text{ kW x 16 (12W+4S)}$ $W = 2.0 \text{ m}, L = 140 \text{ m}, H = 2 \text{ m}, 4 \text{ nos.}$ $D1200$ $D = 12 \text{ m}, H = 4.0 \text{ m 4 nos.}$ $66 \text{ kW x 4 (3W+1S)}$ $33 \text{ kV x 2,500 \text{ kVA x 2 (1W+1S)}}$ $6.6 \text{ kV x 1,875 \text{ kVA}}$ $SCADA System$ $II, access road and internal road$ $II Structure$ $L = 10 \text{ m } 28,666 \text{ nos.}$ $D0, W500 \text{ x H700 W600 \text{ x H750}}$ $D0, W500 \text{ x H700 W600 \text{ x H750}}$
Plant Plant Land Development Outlet Facilities D: House Connection E: Drainage Facility RCC Precast Drain Box Culvert and	Treatment Method: Conventional Activated Major Facility: Coarse Screen Grit Chamber Fine Screen Lift Pump Primary Sedimentation Tank Primary Sludge Pump Aeration Tank Blower Secondary Sedimentation Tank Secondary Sludge Pump Chlorination Tank Discharge Pipe Sludge Thickener (Gravity) Sludge Dewatering Facility Electric Substation Power Generation Unit Control Room land grading, drainage works, boundary wal Outlet Pipe D1400 L = 100 m x 2, Outfa Inspection chamber and PVC pipe D160 I W300 x H200, W350 x H400, W450 x H50 Total Length: 504.1 km W300 x H200, W350 x H400, W450 x H55 Total Length: 7.8 km RC Pipe D	$W = 1.2 \text{ m}$ $W = 1.2 \text{ m}, L = 15 \text{ m}$ $W = 2 \text{ m}$ $250 \text{ kW x 2 (1W+1S)}$ 120 kW x 2 (2W) $D = 23 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $3.7 \text{ kW x 6(4W+2S)}$ $W = 8 \text{ m}, L = 70 \text{ m}, H = 1.5 \text{ m}, 8 \text{ nos.}$ $160 \text{ m3/min x 220 \text{ kW x 2 (1W+1S)}}$ $80 \text{ m3/min x 140 \text{ kW x 2 (2W)}}$ $D = 25 \text{ m}, H = 3.5 \text{ m 8 nos.}$ $15 \text{ kW x 16 (12W+4S)}$ $W = 2.0 \text{ m}, L = 140 \text{ m}, H = 2 \text{ m}, 4 \text{ nos.}$ $D1200$ $D = 12 \text{ m}, H = 4.0 \text{ m 4 nos.}$ $66 \text{ kW x 4 (3W+1S)}$ $33 \text{ kV x 2,500 \text{ kVA x 2 (1W+1S)}}$ $6.6 \text{ kV x 1,875 \text{ kVA}}$ $SCADA \text{ System}$ $II, \text{ access road and internal road}$ $II \text{ Structure}$ $L = 10 \text{ m } 28,666 \text{ nos.}$ $D0, W500 \text{ x H700 W600 \text{ x H750}}$ $D0, W500 \text{ x H700 W600 \text{ x H750}}$

Attachment-3: Organization Chart of RMC



Attachment-4: Implementation Schedule

Procedure	Period										
	i chida	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Conclusion of L/A		Δ									
Selection of Consultant	9 months										
Consulting Service (Engineering Service)	99 months										
Review of DPR	3 months										
Detail Design	15 months										
Tender Assistance	12 months										
Construction Supervision	72 months										
Selection of Contractor	12 months										
Land Acquisition	12 months										
Construction	48 months										
Defects Liability Period of STP	24 month										
Consulting Service (Capacity Development)	87 months										

Appendix B6.2: Draft TOR of Capacity Development Consultant

Terms of Reference for Capacity Development Consultant under Ranch Sewerage Project

1. Background of the Project

(1) Background

Ranchi City, the capital city of Jharkhand State, is located in the eastern part of India and has a population of 1,100,000, as of 2011. Ranchi City has not yet been provided with a public sewerage system consisting of sewerage pipe reticulation and sewage treatment plant, except for U-drains provided along the streets that are being used for discharging both rainwater and wastewater into downstream rivers.

With an increase in population of Ranchi City, water consumption has been increasing along with the provision of new water supply facilities, resulting in the increase in generation of sewage water being discharged into the streams and rivers. Thus, the pollution load in rivers has increased, bringing about environmental deterioration as well as health damages to the residents. Therefore, the establishment of a public sewerage system is urgently required.

In 2005, RMC entrusted the preparation of DPR of a sewerage and drainage project to Meinhardt. The DPR was prepared from 2006 to 2007. The project area of DPR covers the entire RMC jurisdictional area of 175 km2, consisting of four zones (Zone-I to Zone IV: refer to Attachment-1). RMC submitted the DPR to CPHEEO for application to the JNNURM scheme in 2012. Subsequent to the observation by CPHEEO in February 2013, the DPR was revised by RMC in August 2013.

In parallel with the above, the Central Government of India requested Japan International Corporation Agency (JICA) for implementation of the Project in June 2013. As a result of the discussion between the Indian Government and JICA, it was decided that Zone-I was to be implemented under JNNURM scheme, while Zone-II, III & IV were the candidate area of the JICA fund project.

As a result of the project preparation study "Preparatory Survey on Ranchi Sewerage Project" conducted by JICA in 2014, it was decided that Zone-II area was the target area of the JICA fund project (the Project) and the revised DPR for Zone-II was prepared in September 2014 and approved by CPHEEO in October 2014.

(2) Project Objective

The objective of the Project is to establish proper and stable sewerage service in Ranch city through provision of sewerage and drainage facilities and enhancement of capacity of RMC

in sewerage service, thereby contributing to improvement of the living environment of the residents of Ranch city including poverty group.

(3) Project Area and Target Population

As mentioned above the project area is the Zone-II (70.8km2) which is located in the central part of the city and has the largest population and highest population density as of 2011 census. The population of Zone-II is 592,304 in 2011 and projected to be 949,869 in 2046.

(4) Project Scope

The project scope consists of 1) Facility Construction and 2) Capacity Development of RMC.

- 1) Facility Construction
- Construction of sewerage and drainage facility
- Provision of public toilet
- Provision of septic tank where the sewerage facility is not constructed
- 2) Capacity Development of RMC

In addition to the above facility construction, the capacity development service is to be provided to RMC. The capacity development is to assist RMC for implementation of the "Organization Strengthening Action Plan" (Action Plan) proposed in above-mentioned "Preparatory Survey on Ranchi Sewerage Project".

2. The Consulting Service

2.1 Objective of the Consulting Service

The consulting services shall be provided by an international consulting firm (the Consultant) selected in compliance with Guidelines for the Employment of Consultants under Japanese ODA Loans, April 2012. As mentioned above, the project scope consists of 1) Facility Construction and 2) Capacity Development of RMC. Accordingly, two consulting services, i.e. 1) Engineering Service and 2) Capacity Development, will be provided by two separate consultants. This TOR is for procurement of the Capacity Development Consultant.

The objective of the capacity development is to assist RMC in implementation of the "Organization Strengthening Action Plan" (the Action Plan) proposed in the "Preparatory Survey on Ranchi Sewerage Project". The action plan is designed so that the reliable and sustainable water supply and sewerage service are provided in Ranchi city by establishing the water supply and sewerage wing (WSSW) of Ranchi and enhance its capacity. Furthermore, it is expected by these improvements, the project effect and benefit of Ranch Sewerage Project (the Project) will be brought out in a maximum extent. The present organization chart of RMC is shown in Attachment-2.

2.2 Scope of the Consulting Service

The consultant shall assist and coordinate with RMC in implementation of the Action Plan consisting of the following activities:

- 1) Setting of Policy, Rules and Regulations
- 2) Establishment of WSSW
- 3) Establish administration system of WSSW
- 4) Development of a Business Plan
- 5) Improvement of Financial Management Systems
- 6) Water and Sanitation Tariff Setting and Revenue Collection
- 7) Management Information System
- 8) Asset Management System
- 9) Customer Service
- 10) Outsourcing

The task of each activity is described in the table below.

Tasks of the Proposed Organization Strengthening Action Plan

1. Setting of Policy, Rules and Regulations

- 1.1 Establish Regulation and Fund allocation
 - Development of institutional re-organization plan and phase-wise road map for its implementation
 - Costing (costs and cost-saving implications) of institutional development plan
 - Projection of funds to be mobilized on rolling plan basis
 - Identify structure, powers and resources needed to create sustainable and effective fund.
 - 1.2 Establish accountability mechanisms
 - Establish a sound accounting practice and systems to manage available resources

2. Establishment of WSSW

- 2.1 Institutional and organizational set up WSSW
 - Review of institutional options for creating functional autonomy in city-level RMC's WSSW operations.
 - Assist RMC in Independent operations Creation of Water Supply and Sewerage Wing (WSSW)
- 2.2 Transfer of authority, functions and assets from DWSD
- Development of phase-wise road map for its implementation

3. Establish administration system of WSSW

- 3.1 Establish Project Steering Committee and PIU
 - Help in establishing
 - / Project Steering Committee
 - / Project Implementation Unit (PIU)
 - Assist in preparation of bidding documents compliant with latest standard bidding documents
 - Design qualification criteria which is compliant with donor guidelines.
 - Assist PIU staff in developing contract packaging and procurement time schedules for each contract package
- 3.2 Formulate Administration system incl. decision making
 - Analysis of administrative and structural constraints to functional autonomy such as existing rules and regulations and staffing structure
 - Mapping of staff resources, skills and expertise
 - Define roles and responsibilities for each position
 - Suggest methods / programmes for organizational development
 - Design an incentive system for staff

- Prepare HRM and HRD plan taking into account futuristic trends and likely technological developments
- Identify weaknesses in official documentation, procedures and ways to modernize, upgrade and improve it
- Review and prepare official procedures with emphasis on essential and critical documentation work of department at various levels
- 3.3 Develop 'job description' for every position of WSSW
 - Study existing structure and its design for specifically defined various staff responsibilities
 - Assessment of current professional competence of staff at various levels
 - Identification of an integrated core techno-management skills and required knowledge spectrum at various structural layers of organization
- 3.4 Establish Performance Management System for WSSW staff
 - Develop monitoring and evaluation indicator and criteria to assess performance at various levels
 - Establish Performance Management System for WSSW staff
- 3.5 Implement recruitment at various positions
- 3.6 Develop and conduct Training Plan for WSSW staff
 - Carry out Training Needs Assessment (TNA)
 - Prepare course / training curriculum and syllabus
 - Develop, facilitate, execute and implementation of rolling staff training programme covering all categories of staff
 - Identification of skill and operational requirement of field staff with priorities for phased training programmes and challenges linked
 - Identification of training needs and preparation of training plan, including technical, accounting and management training
 - Identification of training requirements for usage of IT applications and infrastructure implemented
 - Evaluation and mid-course assessment of imparted training to apply corrections.
 - Arranging/ contracting of training institutes, trainers, training modules
 - Plan and organize regular training events, including workshops and seminars for sharing lessons learnt

4. Development of a Business Plan

- 4.1 Long term Plan
 - Assist RMC in Development of a Business Plan
 - / Assessment of present water supply operations
 - / Planning Framework
 - / Implementation and Handholding Support
 - Study and update water demand projection and wastewater discharge for various end-user groups
- 4.2 Medium-term plan: five-year plan
 - Prepare financial projections for operations 10 years after project completion;
- 4.3 Annual plan
 - Train staff in the preparation of annual budget estimates and disbursement plans;

5. Improvement of Financial Management Systems

- 5.1 Review of existing financial /accounting system
 - Study existing financial state / scenario w.r.to :-
 - / Last five year spending.
 - / Authority, delegation, financial powers and procurements.
 - / Financial resources to meet present and futuristic targets.
 - / Financial mechanisms, accountability system and regulatory controls.
 - Study budgeting allocation of previous years for its financial analysis linked with business planning.
 - Assess existing methodology and mechanism for financial reforms in accordance with State /Center rules and regulations.
 - Assessment of professional experience and skill of concerned staff in financial aspects.
- 5.2 Develop financial management system
 - Develop financial management system (in relation to asset management system, establishment, operational costs, revenue collection etc.)
 - Assist in capacity building of staff for the improved financial management systems (Double Entry Accounting System)

- Strengthening, restructuring and capacity building of RMC, for its assessment and integration with present and proposed financial outlook.
- Develop budgetary control processes, design budget procedures and budget formats;
- Develop mechanisms for the transfer of funds
- Review the financial management system of agencies involved in the program and make recommendations for optimal integration.
- Direct & advise on the establishment of an efficient billing & collection system.
- 5.3 Trainig for preparation of financial statements

6. Water and Sanitation Tariff Setting and Revenue Collection

- 6.1 Door to door survey on present connection and payment
 - Facilitate and assist PIU in carrying out door-to-door survey to collect data and prepare report on -
 - / Status of installed water meters
 - / Illegal and unauthorized connections
 - / Other water connections (non-revenue generating)
 - / Present revenue system (meter reading, billing, revenue collection...etc.)
 - Train staff in data collection; oversee the collection of data for baseline & completion surveys and prepare reports accordingly.
 - Assist the PIU with the invitation and selection of NGOs to be involved in the surveys
- 6.2 Establish tariff 'Rules and Regulations'
- 6.3 Carry out campaign against defaulters and illegal connections
 - Prepare Awareness campaign on the need for and application of user charges for improved urban services,
 - Prepare Information, Education and Communication (IEC) materials and media campaigns, advertisement clippings, Web pages, etc
- 6.4 Installation of water meters
 - Build stakeholders' awareness on the long-term benefits and short-term inconvenience in order to gain full support of the beneficiaries.
- 6.5 Campaigns for mandatory water supply and sewerage connection
 - Provide continuous guidance on suitable mechanisms for participatory interaction with and training of local government and CBOs;
- 6.6 Develop and implement an improved revenue collection plan
 - Prepare annual reports on performance and impact of community participation and development activities.
- 6.7 Prepare and execute tariff revisions for financial sustainability
 - Assist RMC with water and sanitation tariff setting and revenue collection reforms
 - Support for preparation of rules and regulations for periodic review of tariff, as may be required
 - Preparation of water tariff determination manual with tariff norms and principles.
 - Review cost recovery policies and tariff levels including:
 - / Cost-recovery mechanisms (including necessary institutional arrangements) through taxes, user charges and/or other techniques

/ Tariff structure taking into account affordability, willingness to pay, water conservation,

cross-subsidization, and full cost-recovery requirements

7. Management Information System

- 7.1 Study the current information management/monitoring practices
 - Assess the quality and completeness of data gathered and its use by all MIS implementers, communities and management;
 - Study existing Data Base management and Information system of RMC.
- 7.2 Design Information System for water supply and sewerage works
 - Design MIS for water supply and sewerage works
 - Assess and propose MIS procedures, indicators, and reports;
 - Draft a conceptual design of the MIS program
 - Establish an Performance Monitoring System
 - Prepare a framework for continuous monitoring and feedback mechanism
- 7.3 Develop, install and implement the Information System
 - Develop, install and pilot test the MIS operations
 - After MIS conceptual design is implemented, make periodic visits to all stakeholders to discuss

MIS procedures

- Mobilize local NGOs and community organizations in carrying out monitoring, quality control and reporting to bring transparency.
- Prepare manual for MIS operations

8. Asset Management System

- 8.1 Preparation of asset inventory of the existing facilities
 - Implement data collection / monitoring system of water supply and sewerage network and at WTP/STP facilities
 - Preparation of the details of assets of the existing water supply and sewerage facilities and clarification of ownership and asset evaluation
- 8.2 Establish and operationalize GIS database of facilities
 - Establish and operationalize GIS database of water supply and sewerage facilities
 - Develop & prepare comprehensive and efficient IT support system for infrastructure planning & management
 - Interpretation of available satellite imagery for use and establish coordination with Satellite and Imagery Department of DRDO / Private sector
 - Develop IT based mapping of network and associated Data Base
 - Assist RMC with GIS technology to identify and work out effective land use
 - Introduce methodologies and advise training of staff on technology and use of GIS and its applications
- 8.3 Establish and implement data collection / update system
 - Study and assess available resources to collect/update information related with assets evaluation / management
 - Assess adequacy of funds for objectively determined 'Asset Management'
- 8.4 Establishment of asset management operation

9. Customer Services

- 9.1 Study on existing public relations and complaint handling system
 - Study and evaluate the existing public relations and complaint handling system
 - Implement the improved public relations strategy and 'complaint handling system'
- 9.2 Prepare water supply and sewerage service contract document
 - Develop and implement specific measures to ensure participation of vulnerable groups, including women and the poor.
 - Prepare water supply and sewerage service contract document
- 9.3 Prepare and implement complaint handling system
 - Design a complaint handling system using MIS
 - Invite feedback from beneficiaries and advise RMC of how these might influence the future
 - Prepare complaint handling system manual

10. Outsourcing

- 10.1 Study on possibilities of outsourcing specific functions
- 10.2 Develop and approve an outsourcing plan
- 10.3 Implement the outsourcing

It should be noted that JICA is dispatching the experts to assist RMC in implementation of the Action Plan. The output of the activity by the JICA experts shall be handed over to the Consultant. The Consultant shall commence the service on the basis of the output from the activities of the JICA experts. The task matrix of the JICA expert and capacity development consultant is shown in Attachment-3.

3. Expected Time Schedule

The total duration of consulting service shall be 87 months. The expected implementation schedule is as shown in the table below.

Procedure	Period
Conclusion of L/A	March 2015
Selection of Consultant	April 2015 - December 2015
Consulting Service (Capacity Development)	January 2016 - March 2023

4. Staffing

(1) Required Input of Expertise

The Consultant shall assign following experts for conducting the consulting service.

	Total M/M
Professional (A)	
1. Team Leader / Institutional Development and Organizational	19
Strengthening Specialist	
2. Human Resources Management and Training Specialist	18
3. Municipal Water Tariff / Finance Specialist	18
4. Management Information System Specialist	14
5. GIS Specialist	7
6. Information, Education and Communication Specialist	7
Total of Professional (A)	83
Professional (B)	
1. Co-team Leader/Organizational Strengthening Specialist	81
2. MIS Database and Network Specialist	55
3. GIS Coordinator	55
4. Customer Service Specialist	55
Total of Professional (B)	246

The indicative work and assignment schedule is shown in Attachement-4 for guidance purpose only.

In addition to the above, the following local support staff shall be assigned:

- Office manager
- Secretary

(2) Qualification and Tasks of the Key Team Members

The required qualification and task of the key team member is shown in the table below.

Professional (A)	
	Institutional Development and Organizational Strengthening Specialist
Qualification	Must be a Institutional Development and Organizational Strengthening Specialist
	with bachelor degree in the related field and more than 20 years of overall
	experience of which about 5 years should be in similar projects as a Team Leader
	or Sub Leader
Tasks	- Manage overall consulting service
	- Undertake following tasks in corporation with other experts:
	1 Setting of Policy, Rules and Regulations
	1.1 Establish Regulation and Fund allocation
	1.2 Establish accountability mechanisms
	2 Establishment of WSSW
	2.1 Institutional and organizational set up WSSW
	2.2 Transfer of authority, functions and assets from DWSD
	3 Establish administration system of WSSW
	3.2 Formulate Administration system incl. decision making
	3.3 Develop 'job description' for every position of WSSW
	3.4 Establish Performance Management System for WSSW staff
	3.5 Implement recruitment at various positions
	3.6 Develop and conduct Training Plan for WSSW staff
	4 Development of a Business Plan
	4.1 Long term Plan
	4.2 Medium-term plan: five-year plan
	4.3 Annual plan
	6 Water and Sanitation Tariff Setting and Revenue Collection
	6.1 Door to door survey on present connection and payment
	6.2 Establish tariff 'Rules and Regulations'
	6.6 Develop and implement an improved revenue collection plan
	6.7 Prepare and execute tariff revisions for financial sustainability
	9 Customer Services
	9.2 Prepare water supply and sewerage service contract document
	10 Outsourcing
	10.1 Study on possibilities of outsourcing specific functions
	10.2 Develop and approve an outsourcing plan
	10.3 Implement the outsourcing
	The detail of each task is as described in "2.2 Scope of the Consulting Service".
2. Human Resour	ces Management and Training Specialist
Qualification	Must be a Human Resources Management and Training Specialist with bachelor
	degree in the related field and more than 15 years of overall experience of which
	about 5 years should be in similar projects as a Human Resources Management
	and Training Specialist

Tasks	- Undertake following tasks in corporation with other experts:
	2 Establishment of WSSW
	2.1 Institutional and organizational set up WSSW
	3 Establish administration system of WSSW
	3.2 Formulate Administration system incl. decision making
	3.3 Develop 'job description' for every position of WSSW
	3.4 Establish Performance Management System for WSSW staff
	3.5 Implement recruitment at various positions
	3.6 Develop and conduct Training Plan for WSSW staff
	5 Improvement of Financial Management Systems
	5.1 Review of existing financial /accounting system
	5.2 Develop financial management system
	5.3 Trainig of preparation of financial statements
	7 Management Information System
	7.1 Study the current information management/monitoring practices
	7.2 Design Information System for water supply and sewerage works
	7.3 Develop, install and implement the Information System
	9 Customer Services
	9.1 Study on existing public relations and complaint handling system
	10 Outsourcing
	10.1 Study on possibilities of outsourcing specific functions
	10.2 Develop and approve an outsourcing plan
	10.3 Implement the outsourcing
	The detail of each task is as described in "2.2 Scope of the Consulting Service".
	The detail of each task is as described in 2.2 scope of the consulting service .
3. Municipal Wa	ater Tariff / Finance Specialist
Qualification	Must be a Municipal Water Tariff / Finance Specialist with bachelor degree in the
-	related field and more than 10 years of overall experience of which about 5 years
	should be in similar projects as a Municipal Water Tariff / Finance Specialist
Tasks	- Undertake following tasks in corporation with other experts:
1 45K5	
	1 Setting of Policy, Rules and Regulations
	1.1 Establish Regulation and Fund allocation
	1.2 Establish accountability mechanisms
	2 Establishment of WSSW
	2.1 Institutional and organizational set up WSSW
	2.2 Transfer of authority, functions and assets from DWSD
	3 Establish administration system of WSSW
	3.2 Formulate Administration system incl. decision making
	3.3 Develop 'job description' for every position of WSSW
	3.4 Establish Performance Management System for WSSW staff3.5 Implement recruitment at various positions
	3.6 Develop and conduct Training Plan for WSSW staff
	4 Development of a Business Plan
	4.1 Long term Plan
	4.2 Medium-term plan: five-year plan
	4.3 Annual plan
	5 Improvement of Financial Management Systems
	5.1 Review of existing financial /accounting system
	5.2 Develop financial management system
	5.3 Trainig of preparation of financial statements
	6 Water and Sanitation Tariff Setting and Revenue Collection
	6.7 Prepare and execute tariff revisions for financial sustainability
	7 Management Information System
	7.1 Study the current information management/monitoring practices
	7.2 Design Information System for water supply and sewerage works

	<u> </u>
	7.3 Develop, install and implement the Information System
	8 Asset Management System
	8.4 Establishment of asset management operation
	10 Outsourcing
	10.1 Study on possibilities of outsourcing specific functions
	10.2 Develop and approve an outsourcing plan
	10.3 Implement the outsourcing
	The detail of each task is as described in "2.2 Scope of the Consulting Service".
4. Management I	Information System Specialist
Qualification	Must be a Management Information System Specialist with bachelor degree in the
C	related field and more than 10 years of overall experience of which about 3 years
	should be in similar projects as s a Management Information System Specialist
Tasks	- Undertake following tasks in corporation with other experts:
	3 Establish administration system of WSSW
	3.6 Develop and conduct Training Plan for WSSW staff
	5 Improvement of Financial Management Systems
	5.1 Review of existing financial /accounting system
	5.2 Develop financial management system
	5.3 Training of preparation of financial statements
	6 Water and Sanitation Tariff Setting and Revenue Collection
	6.1 Door to door survey on present connection and payment
	6.4 Installation of water meters
	6.6 Develop and implement an improved revenue collection plan
	7 Management Information System
	7.1 Study the current information management/monitoring practices
	7.2 Design Information System for water supply and sewerage works
	7.3 Develop, install and implement the Information System
	8 Asset Management System
	8.1 Preparation of asset inventory of the existing facilities
	8.2 Establish and operationalize GIS database of facilities
	8.3 Establish and implement data collection / update system
	8.4 Establishment of asset management operation
	9 Customer Services
	9.1 Study on existing public relations and complaint handling system
	9.2 Prepare water supply and sewerage service contract document
	9.3 Prepare and implement complaint handling system
	10 Outsourcing
	10.1 Study on possibilities of outsourcing specific functions
	10.2 Develop and approve an outsourcing plan
	10.3 Implement the outsourcing
	The detail of each task is as described in "2.2 Scope of the Consulting Service".
5. GIS Specialist	
Qualification	Must be a GIS Specialist with bachelor degree in the related field and more than 7
	years of overall experience of which about 2 years should be in similar projects as
	a GIS Specialist
Tasks	- Undertake following tasks in corporation with other experts:
LUDIO	
	3 Establish administration system of WSSW
	3.6 Develop and conduct Training Plan for WSSW staff
	6 Water and Sanitation Tariff Setting and Revenue Collection
	6.1 Door to door survey on present connection and payment
	6.4 Installation of water meters

	7 Management Information System
	7.1 Study the current information management/monitoring practices
	7.2 Design Information System for water supply and sewerage works
	7.3 Develop, install and implement the Information System
	8 Asset Management System
	8.1 Preparation of asset inventory of the existing facilities
	8.2 Establish and operationalize GIS database of facilities
	8.3 Establish and implement data collection / update system
	8.4 Establishment of asset management operation9 Customer Services
	9.1 Study on existing public relations and complaint handling system10 Outsourcing
	0
	10.1 Study on possibilities of outsourcing specific functions10.2 Develop and approve an outsourcing plan
	10.2 Develop and approve an outsourcing plan 10.3 Implement the outsourcing
	10.5 Implement the outsourcing
	The detail of each task is as described in "2.2 Scope of the Consulting Service".
6. Information,	Education and Communication Specialist
Qualification	Must be a IEC Specialist with bachelor degree in the related field and more than 7
	years of overall experience of which about 2 years should be in similar projects as
	a IEC Specialist
Tasks	- Undertake following tasks in corporation with other experts:
1 05K5	
	3 Establish administration system of WSSW
	3.6 Develop and conduct Training Plan for WSSW staff
	5 Improvement of Financial Management Systems
	5.3 Trainig of preparation of financial statements
	6 Water and Sanitation Tariff Setting and Revenue Collection
	6.1 Door to door survey on present connection and payment
	6.3 Carry out campaign against defaulters and illegal connections
	6.4 Installation of water meters
	6.5 Campaigns for mandatory water supply and sewerage connection
	6.6 Develop and implement an improved revenue collection plan
	7 Management Information System
	7.1 Study the current information management/monitoring practices
	7.2 Design Information System for water supply and sewerage works
	7.3 Develop, install and implement the Information System
	8 Asset Management System
	8.4 Establishment of asset management operation9 Customer Services
	9.1 Study on existing public relations and complaint handling system9.2 Prepare water supply and sewerage service contract document
	9.2 Prepare water supply and sewerage service contract document9.3 Prepare and implement complaint handling system
	7.5 Trepare and imprement compraint nandning system
	The detail of each task is as described in "2.2 Scope of the Consulting Service"
Professional (B)	
	er/Organizational Strengthening Specialist
Qualification	Must be a Organization Strengthening Specialist with bachelor degree in the
Zummention	
	related field and more than 15 years of overall experience of which about 3 years
	should be in similar projects as an Organization Strengthening Specialist
Tasks	- Assist Professional (A) Team Leader / Institutional Development and
	Organizational Strengthening Specialist in overall consulting service
	- Assist Professional (A) Human Resources Management and Training
	Specialist in overall consulting service
	- Constantly liaise with RMC during overall period of consulting service

2. MIS Database and Network Specialist											
Qualification	Must be a MIS Database and Network Specialist with bachelor degree in the										
	related field and more than 5 years of overall experience of which about 2 years										
	should be in similar projects as a MIS Database and Network Specialist										
Tasks	Tasks - Assist Professional (A) Management Information System Specialist in overall consulting service										
3. GIS Coordina	tor										
Qualification	Must be a GIS Coordinator with bachelor degree in the related field and more than										
	5 years of overall experience of which about 2 years should be in similar projects										
	as a GIS cordinator										
Tasks	- Assist Professional (A) GIS Specialist in overall consulting service										
4. Customer Serv	vice Specialist										
Qualification	Must be a GIS Coordinator with bachelor degree in the related field and more than										
	5 years of overall experience of which about 2 years should be in similar projects										
	as a GIS cordinator										
Tasks	 Assist Professional (A) Municipal Water Tariff / Finance Specialist and IEC Specialist in overall consulting service 										

5. Reporting

The Consultant shall prepare the following reports and documents and submit to RMC, in sufficient numbers depending on the type of reports, both in hard and soft copies.

- 1) Inception Report
- 2) Bi-monthly Progress Report
- 3) Special Report as required
- 4) Annual Report
- 5) Completion Report

6. Obligation of the Executing Agency

A certain range of arrangements and services will be provided by the Executing Agency to the Consultant for smooth implementation of the Consulting Services. In this context, the Executing Agency will:

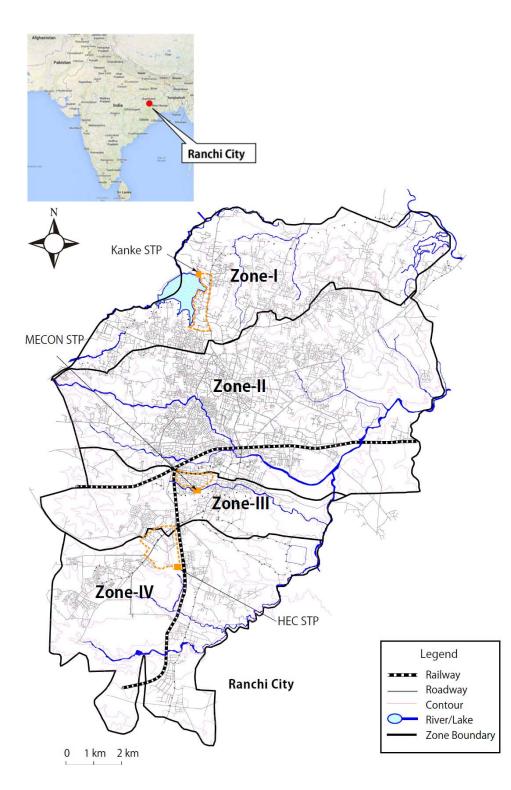
- Make available to the Consultant existing reports and data related to the Project
- Appoint counterpart officials, agent and representative as may be necessary for effective implementation of the Consulting Services;
- Use its best efforts to ensure that the assistance and exemption, as described in the Standard Request for Proposal issued by JICA, will be provided to the Consultant, in relation to
 - work permit and such other documents;
 - entry and exit visas, residence permits, exchange permits and such other documents
 - clearance through customs;

- instructions and information to officials, agent and representatives of the Borrower's Government;
- exemption from any requirement for registration to practice their profession;
- privilege pursuant to the applicable law in the Borrower's Country.

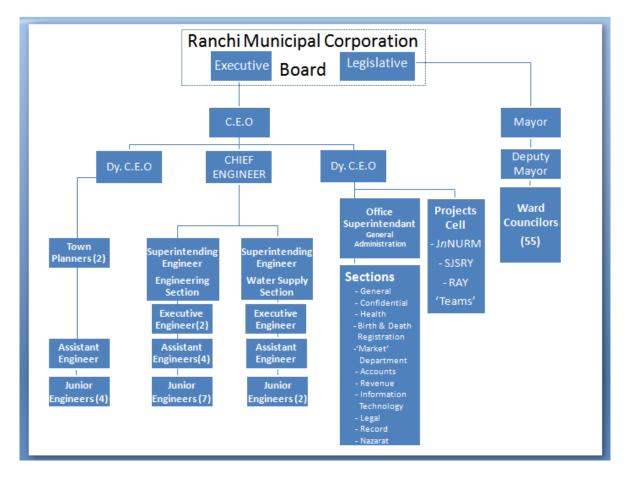
Attachments

Attachment-1:	Location Map
Attachment-2:	Organization Chart of RMC
Attachment-3:	Task matrix of the JICA expert and capacity development consultant
Attachment-4:	Indicative Work and Assignment Schedule

Attachment-1: Location Map



Attachment-2: Organization Chart of RMC

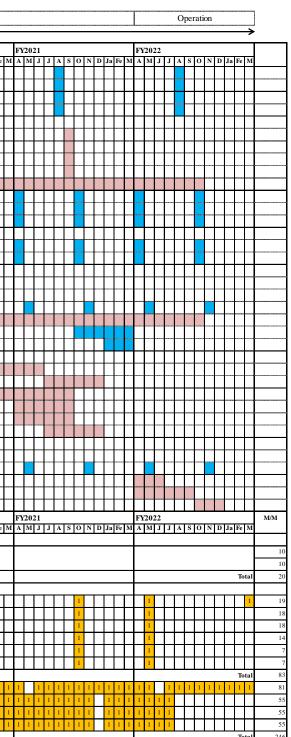


Attachment-3: Task matrix of the JICA expert and capacity development consultant

				st	ning		st	ning	Municipal Water Tariff / Finance Specialist	Management Information System Specialist		Information, Education and Communication Specialist
				Institutional Development and Organizational Strenghtening Specialist	 Human Resouce Management and Taining Specialist 	ant	Institutional Development and Organizational Strenghtening Specialist	Human Resouce Management and Taining Specialist	Spec	Spec		unica
				l Spe	and	Capacity Development Consultant	d Spe	and	nce	tem		E E
				 Institutional Development and Organizational Strenghtening 5 	nent	OD	Institutional Development and Organizational Strenghtening S	nent	ĩnai	Syst		LCo
				nen hter	ngen	IT C	nen hter	ıger	ff / F	ion		and
				lopı reng	Aana	mei	lopi æng	Aana	Tari	rmat		tion
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			the	tior izat	n Re llist	Õ	tior izati	n Re dist	cipa	gem	eci	list
			JICA Exper	stitu gan	Human Re Specialist	cit	stitu gan	Human Re Specialist	unic	anag	IS SI	Informtio Specialist
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	1.1 1.2	Establish Regulation and Fund allocation Establish accountability mechanisms		0			0		0		<u> </u>	
2		lishment of WSSW		0		_	0		0		<u> </u>	
	2.1	Institutional and organizational set up WSSW		0	0		0	0	0	-		
	2.1	Transfer of authority, functions and assets from DWSD	+	0		-	0		0		1	†
3		lish administration system of WSSW	1			-		L				1
	3.1	Establish Project Steering Committee and PIU		0	0							
	3.2	Formulate Administration system incl. decision making		0	0		0	0	0			
	3.3	Develop 'job description' for every position of WSSW		0	0		0	0	0			
	3.4	Establish Performance Management System for WSSW staff		0	0		0	0	0		L	
	3.5	Implement recruitment at various positions		0	0	_	0	0	0			
	3.6	Develop and conduct Training Plan for WSSW staff		0	0		0	0	0	0	0	0
4		opment of a Business Plan Long term Plan				_	0		0	-	<u> </u>	-
		Medium-term plan: five-year plan		0			0		0			
	4.3	Annual plan		0			0		0			
5		ovement of Financial Management Systems		<u> </u>								
	5.1	Review of existing financial /accounting system						0	0	0		
	5.2	Develop financial management system						0	0	0		
	5.3	Trainig of preparation of financial statements						0	0	0		0
6		r and Sanitation Tariff Setting and Revenue Collection				_						
		Door to door survey on present connection and payment					0			0	0	0
	6.2 6.3	Establish tariff 'Rules and Regulations' Carry out campaign against defaulters and illegal connections					0				<u> </u>	•
	6.4	Installation of water meters								0	0	0
	6.5	Campaigns for mandatory water supply and sewerage connection	1							0	0	0
	6.6	Develop and implement an improved revenue collection plan	1			1	0		1	0		0
	6.7	Prepare and execute tariff revisions for financial sustainability	1		1	1	0		0			
7	Mana	agement Information System										
	7.1	Study the current information management/monitoring practices						0	0	0	0	0
	7.2	Design Information System for water supply and sewerage works		L				0	0	0	0	0
		Develop, install and implement the Information System	1	L	ļ			0	0	0	0	0
8		t Management System								•		-
	8.1 8.2	Preparation of asset inventory of the existing facilities Establish and operationalize GIS database of facilities	1							0	0	
	8.3	Establish and implement data collection / update system	1			1				0	0	
	8.4	Establishment of asset management operation	1		··· ··	1			0	0	0	0
9		omer Services	-					·				
	9.1	Study on existing public relations and complaint handling system						0		0	0	0
	9.2	Prepare water supply and sewerage service contract document					0			0		0
	9.3	Prepare and implement complaint handling system	1			L				0		0
10		ourcing										
		Study on possibilities of outsourcing specific functions	-				0	0	0	0	0	
		Develop and approve an outsourcing plan Implement the outsourcing	1		-		0	0	0	0	0	
	10.5	implement the outsourcing	1	L	L		0	0	0	0	0	

Attachment-4: Indicative Work and Assignment Schedule

			Se	electio	n of Co	nsultan	nt		Deta	il Desi	gn			S	Selection	n of Co	ontract	or												Const	ructio	 n				
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 Setting of Policy, Rules and Regulations 	1.1 Establish Regulation and Fund allocation																									_			\vdash		\vdash	<u> </u>	_	⊢	₊	
÷	1.2 Establish accountability mechanisms							\rightarrow				++					\rightarrow	++	\square						++	+		\square	\square		\vdash	\square		$\downarrow \downarrow$	$\downarrow \downarrow$	++
2 Establishment of WSSW	2.1 Institutional and organizational set up WSSW													_															\vdash		\vdash	4		44	₩	\rightarrow
	2.2 Transfer of authority, functions and assets from DWSD												++				\rightarrow								++				⊢₽		⊢⊢	⊢	+	╄╋	₩	++
3 Establish administration system of WSSW	3.1 Establish Project Steering Committee and PIU				_																								H		\vdash			⊢	+++	
system of widd w	3.2 Formulate Administration system incl. decision making		_									_					_												\vdash				++-	┿	+-+-	
	3.3 Develop 'job description' for every position of WSSW																						+						┝╼╂╼┦				+- +-	++	╋	
	3.4 Establish Performance Management System for WSSW staff																						+ +-		+++				┢╍┠╍┦		\vdash			++-	+-+-	
	3.5 Implement recruitment at various positions										_											_			+++				┝╼┝╼┦						+-+-	_
4 Development of a Business	3.6 Develop and conduct Training Plan for WSSW staff 4.1 Long term Plan							++																					┍┿┦		┢╋┷		+++	⇇	╇	
Plan	4.2 Medium-term plan: five-year plan									<u> </u>							++								+-+-				┍╼┼╼┦			++-	+-+-	+	+++	
	4.3 Annual plan								· · · ·	- I						· · ·									····								+	+	+-+-	
5 Improvement of Financial	5.1 Review of existing financial /accounting system					+++				+++		++					+									+			┍┿┦		┍╇╴	⊢	┿╋	╇	┿	++
Management Systems	5.2 Develop financial management system												+										+		+++				┍┼┥			++-	+-+-	++-	++	
	5.3 Trainig of preparation of financial statements															· · · ·							+ +-	· ·	·· · ·		· · · ·		-+-1			++	+-+-		++	
6 Water and Sanitation Tariff	6.1 Door to door survey on present connection and payment					+++						++					++									+ +			┢╋┙		┣━	H	┿╋	╇	┿	++
Setting and Revenue	6.2 Establish tariff 'Rules and Regulations'							-				++										-		-	++				\vdash		H	-	++	++	++	+++
Collection	6.3 Carry out campaign against defaulters and illegal connections												+-+											+	+++									H	+++	
	6.4 Installation of water meters											-										-	+	+					┍╼╄╼┦		H		+-+-	+−	++	
	6.5 Campaigns for mandatory water supply and sewerage connection																								-				-+							
	6.6 Develop and implement an improved revenue collection plan					<u> - </u>				+ + +													+-+-	+ -	++	++			┍┼┦		H			1-1-	+-+-	
	6.7 Prepare and execute tariff revisions for financial sustainability																								++				+ +		\vdash		+-+-	++	+++	
7 Management Information	7.1 Study the current information management/monitoring practices					+++		++					++										++		++		-+-+		┍╋┦		\vdash	H	┿╋	╈	┢╋╴	++
System	7.2 Design Information System for water supply and sewerage works		++					-				-		_		_				_					++				H		\vdash	H	++	++	+	
7 Management Information System 7.1 7.2 7.2 7.3 7.3 8 Asset Management System 8.1	7.3 Develop, install and implement the Information System					<u> </u>				+ + -													+-+-	+ -	++	++			┍┼┦		\vdash	\vdash	++	++-	+-+-	
8 Asset Management System	8.1 Preparation of asset inventory of the existing facilities	Lege	end																				++		++		-+-+		┍┼┦		\vdash	\vdash	┼╊	++	╋	
• • • • • • • • • • • • • • • • • • • •	8.2 Establish and operationalize GIS database of facilities			ition by	ЛСА Ехр	oert											++						· · ·	· ·	++	+-+			\square		\vdash	+-	++	++	+-+-	
	8.3 Establish and implement data collection / update system			-	-		Capacity	Devel	opment Cons	ultant		++			_										++				\square		\vdash	H	++	++	++	++
	8.4 Establishment of asset management operation				Capacity													- I - I -						+ -	+ +				r+q		H+	++	+-+-	++	+++	
9 Customer Services	9.1 Study on existing public relations and complaint handling system				Capacity																				++		-+-+		┍┼┦		\vdash	++-	++	┢		++
	9.2 Prepare water supply and sewerage service contract document				sewerage		ment ex	Jiisuitai									++								++				\square		\vdash	H	++			++
	9.3 Prepare and implement complaint handling system																							+ -	- t- t-				r+q		H	H	+-+-			
10 Outsourcing	10.1 Study on possibilities of outsourcing specific functions		ТТ		ТГ	ПП			TTT	П																			H		H	┢┼╴	++	┼┲	╋╋	++
5	10.2 Develop and approve an outsourcing plan	· · · ·											-						-										\square		\vdash		+	++-		
	10.3 Implement the outsourcing		++					-				++					++								++				\square		\vdash	H	++	++	++	++
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JICA Expert																																				
1) Institutional Development and	d Organizational Strenghtening Specialist		1 1	1	1 1	1 1	1 1		1																											
2) Human Resource Managemen	nt and Taining Specialist		1 1	1 1	1		1 1	1 1	1																											
Capacity Development Cons	sultant																																			
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1) Team Leader /Institutional De	evelopment and Organizational Strenghtening Specialist						1	1 1	1 1 1 1			1		1		1			1					1	1		1		ĽĽ		1				1	
2) Human Resouce Management	t and Taining Specialist						1	1 1	1 1 1 1			1		1		1			1		1			1	1		1		Ш		1	Ш	Ш	Ш	1	
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Information, Education and Con	mmunication Specialist						1	1	1 1					1															$\Box U$		∟∟			Ш	Ш	
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	onal Strenghtening Specialist						1	1 1	1 1 1 1	1 1	1 1	1 1 1	1	1	1 1 1	1 1	1 1	1 1 1	1	1 1	1 1	1 1	1 1	1 1	1	1 1	1 1	1 1	41	1 1	Ц_	1 1	11	44	1	1 1 1
 MIS Database + Network 			+				1	1 1	1 1 1 1	1 1	1 1	1 1	1	1 1	1 1 1	1 1	1	1 1 1	1	\square	\square	++	\square	\square	++	++	++	+	⊢₽	1 1	11	1 1	11	ΨĽ	44	1 1 1
3) GIS Coordinator							1	1 1	1 1 1 1	1 1	1 1	1 1	1	1 1	1 1 1	1 1	1	1 1 1	1	\square	\square	++		\square	++	+	+	+	⊢ै	1 1	11	1 1	11	₽₽ ¹	4	1 1 1
 Customer Service 			_				1	1 1	1 1 1 1	1 1	1 1	1 1	1	1 1	1 1 1	1 1	1	1 1 1	1					Ц					_ <u>_</u>	1 1	11	1 1			Ц	1 1 1
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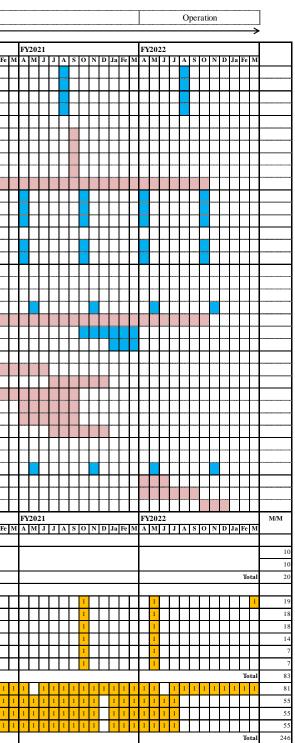


Appendix B6.3 Task matrix of JICA Expert and Capacity Development Consultant

	ing of Policy, Rules and Regulations	JICA Expert	1) Institutional Development and Organizational Strenghtening Specialist	2) Human Resouce Management and Taining Specialist	Capacity Development Consultant	1) Institutional Development and Organizational Strenghtening Specialist	2) Human Resouce Management and Taining Specialist	3) Municipal Water Tariff / Finance Specialist	4) Management Information System Specialist	5) GIS Specialist	6) Information, Education and Communication Specialist
		-				•		•			
1.1	Establish Regulation and Fund allocation		0			0		0			
1.2	Establish accountability mechanisms		0			0		0			
	blishment of WSSW	_			_						
2.1	Institutional and organizational set up WSSW		0	0		0	0	0			
2.2	Transfer of authority, functions and assets from DWSD	L	0		1	0		0		<u> </u>	ļ
	blish administration system of WSSW	_			-				<u> </u>	──	
3.1	Establish Project Steering Committee and PIU		0	0	_						
3.2	Formulate Administration system incl. decision making		0	0	_	0	0	0			
3.3	Develop 'job description' for every position of WSSW		0	0	_	0	0	0			
3.4	Establish Performance Management System for WSSW staff		0	0		0	0	0			
3.5	Implement recruitment at various positions		0	0	_	0	0	0			
3.6	Develop and conduct Training Plan for WSSW staff		0	0		0	0	0	0	0	0
4 Deve	elopment of a Business Plan										
4.1	Long term Plan		0			0		0			
4.2	Medium-term plan: five-year plan		0			0		0			
4.3	Annual plan		0			0		0			
5 Impr	rovement of Financial Management Systems										
5.1	Review of existing financial/accounting system						0	0	0		
5.2	Develop financial management system						0	0	0		
5.3	Trainig of preparation of financial statements						0	0	0		0
6 Wat	er and Sanitation Tariff Setting and Revenue Collection										
6.1	Door to door survey on present connection and payment					0			0	0	0
6.2	Establish tariff 'Rules and Regulations'					0					
6.3	Carry out campaign against defaulters and illegal connections										0
6.4	Installation of water meters								0	0	0
6.5	Campaigns for mandatory water supply and sewerage connection										0
6.6	Develop and implement an improved revenue collection plan					0			0		0
6.7	Prepare and execute tariff revisions for financial sustainability					0		0			
7 Man	agement Information System										
7.1	Study the current information management/monitoring practices						0	0	0	0	0
7.2	Design Information System for water supply and sewerage works						0	0	0	0	0
7.3	Develop, install and implement the Information System						0	0	0	0	0
8 Asse	et Management System										
8.1	Preparation of asset inventory of the existing facilities								0	0	
8.2	Establish and operationalize GIS database of facilities								0	0	
8.3	Establish and implement data collection / update system								0	0	
8.4	Establishment of asset management operation							0	0	0	0
9 Cust	tomer Services										
9.1	Study on existing public relations and complaint handling system				1		0		0	0	0
9.2	Prepare water supply and sewerage service contract document	1		1	1	0			0		0
9.3	Prepare and implement complaint handling system	1		1	1				0		0
	sourcing			-	1						
	Study on possibilities of outsourcing specific functions				1	0	0	0	0	0	
10.1					1	0	0	0	0	0	
	Implement the outsourcing	1		1	1	0	0	0	0	0	
10.5		I	·	·	1						

Appendix B6.4: Manning Schedule of JICA Expert and Capacity Development Consultant

			Sele	ection of	f Consu	ıltant			Detail l	Desigi	n		S	Selection	n of Co	ontrac	tor	[Cons	tructi	ion				
	Pledge	L/	A	J	ICA Ex	nert	←				Capa	city De	velopp	nent Co	ncultar	nt		<u>.</u>																
								FY201	1		Capa	city De			nsuitai	III			FY2018 FY2019 F															
	Task	FY2014 Ja Fe M		JJA	A S O	N D	Ja Fe N		J J A	so	NDJ	a Fe M	FY201'	JJA	so	ND	Ja Fe M	FY201 A M	.8 JJA	so	N D	Ja Fe		M J	JA	SON	N D	Ja Fe N	FY2 I A M	2020 M J	JAS	5 O N	D Ja	Fe
1 Setting of Policy, Rules and	1.1 Establish Regulation and Fund allocation																				П											T	\square	,
Regulations	1.2 Establish accountability mechanisms																																	T
2 Establishment of WSSW	2.1 Institutional and organizational set up WSSW					П									Ш	ПП						П											П	T
	2.2 Transfer of authority, functions and assets from DWSD																																	
3 Establish administration	3.1 Establish Project Steering Committee and PIU																				П											T	\square	,
system of WSSW	3.2 Formulate Administration system incl. decision making																																\square	
	3.3 Develop 'job description' for every position of WSSW									ТТ																							\square	
	3.4 Establish Performance Management System for WSSW staff																																	
	3.5 Implement recruitment at various positions																																	
	3.6 Develop and conduct Training Plan for WSSW staff																																	
4 Development of a Business	4.1 Long term Plan					П				П						ПП						П											П	ıΤ
Plan	4.2 Medium-term plan: five-year plan																																\square	Т
	4.3 Annual plan							*******																									\square	
5 Improvement of Financial	5.1 Review of existing financial/accounting system																																\square	,T
Management Systems	5.2 Develop financial management system																																\square	T
	5.3 Trainig of preparation of financial statements																																\square	Т
6 Water and Sanitation Tariff	6.1 Door to door survey on present connection and payment					\square										\square																		
Setting and Revenue	6.2 Establish tariff 'Rules and Regulations'				++							11								$\uparrow \uparrow$	++			+++								\top		1
Collection	6.3 Carry out campaign against defaulters and illegal connections																																	_
	6.4 Installation of water meters																														-			_
	6.5 Campaigns for mandatory water supply and sewerage connection																																	
	6.6 Develop and implement an improved revenue collection plan																																	
	6.7 Prepare and execute tariff revisions for financial sustainability																																	
7 Management Information	7.1 Study the current information management/monitoring practices																			++														
System	7.2 Design Information System for water supply and sewerage works																						-								_	-		
	7.3 Develop, install and implement the Information System																								_							-		
8 Asset Management System	8.1 Preparation of asset inventory of the existing facilities	Lege	end																	++						++								
	8.2 Establish and operationalize GIS database of facilities	_		on by ЛСА	Expert					-															· · · ·						_	+		-
	8.3 Establish and implement data collection / update system			л by ЛСА			acit v Dev	elopment	t Consult:	ant -																				-		+		-
	8.4 Establishment of asset management operation			on by Capa																			-											-
9 Customer Services	9.1 Study on existing public relations and complaint handling system			on by Capa						-																								1
	9.2 Prepare water supply and sewerage service contract document			ly for sew			n consu	lant		-							· · ··			+-+-	+ + -		-	+ + +								-		-
	9.3 Prepare and implement complaint handling system									-													-	· · · ·								+		
10 Outsourcing	10.1 Study on possibilities of outsourcing specific functions	htt	T	ПТ	П	ПП	П	ПП			╉╋╋									++		\vdash										╈	H	1
	10.2 Develop and approve an outsourcing plan				+++-																		-	+ + +						-		++-		-
	10.3 Implement the outsourcing																· · ··							+ + +								++-	+++	-
	* *	FY2014	1 FY20	15				FY201	6				FY201'	7				FY201	8				F	2019					FY2	2020		سلسلم	لسلسه	
	Manning Schedule				A S O	N D	Ja Fe N			so	N D J	a Fe M			S O	ND	Ja Fe M			s o	N D	Ja Fe		M J	JA	SON	N D	Ja Fe M			JAS	O N	D Ja	Fe
JICA Expert																																		
1) Institutional Development and	l Organizational Strenghtening Specialist		1 1 1		1 1 1	1 1	1	1																										
2) Human Resource Managemen	t and Taining Specialist		1 1 1	1 1		1	1 1	1 1																										
Capacity Development Cons	sultant																																	
Professional (A)																																		
1) Team Leader /Institutional De	velopment and Organizational Strenghtening Specialist						1 1 1	1 1	1 1		1		1		1			1		1			1			1			1				1	T
2) Human Resouce Management	and Taining Specialist	1					1 1 1	1 1	1 1		1		1		1	П		1		1		П	1			1			1				1	T
 Municipal Water Tariff / Finar 	ice Specialist						1 1 1	1 1	1 1		1		1		1			1		1			1			1			1				1	
4) Management Information Sys	tem Specialist						1 1		1 1				1		1			1		1			1			1			1				1	, T
5) GIS Specialist		1					1 1		1 1				1		П	П						П												T
6) Informtion, Education and Con	mmunication Specialist	1					1 1		1 1	++			1							$\uparrow \uparrow$	++	\square	Π			11			Ħ	\top		\square		T
Professional (B)	*	1	1																			• •	+						Ľ					
	onal Strenghtening Specialist	1	1				1 1 1	1 1	1 1 1	1 1	1 1	1 1 1	1	1 1 1	1 1	1 1	1 1 1	1	1 1 1	1 1	1 1	1 1	1 1	1	1 1	1 1 1	1 1	1 1 1	1	1	1 1 1	1 1	1 1	1
2) MIS Database + Network	- • •	1					1 1 1	1 1	1 1 1	1 1	1	1 1 1	1 1	1 1 1	1 1	1	1 1 1	1										1 1 1	1	1 1	1 1 1	1 1		1
3) GIS Coordinator		1	1				1 1 1	1 1	1 1 1	1 1	1	1 1 1	1 1	1 1 1	1 1	1	1 1 1	1		$\uparrow \uparrow$	++	\square	Π	$\uparrow \uparrow \uparrow$		11		1 1 1	1	1 1	1 1 1	1 1		1
 Customer Service 		1					1 1 1	1 1	1 1 1	1 1	1	1 1 1	1 1	1 1 1	1 1	1	1 1 1	1			$\uparrow\uparrow$		\square					1 1 1	1	1 1	1 1 1	1 1		1
		1	1																			• •	+						Γ					_
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Appendix B6.5"Data Sheet" to be attached to "2. Selection Procedure" of RFP[For Selection of Engineering Service Consultant]

TENTATIVE

Paragraph Reference	
1. (b)	The Applicable Guidelines are those published in April 2012.
2.1	Amount of the Loan Agreement: <u>To be determined later</u> Signed date of the Loan Agreement: <u>To be determined later</u> Name of Project: <u>Ranchi Sewerage Project</u>
2.2	Name of the Client: Ranchi Municipal Corporation (RMC)
2.3	Name of the assignment: Engineering Service for Ranchi Sewerage Project
2.4	A pre-proposal conference will be held: Yes No <u>Date: To be determined later</u> <u>Place: To be determined later</u>
	Address: <u>To be confirmed later</u> Telephone: <u>To be confirmed later</u> E-mail: <u>To be confirmed later</u>
2.5	The Client will provide the following inputs, project data, reports, etc. to facilitate the preparation of the Proposals:
	"Final Report "Preparatory Survey on Ranchi Sewerage Project, JICA 2014
4.1(c)	A list of debarred firms and individuals is available at the World Bank's website: www.worldbank.org/debarr
6.3	Proposals shall be submitted in the following language: English
7.1	Proposals must remain valid <u>90</u> days after the submission deadline date, i.e. until: <u><i>To be determined later</i></u>
7.8 (a)	The price of the Financial Proposal shall be adjusted by the following factor:
	Local Currency Portion:To be determined laterForeign Currency Portion:To be determined later
7.8(b)	The fixed portion of the price of the Financial Proposal shall be adjusted by the following factor:
	Local Currency Portion:To be determined laterForeign Currency Portion:To be determined later
8.1	Clarifications may be requested by <u>To be determined later</u>

	The address for requesting clarifications is: <u><i>To be confirmed later</i></u> Facsimile: <u><i>To be confirmed later</i></u> E-mail: <u><i>To be confirmed later</i></u>						
11.1 (i)	Minimum numbers of man-months for Experts are:						
	- International Experts: <u>158</u> man-months - Local Experts: <u>311</u> man-months - Total: <u>469</u> man-months						
	(1) a per diem allowance in respect of Experts of the Consultant for every day in which the Experts shall be absent from their home office;						
	(2) cost of necessary international and local air travel of Experts by the most appropriate means of transport and the most direct practicable route;						
	(3) land transportation including vehicle rental;						
	(4) cost of international or local communications such as the use of telephone and facsimile required for the purpose of the Services;						
	(5) cost, rental and freight of any equipment required to be provided by the Consultants for the purposes of the Services;						
	(6) cost of printing and dispatching of the reports to be produced for the Services;						
	(7) miscellaneous administrative and support costs including office operations, support personnel and translation;						
	(8) provisional sums; and						
	(9) cost of such further items required for purposes of the Services not covered in the foregoing.						
11.1 (ii) c	Amount for provisional sums:- for foreign currency:To be determined later- for local currency:To be determined later						
	Contingency amount: - for foreign currency: <u>To be determined later</u> - for local currency: <u>To be determined later</u>						
11.3	The other international traded currency(ies) permitted are: (i) US dollar						
12.3	Number of copies of the Technical Proposal: <u>To be determined later</u>						
12.5	Time and date of the Proposal submission deadline:						
	- Time: <u>To be determined later</u> - Date: <u>To be determined later</u>						
12.6	Consultants must submit the original and all copies of the Technical Proposal, and the original Financial Proposal to the Client to the following address: <u>To be determined later</u>						

	Proposals must be submitted no later than the following date an <u>To be determined later</u>	d time:
14.2	Criteria, sub-criteria, and point system for the evaluation are:	Points
	(i) Experience of the Consultants relevant to the assignment:a) Experience of international projects of comparable size, complexity and technical specialty	[5]
	b) Experience in developing countries under comparable conditions	[5]
	c) Experience in Japanese ODA projects Total points for criterion (i):	[5] [15]
	(ii) Adequacy of the proposed methodology and work plan in responding to the Terms of Reference:	
	a) Technical approach and methodologyb) Work planc) Organization and staffingTotal points for criterion (ii):	[15] [7] [13] [35]
	(iii) Key Experts' qualifications and competence for the assignment:	
	 a) Project Manager b) [Sewerage/Civil Engineer] c) [Sewerage Treatment Plant Expert] d) [Mechanical and Electrical Engineer] e) [SCADA Engineer] f) [Cost Estimate and Tender Expert] Total points for criterion (iii): 	[10] [8] [7] [5] [5] [5] [40]
	The number of points to be assigned to each of the abov disciplines shall be determined considering the following thr and relevant percentage weights:	
	 General qualifications Adequacy for the assignment Familiarity with the language and the conditions of the Court 	[30%] [60%]
	Total weight:	[10%]
	(iv) Suitability of the transfer of knowledge (training) program:	
	 a) Relevance of training program b) Training approach and methodology c) Qualifications of Key Experts and trainers Total points for criterion (iv): 	[4] [4] [2] [10]
	Total points for the four criteria:	100
	The minimum technical score (St) required to pass is: 70 Points	

14.4	Expected date (month/year) for public opening of Financial Proposals: <u>To</u> <u>be determined later</u> at: <u>To be determined later</u>
14.6(i)	The single currency for price conversion is: <u>To be determined later</u> The source of official selling rates is: <u>To be determined later</u> The date of exchange rates is: <u>To be determined later</u>
14.8	Quality-Cost Ratio: 80:20
15.1	Expected date and address for contract negotiations: <u>To be determined later</u>
17.2	Expected date for commencement of consulting services <u>To be determined later</u>

[For Selection of Capacity Development Consultant]

TENTATIVE

Paragraph Reference	
1. (b)	The Applicable Guidelines are those published in April 2012.
2.1	Amount of the Loan Agreement: <u>To be determined later</u> Signed date of the Loan Agreement: <u>To be determined later</u> Name of Project: <u>Ranchi Sewerage Project</u>
2.2	Name of the Client: Ranchi Municipal Corporation (RMC)
2.3	Name of the assignment: Capacity Development of RMC for Ranchi Sewerage Project
2.4	A pre-proposal conference will be held: Yes No <u>Date: To be determined later</u> <u>Place: To be determined later</u> Address: <u>To be confirmed later</u> Telephone: <u>To be confirmed later</u> E-mail: To be confirmed later
2.5	The Client will provide the following inputs, project data, reports, etc. to facilitate the preparation of the Proposals: "Final Report "Preparatory Survey on Ranchi Sewerage Project, JICA 2014
4.1(c)	A list of debarred firms and individuals is available at the World Bank's website: www.worldbank.org/debarr
6.3	Proposals shall be submitted in the following language: English

7.1	Proposals must remain valid <u>90</u> days after the submission deadline date, i.e. until: <u><i>To be determined later</i></u>
7.8 (a)	The price of the Financial Proposal shall be adjusted by the following factor:
	Local Currency Portion:To be determined laterForeign Currency Portion:To be determined later
7.8(b)	The fixed portion of the price of the Financial Proposal shall be adjusted by the following factor:
	Local Currency Portion:To be determined laterForeign Currency Portion:To be determined later
8.1	Clarifications may be requested by <u>To be determined later</u> The address for requesting clarifications is: <u>To be confirmed later</u> Facsimile: <u>To be confirmed later</u> E-mail: <u>To be confirmed later</u>
11.1 (i)	Minimum numbers of man-months for Experts are:
	- International Experts: <u>83</u> man-months - Local Experts: <u>246</u> man-months
	- Local Experts: <u>246</u> man-months -Total: <u>329</u> man-months
	 a per diem allowance in respect of Experts of the Consultant for every day in which the Experts shall be absent from their home office;
	(2) cost of necessary international and local air travel of Experts by the most appropriate means of transport and the most direct practicable route;
	(3) land transportation including vehicle rental;
	(4) cost of international or local communications such as the use of telephone and facsimile required for the purpose of the Services;
	(5) cost, rental and freight of any equipment required to be provided by the Consultants for the purposes of the Services;
	(6) cost of printing and dispatching of the reports to be produced for the Services;
	(7) miscellaneous administrative and support costs including office operations, support personnel and translation;
	(8) provisional sums; and
	(9) cost of such further items required for purposes of the Services not covered in the foregoing.
11.1 (ii) c	Amount for provisional sums:- for foreign currency:To be determined later- for local currency:To be determined later
	Contingency amount:
1	

	 for foreign currency: <u>To be determined later</u> for local currency: <u>To be determined later</u>
11.3	The other international traded currency(ies) permitted are: (ii) US dollar
12.3	Number of copies of the Technical Proposal: <u>To be determined later</u>
12.5	Time and date of the Proposal submission deadline:
	- Time: <u>To be determined later</u> - Date: <u>To be determined later</u>
12.6	Consultants must submit the original and all copies of the Technical Proposal, and the original Financial Proposal to the Client to the following address: <u>To be determined later</u>
	Proposals must be submitted no later than the following date and time: <u>To be determined later</u>
14.2	Criteria, sub-criteria, and point system for the evaluation are: <u>Points</u>
	 (i) Experience of the Consultants relevant to the assignment: a) Experience of international projects of comparable size, complexity and technical specialty
	b) Experience in developing countries under [2] comparable conditions
	c) Experience in Japanese ODA projects [4] Total points for criterion (i): [10]
	(ii) Adequacy of the proposed methodology and work plan in responding to the Terms of Reference:
	a) Technical approach and methodology[10]b) Work plan[5]c) Organization and staffing[5]
	Total points for criterion (ii): [20]
	(iii) Key Experts' qualifications and competence for the assignment:
	 a) [Team Leader / Institutional Development and Organizational Strengthening Specialist] [10] b) [Human Resources Management and Training Specialist] [8] c) [Municipal Water Tariff / Finance Specialist] [8] d) [Management Information System Specialist] [8] e) [GIS Specialist] [8] f) [IEC Specialist] [8] f) [IEC Specialist] [8] Total points for criterion (iii): [50] The number of points to be assigned to each of the above positions or disciplines shall be determined considering the following three sub-criteria
	and relevant percentage weights:

	 General qualifications Adequacy for the assignment Familiarity with the language and the conditions of the Country Total weight: 	[30%] [60%] [10%] 100%
	(iv) Suitability of the transfer of knowledge (training) program:	
	 a) Relevance of training program b) Training approach and methodology c) Qualifications of Key Experts and trainers Total points for criterion (iv): 	[8] [8] [4] [20]
	Total points for the four criteria:	100
	The minimum technical score (St) required to pass is: <u>70</u> Points	
14.4	Expected date (month/year) for public opening of Financial Propo <u>be determined later_at:</u> <u>To be determined later</u>	sals: <u>To</u>
14.6(i)	The single currency for price conversion is: <u>To be determined later</u> The source of official selling rates is: <u>To be determined later</u> The date of exchange rates is: <u>To be determined later</u>	<u>er</u>
14.8	Quality-Cost Ratio: <u>90 : 10</u>	
15.1	Expected date and address for contract negotiations: <u>To be determined later</u>	
17.2	Expected date for commencement of consulting services <u>To be determined later</u>	

Appendix C1

CHAPTER C1 ORGANIZATIONAL STRENGTHENING PLAN FOR RMC

	INDICATORS	Value	UNIT
A	Resource Mobilization		
1	Per Capita Income	595	Rs. p. a.
2	Sources of Funds		
	a Share of Own Sources in Total Revenue Income (RI)	25	%
	b Share of Property Tax in Total Revenue Income	9	%
	c Share of Revenue Grants & Subsidies in Total RI	75	%
3	Growth in Revenue Income	46	% p.a.
4	Growth in Own Sources of Revenue Income	31	%
5	Per Capita Own Income	149	INR p.a.
B	Fund Application		
1	Per Capita Expenditure	689	INR p.a.
2	Uses of Funds		
	a Share of Establishment Expenditure in Total Revenue Expenditure (RE)	77	%
	b Share of O & M Expenditure in Total Revenue Expenditure	23	%
	c Share of Establishment Expenditure to Total RI	45	%
3	Growth in Establishment Expenditure	20	%
4	Growth in O&M Expenditure	35	%
5	Growth in Total Revenue Expenditure	24	% p.a.
С	Liability Management		
1	Per Capita Liability (2012-2013)		
	a Outstanding Debt per Capita	877	INR
	b Outstanding Non-Debt Liability per Capita	4,371	INR
	c Total Outstanding Liability per Capita	5,248	INR
2	As a Proportion of Property Tax Current Demand (2012-1013 estimated)		
	a Outstanding Debt as % of P.T Demand	1,406	%
	b Outstanding Non-Debt Liability as % of P.T Demand	7,003	%
	c Total Outstanding Liability as % of P.T Demand	8,409	%
3	As a Proportion of Property Tax Own Revenue Income (2012-2013 estimated)		
	a Outstanding Debts as % of Own Revenue Sources	526	%
	b O/S Non- Debt Liability as % of Own Revenue Sources	2,623	%
	c Total O/S Liability as % of Own Revenue Sources	3,149	
4	Non-Debt Liability as % of Total Liability	83	%
5	Debt Servicing Ratio (D.S/Revenue Income)	*	%
D	Performance Indicators		
1	Operating Ratio	43	%

Appendix C1.1 Key Financial Indicators

2	Grov	wth in per Capita Own Income	23	% p.a.
3	Grov	vth in Per Capita Grant	47	%p.a.
4	Grov	wth in Per Capita Total Revenue Income	42	%p.a.
5	Grov	wth in Per Capita Establishment Expenditure	16	%p.a.
6	Grov	wth in Per Capita O & M Expenditure	31	%p.a.
7	Grov	wth in Per Capita Revenue Expenditure	20	%p.a.
8	Capi	tal Utilization Ratio	*	Ratio
Е	Effic	ciency Indicators		
1	Tax	Collection Performance		
	а	Property Tax	96	%
		Water TAX	58	%
		Latrine TAX	64	%
	b	Water Charges	34	%.
	с	Sewer Charges	Nil	%
	d	Other Taxes	*	%
2	No.	of Property Tax Assessments per Tax Collection Staff	625	Nos.
3	Prop	erty Tax Demand per Assessment	787	INR p.a.
4	No.	of Municipal Staff per 1000 Population	6.2	Nos.
5	Ann	ual Revenue (Own Source) per Municipal staff	2.4	INR Lakh p.a.
6	Рори	alation per Residential Property Tax Assessments	12.6	Persons

* Data not available

Service	Function	Organization executing
Water	Approvals and sanctions for project	UDD
Supply	Project Planning, design and execution	DW&SD
	Construction of Intake works and WTP	DW&SD
	O & M of network, pumping stations, Intake works and WTP	DW&SD
	Allocation of raw water from rivers and reservoirs	Water Resources
	Water quality of raw and treated water	DW&SD
	Providing household connections	RMC
	Billing and revenue collection	RMC and DW&SD
Drainage	Approvals and sanctions for project	UDD
	Project Planning, design and execution	DW&SD,
		Roads Department, and
		RMC
	O & M of network	RMC
Sewerage	Approvals and sanctions for project	UDD
	Project Planning, design and execution	None
	O & M of network, pumping stations and STP - <i>No</i> sewerage network available	None
	Septic tank cleaning	RMC
	Water quality of raw sewerage	None
	Billing and revenue collection	RMC

Appendix C1.3 Training profile sheets	
TITLE	Understanding Leadership and Management
TARGET GROUP	 PIU: PD, PM, DF, select Dy PM - UDD: select Jt. Secy, CE, and select SE & EE; RMC: CEO, Dy CEO, CE, select SE's and select EE's. DWSD: SE (Urban Circle)
OBJECTIVE / S	After the training the participants will be able to 1. develop a change management plan 2. find solutions to leadership issues at the work place
KEY CONCEPTS-	 What is leadership? The difference between leadership and management; Assessing leadership competencies and developmental needs; Articulate leadership vision, in light of the assessment, and consider the best way(s) to realize it Processes for establishing direction, aligning people, and motivating people to follow the vision Identifying different leadership style: Tasking, Encouraging, Steering, Entrusting Leading Effective Teams What is a team? The stages of team development: Forming, Storming, Norming, Performing, Adjourning Leading and maintaining effective, productive teams Evaluating team progress and coaching team members as necessary Building Relationships: How individual differences affect your ability to lead Identifying motivational patterns: How to be more influential by understanding motivational patterns; Using an understanding of individual differences to help manage conflict more effectively Ethics and Leadership: The definition of ethics and the link between ethics and trust; The role of ethical 4erkeley4 and leadership; The difference between personal and organizational ethics; Discuss the effect of the triple constraint on ethics Negotiating Conflict; Major sources of conflict on project teams The five modes of handling conflict – Forcing, Smoothing, Withdrawing, Compromising, Problem Solving The difference between competitive negotiation and collaborative negotiation Conflict scenarios and strategies for initiating conflict resolution Power bases used in typical organizations How to plan and conduct collaborative negotiation Leading Change – Self's Role in a changing organization; Predictable stages of adjusting to change; Appropriate leadership strategies for each stage Developing a change management plan
DURATION	Three (3) Days
VENUE – Institute, Location	Indian Institute of Management, Kolkatta
METHOD/S	Interactive group discussions, Group Discussions, Working exercises
COST (Indicative approximation) INR 17500 per head per day

TITLE	Understanding Project Management concepts	
TARGET GROUP	PIU: PD, PM, DF, all Dy PM	
	UDD: select Jt. Secy, CE, and select SE & EE;	
	RMC: CEO, Dy CEO, CE, SE's and EE's.	
	DWSD: SE (Urban Circle) and EE's	
OBJECTIVE / S	After the training the participants will be able to 1. Understand the concepts	
	2. Apply project management principles	
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	• Introduction to Project Management; What are "projects"?; Why project management?	
	• The project life cycle; Influences on a project; Key stakeholders	
	• Project management process groups; Project manager responsibilities	
	Project Initiation	
	Understanding the role of senior management	
	• Needs Assessment; Project selection; Benefit/cost ratio; Present value and net present value	
	Building SMART objectives – Specific, Measurable, Agreed to, Realistic, Time-constrained	
	Developing Requirements; Project charters; Project Requirements Document	
	Project Planning; Scope planning; The work breakdown structure	
	Estimating; Schedule Planning	
	• Network Diagrams – CPM; Speeding up the Schedule	
	 Project Management Planning Software – PRIMAVERA / MS PROJECT (OVERVIEW ONLY – Software training covered separately) 	
	Cost Planning	
	Responsibility Matrix; Resource Loading and Levelling; Risk Planning; Procurement	
	Planning; Communication and quality planning	
	Project Implementation; Baselines; Developing the project team; Organizations and team structures; Managing change; Managing Risk	
	• Performance reporting; Assessing and monitoring project performance	
	Reserves; Earned value; Sunk costs	
	Project Closeout – Scope verification and acceptance; Administrative and contractual closure	
	Transferring lessons learned to current/future project	
	Case study	
DURATION	Five (5) Days	
VENUE – Institute, Location	In- house, Ranchi	
FACULTY	By invitation from Project Management Institute, NOIDA	
METHOD/S	Interactive group discussions, Group Discussions, Working exercises	
COST (Indicative approximation)	INR 4200 per head per day	

TITLE	How to use Primavera / MS Project software for project
	management
TARGET GROUP	PIU: All Dy PM, all FE
	UDD: SE & select EE;
	RMC: select SE's and EE's.
	DWSD: SE (Urban Circle) and select EE
OBJECTIVE / S	After the training the participants will be able to
	1. Understand the concepts
	2. Confidently apply Primavera / MS Project software for project management
KEY CONCEPTS- INDICATIVE	Overview
PROGRAMME OUTLINE	 Building a Project plan. Networking techniques for Time, Resource and Cost Scheduling – Tracking and Monitoring of projects Multiple Project Management, Data interface with Excel Project coordination and integration management Tracking Progress Assessing the quality of the project. Communication
	Software demonstration and application
	 Activities, Calendars- Definition, Sequencing & Estimate Duration How to Develop a Schedule Plan and Control Network Analysis-CPM, PERT,PDM How to Prepare Work Breakdown Structure (WBS) How to update WBS Constraints How to Manage Cost in a Project How to do Resource Planning and Cost Estimation How to Prepare Resource Sheet How to Define Resource root and to Allocate Resources Filters and Grouping How Material Resources are being allocated Analyzing resources by 6erkeley6 the resource using Crashing, Stretching & Splitting Earned Value Analysis Method of Developing Different types of reports according to Industrial needs Schedule in multiple Projects Customization Exercise Project
DURATION	Five (5) Days
VENUE – Institute, Location	In- house, Ranchi
FACULTY	By invitation from Project Management Institute, NOIDA
METHOD/S	Interactive group discussions, Group Discussions, Working exercises
COST (Indicative approximation) Source: IICA Study Team	INR 4200 per head per day

TITLE	Construction of sewerage system - planning, norms, and	
	institutional issues	
TARGET GROUP	PIU: PD, PM, All Dy PM, all FE, Env Er.	
	UDD: SE & select EE;	
	RMC: select SE's and EE's.	
	DWSD: SE (Urban Circle) and select EE	
OBJECTIVE / S	After the training the participants will be able to:	
	1. Understand concepts of Technical Planning, Management and	
	Organization 2. Carry out selection of a management system	
KEY CONCEPTS - INDICATIVE	Technical Planning O Route Selection	
PROGRAMME OUTLINE	 Route Selection Sewer Design 	
	• Sewer Alignment	
	 Estimating Works 	
	Management and Organization	
	Project CycleLevels of Management	
	 Levels of Management Administration and Logistics 	
	 Site Management 	
	Appropriate Setting Out Methods	
	 General Observations 	
	• The Centre Line	
	O Ditching and Sloping Construction Procedures	
	• Construction Procedures • Site overview	
	• Clearing	
	• Earthworks	
	• Embankments	
	o Drainage	
	o Culverts	
	 Compaction Erosion Protection 	
DURATION	Three (3) days	
VENUE – Institute, Location	In- house, Ranchi	
FACULTY	By invitation from ESCI, Hyderabad	
TRAINING METHODS	Presentations, Group discussions, Case studies	
COST (Indicative approximation)	INR 4500 per head per day	

TITLE	Understanding Contract Management process
TARGET GROUP	PIU: PD, DF, PM, All Dy PM, PO
	UDD: SE & select EE;
	RMC: Dy CEO, select SE's and select EE's, OS, CAO.
	DWSD: SE (Urban Circle) and select EE
OBJECTIVE / S	
Objective/S	After the training the participants will be able to 1. Understand the concepts
	2. Apply contract management principles to current / future projects
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	 Contract management definition; Description and uses of contracts; Client and Contractor perspectives
	• Teamwork—Roles and Responsibilities; Concept of agency; Types of authority; Privacy of contract; Contractor personnel
	 Concepts and Principles of Contract Law; Mandatory elements of a legally enforceable contract; Terms and conditions; Remedies; Interpreting contract provisions
	• Contracting Methods; Contracting methods—competitive and noncompetitive; Purchase cards, imprest funds or petty cash; Sealed bidding, two-step sealed bidding, competitive negotiation and competitive proposals;
	• Purchase agreements vs. contracts; Single-source negotiation vs. sole-source negotiation
	 Developing Contract Pricing Agreements; Uncertainty and risk in contract pricing
	• Categories and types of contracts; Incentive; Fixed-price; Time and materials; Cost-reimbursement ; Selecting contract types
	 Pre-award Phase: Buyer activities –Plan purchases and acquisitions; Plan contracting; Request response; Bid/no-bid decision; Bid or proposal preparation
	Award Phase: Source selection process; Selection criteria:
	management, technical and price criteria; Evaluation standards, Evaluation procedures
	 Negotiation objectives; Negotiating a contract; Tactics and counter-tactics; Document agreement or walk away
	Contract Administration: Key contract administration policies, Continued communication, Tasks for Client and Contractor
	Contract analysis: Performance and progress; Records, files and documentation
	Resolving claims and disputes
	• Termination
	Case studies
DURATION	Three (3) days
VENUE – Institute, Location	Xavier Institute of Management, Bhubaneshwar
METHOD/S	Interactive presentations, Practical working exercises
COST (Indicative approximation)	INR 13000 per head per day

TITLE	Contract administration and procurement procedures – FIDIC conditions
TARGET GROUP	PIU: PD, DF, PM, All Dy PM, POUDD: SE & select EE;RMC: Dy CEO, select SE's and select EE's, OS, CAO.
	DWSD: SE (Urban Circle) and select EE
OBJECTIVE / S	After the training the participants will be able to 1. Comprehend the various FIDIC conditions of contract
	2. Carry out procurement using FIDIC conditions of contract
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	 Introduction Principles Background to FIDIC Contracts Harmonisation based on the type of project FIDIC Family of Conditions of Contract Principles and general review of the FIDIC Contracts
	 Features Structure of the FIDIC contracts Clauses and other documents in the Contracts for Construction and for Plant & Design-Build Forms Terms and definitions User Friendliness
	 Design Responsibilities and Workmanship Obligations and quality procedures for design and construction
	 Contract Preparation Procedures during Construction Project management procedures during construction Financial Procedures Procedures for variations and payment
	 Risk allocation Works contract and service agreement discrepancies Claims Procedures Procedures for submitting and dealing with claims by the Employer and the Contractor Dispute Resolution The Dispute Adjudication Board and other dispute resolution procedures
	Case Study
DURATION	Three (3) Days
VENUE – Institute, Location	In-House, RANCHI
FACULTY	By invitation from NICMAR (PUNE)
METHOD/S	Interactive presentations
COST (Indicative approximation) Source: JICA Study Team	INR 4700 per head per day

TITLE	Understanding JICA procurement procedures
TARGET GROUP	PIU: PD, PM, All Dy PM, all FE, Env Er.
	UDD: SE & select EE;
	RMC: select SE's and EE's.
	DWSD: SE (Urban Circle) and select EE
OBJECTIVE / S	After the training the participants will be able to 1. Understand the concepts
	2. Apply JICA procurement principles to current / future projects
KEY CONCEPTS- INDICATIVE	Definition; Description and uses;
PROGRAMME OUTLINE	• Concepts and Principles of Contract Law with respect to JICA; Terms and conditions; Interpreting contract provisions
	 Contracting methods—competitive and non-competitive; Sealed bidding, two-step sealed bidding, competitive negotiation and competitive proposals;
	• JICA prescribed agreements vs. contracts; Single-source negotiation vs. sole-source negotiation
	• Categories and types of contracts; Incentive; Fixed-price; Time and materials; Cost-reimbursement ; Selecting contract types
	Contract Administration: Key contract administration policies, Continued communication, Tasks for Client and Contractor
	Contract analysis: Performance and progress; Records, files and documentation
	• Termination
	Case studies
DURATION	One (1) day workshop
FACULTY	By invitation from JICA, New delhi
VENUE – Institute, Location	In-House Ranchi
METHOD/S	Interactive presentations, Practical working exercises
COST (Indicative approximation)	INR 2500 per head per day

TITLE	Quality Assurance Systems and TQM for projects	
TARGET GROUP	PIU: PD, PM, All Dy PM, all FE, Env Er.	
	UDD: SE & select EE;	
	RMC: select SE's and EE's.	
	DWSD: SE (Urban Circle) and select EE	
OBJECTIVE / S	After the training the participants will be able to 1. Explain the meaning of total quality management (TQM)	
	2. Identify costs of quality	
	3. Apply tools for identifying and solving quality problems	
KEY CONCEPTS- INDICATIVE	Overview	
PROGRAMME OUTLINE	• Elements of total quality management (TQM)	
	o Customer-focused	
	 Total employee involvement 	
	o Process-centered	
	• Integrated system	
	 Continual improvement 	
	• Fact-based decision making	
	o Communications	
	TQM practices	
	o cross-functional outcome	
	 process management supplier quality management 	
	 strategic planning cross-functional training 	
	 employee involvement 	
	How to implement Quality Assurance	
	• Quality management plan	
	• Quality metrics	
	 Process improvement plan 	
	• Work performance information	
	 Approved change requests 	
	 Quality control measurements 	
	 Quality Assurance Outputs 	
	 Requested changes 	
	 Recommended corrective actions 	
	Project management plan updates	
	Quality Control Methods	
	• Statistical Quality Control with sampling by attributes	
	• Statistical Quality Control with sampling by variables	
	• The seven tools:	
	 Cause-and-effect diagram (also known as the "fishbone" or Ishikawa diagram) 	
	 Check sheet 	
	 Cneck sneet Control chart 	
	 Histogram 	
	 Pareto chart 	
	 Faleto chart Scatter diagram 	
	Scatter diagramStratification (alternately, flow chart or run chart)	
	• Exercise to apply each of the above	
	Quality Audit	

	• What is an Audit?	
	 Types of Audit 	
	 Internal and External Audits 	
	 The purpose of an Internal Audit System 	
	 The structure of an Internal Audit System 	
	• The basic approaches to Auditing	
	 Organizing Audits: Management 	
	o Auditors	
	 Exercise in Auditing 	
DURATION	Five (5) days	
VENUE – Institute, Location	In-house, Ranchi	
FACULTY	By invitation from NICMAR (PUNE)	
METHOD/S	Interactive presentations, Practical working exercises	
COST (Indicative approximation)	INR 4700 per head per day	

TITLE	Quality control tests in field and laboratories	
TARGET GROUP	PIU: all FE's	
	UDD: Select AE's;	
	RMC: all AE's.	
	DWSD: Select AE's	
OBJECTIVE / S	After the training the participants will be able to 1. Understand the need for conducting the various field and lab test 2. Carry out each test and present results in the prescribed format	
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	 For sewerage project Field test Standard Penetration Test Slump test; concrete mix density; water cement ratio GSB Compaction (Sand replacement) test; Lab test Sand content in soil; liquid limit; plastic limit; CBR Index aggregate crushing value, impact value; water quality; Steel Tensile test; Concrete cube test (7 & 28 days) Field Demonstrations Practical working exercises 	
DURATION	Three (3) days	
VENUE – Institute, Location	Birla Institute of Technology, Mesra Ranchi	
METHOD/S	Interactive presentations, Field Demonstrations Practical working exercises	
COST (Indicative approximation)	INR 3000 per head per day	

TITLE	Land acquisition, resettlement and rehabilitation policies
TARGET GROUP	PIU: PM, DF, Select Dy PM, CDO, PO, LO
	UDD: SE & select EE;
	RMC: Dy CEO, Select EE, OS, Town Planner.
	DWSD: SE (Urban Circle) and select EE
OBJECTIVE / S	After the Seminar the participants will be able to
	1. Understand the statutes and clauses of LA act
	2. Apply the guidelines in infrastructure projects
KEY CONCEPTS- INDICATIVE	GoI & GoO Land acquisition, resettlement and rehabilitation policies
PROGRAMME OUTLINE	Land Acquisition Act
	Ownerships of land
	 Action necessary for acquisition depending on ownership of land Private land Government land Defence land
	Accuracy of DPR from Land acquisition considerations
	Importance of accurate valuation
	Role of OWD officers in land Acquisition
	Procedure and documentation
	How to expedite the procedure
DURATION	One (1) day
VENUE – Institute, Location	In-House, Ranchi
FACULTY	By invitation from ASCI
TRAINING METHODS	Interactive presentations, group discussions
COST (Indicative approximation)	INR 4500 per head per day

TITLE	Understanding requirements of Construction Supervision (Project
	Implementation)
TARGET GROUP	PIU: PD, PM, All Dy PM, all FE, Env Er.
	UDD: SE & select EE;
	RMC: select SE's and EE's.
	DWSD: SE (Urban Circle) and select EE
OBJECTIVE / S	After the training the participants will be able to
	1. Prepare a checklist / Do-list to follow when supervising projects
	2. Implement best practices of construction supervision
	3. Execute timely closure to the projects supervised
KEY CONCEPTS- INDICATIVE	Overview of contract documents
PROGRAMME OUTLINE	Roles of Employer, Engineer and Contractor, Contract Administration
	Encumbrances at site, social and environment concerns
	Specifications and standards
	Quality control, testing procedures, recording of results
	Quantity measurements and checks, recording of measurement
	Variation Orders, fixing of rates
	Liquidated Damages, Updating of Program, Extension of time
	Determination of Contract
	Dispute Resolution Mechanisms
	Processing of IPCs and Final Payments
	Supervision during Defect Liability Period
	Case Study
DURATION	Two (2) days
VENUE – Institute, Location	In-House, Ranchi
FACULTY	By invitation from ESCI
METHOD/S	Interactive presentations
COST (Indicative approximation)	INR 4500 per head per day

TITLE	How to monitor and report physical & financial progress of work
TARGET GROUP	PIU: All Dy PM, all FE
	UDD: SE & select EE;
	RMC: select SE's and EE's.
	DWSD: SE (Urban Circle) and select EE
OBJECTIVE / S	After the training the participants will be able to
	1. Understand the need for progress monitoring and reporting
	2. Monitor and report physical & financial progress of work in the prescribed form
KEY CONCEPTS- INDICATIVE	• Overview – principles
PROGRAMME OUTLINE	 Choice of Key Performance Indicators Traditional Physical Progress Measurement Limits Effort-Based KPIs Comparison
	Overall Physical Progress Index
	 Weight Matrix Overall Physical Progress Equation
	 Overall Physical Progress Equation 'S Curve' of the Overall Physical Progress
	Baseline to Measure Against
	• Planned Baseline
	Ideal BaselineComparison
	Visual Management
	Document Management System to view
	• Construction equipment details, Meeting/Site visit reports
	 Contract & Correspondence documents, Quality Reports, etc.
	Executive summary of progress details (including latest, location map, Linear & Numerical progress details)
	• Following type of information from site office
	• Contractor Schedule
 Work Progress Financial Progress Bill information Quality Maintenan 	
	e
	Customised reports
	 Physical Progress Report – Quantity wise Physical Progress Bar Chart
	 Financial Progress Report
	• Bill payment status report
	-
	Practical working exercises
DURATION	Three (3) Days
VENUE – Institute, Location	In- house, Ranchi
FACULTY	By invitation from Project Management Institute, NOIDA
METHOD/S	Interactive group discussions, Group Discussions, Working exercises
COST (Indicative approximation)	INR 4200 per head

TITLE	How to carry out topographical surveys, using total station equipment
TARGET GROUP	PIU: all FE's UDD: Select AE's; RMC: all AE's. DWSD: Select AE's
OBJECTIVE / S	After the training the participants will be able to 1. Familiar with every component of the Total Station equipment 2. Take measurement with the equipment 3. Collect and present survey data
KEY CONCEPTS- INDICATIVE PROGRAMME OUTLINE	 Total Station Technology Advantages of Total Station Surveying Limitations Equipment handling procedure
	Components Used in Total Station Surveying RTK Positioning Measurements Coordinate measurement Angle measurement
	 Distance measurement Data processing, recording and data presentation Exercise - Practice session (each participant to practice)
DURATION	Two (2) days
VENUE – Institute, Location	Birla Institute of Technology, Mesra Ranchi
TRAINING METHODS	Interactive presentations, Field Demonstration and practice sessions
COST (Indicative approximation)	INR 3000 per head per day

TITLE	How to use GIS and GPS
TARGET GROUP	PIU: all FE's
	UDD : Select AE's;
	RMC: all AE's.
	DWSD: Select AE's
OBJECTIVE / S	After the training the participants will be able to 1. Comprehend the concept of GPS
	2. Use GIS techniques
	3. Confidently use the GIS and GIS equipment to record data
KEY CONCEPTS- INDICATIVE	• GPS
PROGRAMME OUTLINE	• Basic concept of GPS
TROORAMME OUTLINE	• Structure
	Space segmentControl segment
	 User segment
	• Applications
	 Message format
	 Satellite frequencies
	 Demodulation and decoding
	• Navigation equations
	• Bancroft's method
	 Multidimensional Newton-Raphson calculations
	• Error sources and analysis
	 Accuracy enhancement and surveying
	• Augmentation
	• Precise monitoring
	 Equipment handling procedure
	• GIS
	ApplicationsGIS techniques and technology
	 GIS techniques and technology Relating information from different sources
	 GIS uncertainties
	 Data representation
	o Data capture
	• Raster-to-vector translation
	• Projections, coordinate systems, and registration
	• Spatial analysis with GIS
	• Slope and aspect
	• Data analysis
	• Topological 17erkeley17
	• Geometric Networks
	• Hydrological 17erkeley17
	Cartographic 17erkeley17Map overlay
	 Map overlay Geo-statistics
	 Address geo-coding
	 Reverse geo-coding
	 Multiple Criteria Decision Analysis
	• Data output and cartography
	• Graphic display techniques
	• Spatial Extract, Transform, Load (ETL) software
	• GIS data mining
	• OGC standards
	 Equipment handling procedure

	• File operations (open & close MapInfo; transfer files
	between directories; add & delete files & workspaces)
	• Move around an open Mapper (pan, zoom, change scale,
	grabber etc.)
	• Examine & interpret data in a Mapper or browser view
	• Change the appearance of a map
	• Use of labelling & the I Tool; use of layer control
	• Carrying out simple queries (by attribute & by location)
	• Simple thematic mapping & graphing
	 Map layout; making & printing a map
	 Adding a field to a browser table; attribute data entry;
	computing the contents of a field
	 Importing data from a spreadsheet
	 Simple SQL queries
	• An integrating exercise
	• The underpinning principles of a GIS
	 Directories & folder structures
	• Difference between vector & raster data
	• The importance of coordinate & IDs
	• The difference between graphic features & their attributes
	• What is thematic mapping; main types; where & how to use
	• What are the main GIS functions
	Practical exercises to reinforce topics covered
DURATION	Three (3) Days
VENUE – Institute, Location	Birla Institute of Technology, Mesra Ranchi
TRAINING METHODS	Interactive presentations, Demonstrations, Example exercise
COST (Indicative approximation)	INR 3000 per head per day
Source, IICA Study Teem	· ·

TITLE	How to prepare a Traffic Management Plan
TARGET GROUP	PIU: PM, Select Dy PM, select FE
	UDD: Select EE's;
	RMC: all AE's.
	DWSD: Select EE's
<i>OBJECTIVE / S</i>	After the training the participants will be able to
	1. Comprehend the national (IRC & UTIPEC) and international guidelines
	2. Understand the use and principles of traffic signs and design the same using IRC 67: 2012
	3. Understand the use and principles of road markings and design the same using IRC 37
KEY CONCEPTS- INDICATIVE	Traffic management at construction zones
PROGRAMME OUTLINE	Safety at constriction zones
	Traffic management measures at accident sites
	• Traffic management planning in urban areas, rural areas and intercity sections
	• Select and design urban street furniture such as bollards, guard rails and crash barriers
	• Design the bus stops and bus bays for urban conditions
DURATION	Three (3) Days
VENUE – Institute, Location	In-House Ranchi, New Delhi
FACULTY	By invitation from CRRI
TRAINING METHODS	Interactive presentations and practice sessions
COST (Indicative approximation)	INR 3600 per head per day

TITLE	Financial Accounting and Management in Projects
TARGET GROUP	PIU: PM, DF, PO, LO, AO, AAO
	UDD: Select Jt Secy's, Select Dy Secy's, Select SE; Select EE
	RMC: Dy. CEO, OS, CAO, AO.
	DWSD: -
OBJECTIVE / S	After the training the participants will be able to
	1. understand succinctly financial accounting concepts
	2. comprehend different principles of financial accounting
	3. Understand Generally Accepted Accounting Principles (GAAP)
	4. Develop skills in analysing and interpreting financial and
	accounting information 5. Identify limitations of Financial Accounting
KEV CONCEPTS INDICATE	Introduction
KEY CONCEPTS- INDICATIVE	• Role of Financial Accounting
PROGRAMME OUTLINE	 Principles of Financial Accounting
	• Importance of Financial Accounting
	 Benefits of Financial Accounting Limitations of Financial Accounting
	Accounting Principles
	 Accounting Concepts and Conventions
	• Accounting Standards in India and International Accounting
	Standards
	Information for decision making both financial and non-financial
	• Understanding and analysing the balance sheet, income statement and cash flow statement
	Planning, budgeting and cash flow forecasting
	Cash flow and working capital management
	Understanding and managing costs
	Break-even and contribution analysis
	Driving and monitoring divisional performance
	Preparing and evaluating capital project appraisals
	How to drive and monitor performance and create value
	Case studies
	Practice exercise
DURATION	Two (2) Days
VENUE – Institute, Location	In- house Ranchi,
FACULTY	By invitation from ASCI (HYD)
TRAINING METHODS	Interactive presentations, Case studies, Example exercise
COST (Indicative approximation)	INR 4500 per head per day

TITLE	Understanding commercial banking operations and statutory requirements under IT Act (TDS) and Service Tax for contract management
TARGET GROUP	PIU: PM, DF, PO, LO, AO, AAO
	UDD: Select Jt Secy's, Select Dy Secy's, Select SE; Select EE
	RMC: Dy. CEO, OS, CAO, AO.
	DWSD: -
OBJECTIVE / S	After the training the participants will be able to
	1. Conversant with different commercial practices and options
	2. Efficiently use banking facilities
	3. Facilitate compliance with tax rules
KEY CONCEPTS-	Commercial banking practices and procedures
	How to open an LC
	How to prepare BG's
	Procedure for encashing a BG
	• Provisions relating to TDS under IT ACT and provisions of Service tax law
DURATION	Two (2) Days
VENUE – Institute, Location	In- house Ranchi,
FACULTY	By invitation from ASCI (HYD)
TRAINING METHODS	Interactive presentations, Case studies, Example exercise
COST (Indicative approximation)	INR 4500 per head per day

TITLE	Concepts of Asset management
TARGET GROUP	PIU: PM, MISO, select Comp Op,
	UDD: Select AE, select Comp Op
	RMC: Dy. CEO, Comp Programmer, select Comp Op.
	DWSD: Select EE, select Comp Op.
OBJECTIVE / S	After the Workshop the participants will be able to: 1. Understand the role asset management plays in supporting organizational strategy and objectives 2. Comprehend the principles of asset whole life costing 3. Describe the role of Risk Management in effective Asset Management 4. Measure the Asset Management performance
KEY CONCEPTS - INDICATIVE	Introduction to Asset Management
PROGRAMME OUTLINE	 What is Asset Management? The benefits of AM over traditional approaches Asset Management Roles & Responsibilities
	 Asset Management Policy Outline an Asset Management Policy. Relevance of Policies and Strategies Overview of developing a policy
	 Asset Management Strategy What is an Asset Management Strategy? Outline an Asset Management Strategy Overview of Developing a Strategy
	 Asset Management Planning What is an Asset Management Plan? Outline of an Asset Management Plan Overview of developing a Plan
	 Whole of Life Costing Outline Whole of Life Costing principles Total Cost of Ownership Case Study – Replace v Repair Importance of Risk Management in Asset Management
	Importance of measuring Asset Management performance
	Benefits of a Structured Approach to Asset Management
	Case Study – Outline the benefits of AM
DURATION	Two (2) days
VENUE – Institute, Location	In-House, Ranchi
FACULTY	By invitation from ESCI
METHOD/S	Interactive presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 4500 per head per day

TITLE	How to enter asset data, generate reports and manage asset e-register
TARGET GROUP	PIU: PM, MISO, select Comp Op,
	UDD: Select AE, select Comp Op
	RMC: Dy. CEO, Comp Programmer, select Comp Op.
	DWSD: Select EE, select Comp Op.
OBJECTIVE / S	After the training the participants will be able to
	1. Understand the need for maintaining an asset register
	2. Authenticate and enter correct data in the asset e-register
	3. Generate customised and annual reports for management review
KEY CONCEPTS- INDICATIVE	Overview of asset management software
PROGRAMME OUTLINE	Basic data requirements
	• Data fields and data entry requirements
	How to prepare and present customized /general reports
	Example exercises
DURATION	Two (2) days
VENUE – Institute, Location	In-House, Ranchi
FACULTY	By invitation from ESCI
METHOD/S	Interactive presentations, Group discussions, Case studies
COST (Indicative approximation)	INR 3500 per head per day
Special requirements	One computer should be available per participant

TITLE	How to operate MS Office including MS Word and MS Excel, internet
	explorer, send e-mails and carry out electronic data transfer
TARGET GROUP	PIU: select staff who are not conversant with computers - 5
	UDD: select staff who are not conversant with computers - 4
	RMC: select staff who are not conversant with computers -4
	DWSD: select staff who are not conversant with computers -2
OBJECTIVE / S	After the training the participants will be able to
	1. Connect computer hardware
	2. Prepare letters and simple reports in MS Word
	3. Tabulate information in MS Excel
	4. Carry out web search and send emails/ transfer data
	5. Use maintenance software
KEY CONCEPTS- INDICATIVE	Using Windows XP
PROGRAMME OUTLINE	Working in MS Word
	Working in MS Excel
	Zipping / Unzipping files & folders
	Internet Technologies
	anti virus software usage
	Back up procedures
	Exercises
DURATION	Five (5) Days
VENUE – Institute, Location	In-House
FACULTY	National Informatic Centre (NIC), Ranchi
TRAINING METHODS	Interactive presentations, Demonstrations, Example exercise
COST (Indicative approximation)	INR 3500 per head per day
Special requirements	One computer should be available per participant

Appendix C1.4 Training / Workshop / Seminar Cost Estimation

1) Per participant Per Day Cost when visiting the institute

					Unit: Rs.
	Per participant pe				
Institute	Institute Fee +	D A*	Travel	Total	Rounded off
	Lodge + Board	Rs.	cost*	Rs.	Rs
	Rs.		Rs.		
IIM (CAL)	15000	350	2000	17350	17500
PMI (NOIDA)	10000	350	2500	12850	13000
ESCI (HYD)	4000	350	2500	6850	7000
XIMB (BBI)	12000	350	650	13000	13000
NICMAR (PUNE)	4000	350	2500	6850	7000
BIT (Ranchi)	2000	350	500	2850	3000
ASCI (HYD)	4000	350	2500	6850	7000
CRRI (DEL)	2000	350	2500	4850	5000

*Although, TA, DA is slightly varying for the different levels, for budgeting purpose the highest figures have been considered

Source: JICA Study Team

2) Per participants Per Day Cost when faculty is invited (group of 3 faculty) for 3-5 day programmes

-			-					Unit: Rs.
Institute	Visiting	Visiting	Venue	Total	Per	Misc.	Participa	Total
	Faculty	Faculty	cost		participant	cost, Tea,	nt TA +	
	Fee	TA + DA			per day cost	snacks,	DA	
	Per day				(20	stationery		
			ļ		participants)			
PMI (NOIDA)	50000	0	2500	52500	2625	1000	500	4200
ESCI (HYD)	45000	9000	2500	56500	2855	1000	500	4500
XIMB (BBI)	60000	0	2500	62500	3125	1000	500	4700
NICMAR (PUNE)	60000	0	2500	62500	3125	1000	500	4700
ASCI (HYD)	45000	9000	2500	56500	2855	1000	500	4500
CRRI (DEL)	30000	9000	2500	41500	2075	1000	500	3600

3) Per participants Per Day Cost when faculty (group of 2 faculty) is invited for 1-2 day workshops

Unit: Rs.

Institute	Visiting Faculty Fee Per day	Visiting Faculty TA + DA	Venue cost	Total	Per participant per day cost (20 participants)	Misc. cost Tea, snacks stationary	Partici pant TA+D A	Total	Rounded off
IN-House (Ranchi)	0	0	0	0	0	2000 (incl. venue cost)	500	2500	2500
PMI (NOIDA)	18000	0	2500	20500	1025	1000	500	2525	2500
ESCI (HYD)	30000	6000	2500	38500	1925	1000	500	3425	3500
XIMB (BBI)	40000	0	2500	42500	2125	1000	500	3625	3600
NICMAR (PUNE)	40000	0	2500	42500	2125	1000	500	3625	3600
ASCI (HYD)	30000	6000	2500	38500	1925	1000	500	3425	3500
CRRI (DEL)	12000	6000	2500	20500	1025	1000	500	2525	2500

Source: JICA Study Team

4) Study Tours -

i. In-Country exposure visits for 6 days (10 participants)

Unit: Rs.

Cost head	Per participant cost	Amount
Travel	20000	200000
Lodge & Board	30000	300000
Visit management charges	9000	90000
Total	59000	590000

Source: JICA Study Team

• Say INR 6,00,000/- per visit

ii. Overseas exposure visits for 5 days (10 participants)

Unit: Rs.

Cost head	Per participant cost	Amount
Travel (incl. local travel plus visa cost)	65000	650000
Lodge & Board (@ US\$ 120)	39000	390000
Visit management fee/charges	50000	500000
Total	154000	1540000

Source: JICA Study Team

INR 16,00,000/- per visit annually

_		Es	stimated	number o	f participa	nts	Training	Course	Per day	Total
S. No.	Course Title	PIU	UDD	RMC	DWSD	Total	Provider	duration (Days)	Per head cost (INR)	INR
1.	Understanding leadership and management	5	4	5	1	15	IIM, Kolkata	3	17500	787500
2.	Understanding project management concepts	7	4	9	5	25	PMI NOIDA	5	4200	525000
3.	How to use Primavera / MS Project software for project management	17	2	4	2	25	PMI NOIDA	5	4200	525000
4.	Construction of sewerage system - planning, norms, and institutional issues	20	4	6	5	35	ESCI Hyderabad	3	4500	472500
5.	Understanding contract management process	8	2	5	2	17	XIM Bhubneshwar	3	13000	663000
6.	Contract administration and procurement procedures – FIDIC conditions	6	4	4	1	15	NICMAR Pune	3	4700	211500
7.	Understanding JICA procurement procedures	6	4	4	1	15	JICA, N Delhi	1	2500	37500
8.	Quality Assurance Systems and TQM for sewerage projects	20	4	6	5	35	NICMAR Pune	5	4700	822500
9.	Quality control tests in field and laboratories	13	2	5	4	24	BIT Mesra Ranchi	3	3000	216000
10.	Land acquisition, resettlement and rehabilitation policies	5	2	6	2	15	ASCI Hyderabad	2	4500	135000
11.	Understanding requirements of construction supervision (Project implementation)	20	4	6	5	35	ESCI Hyderabad	2	4500	315000
12.	How to monitor and report physical & financial progress of work	17	2	4	2	25	PMI NOIDA	3	4200	315000
13.	How to carry out topographical surveys, using total station equipment	13	2	5	4	24	BIT Mesra Ranchi	2	3000	144000

Appendix C1.5 Summary – Capacity Building for PIU staff

PREPARATORY SURVEY ON RANCHI SEWERAGE PROJECT

~		Es	stimated	number o	f participa	nts	Training	Course	e Per day	Total
S. No.	Course Title	PIU	UDD	RMC	DWSD	Total	Provider	duration (Days)	Per head cost (INR)	INR
14.	How to use GIS and GPS	13	2	5	4	24	BIT Mesra Ranchi	3	3000	216000
15.	How to prepare a traffic management plan	5	2	5	4	16	CRRI, N Delhi	3	3600	172800
16.	Financial accounting and management in Projects	6	4	5	-	15	ASCI Hyderabad	2	4500	135000
17.	Understanding commercial banking operations and statutory requirements under IT Act (TDS) and Service Tax for contract management	6	4	5	-	15	ASCI Hyderabad	2	4500	135000
18.	Concepts of asset management	4	2	4	2	12	ESCI Hyderabad	2	4500	108000
19.	How to enter asset data, generate reports and manage asset e-register	4	2	4	2	12	ESCI Hyderabad	2	4500	108000
20.	How to operate MS Office including MS Word and MS Excel, internet explorer, send e-mails and carry out electronic data transfer	5	4	4	2	15	NIC Ranchi	5	3500	262500
	TOTAL							59		6306800

Source: JICA Study Team

s.	D	esignation		Workload Distributio	n
No	Assistant Engineer	Junior Engineer	Ward No	Area	Population
Zone 1	Appendix C1.0 O & M Designation Assistant Engineer Junior Engineer (9 Wards) Junior Engineer: JE1-1 (3 WARDS) JE1-2 (3 WARDS) AE1-1 (9 WARDS) JE1-2 (3 WARDS) Junior Engineer: JE1-3 (3 WARDS) e 2 (30 Wards) Image: Colspan="2">Colspan="2"Colspan="2				•
			1	3.32	9897
		Junior Engineer:	2		34451
		-	32		24501
			Total	11.09	68849
			3	4.07	13046
	Assistant Engineer:	Junior Engineer:	4	8.78	34657
1	AE1-1 (9 WARDS)	JE1-2 (3 WARDS)	5	7.97	19139
			Total	20.82	66842
			33	1.18	17228
		Junior Engineer:	34	2.26	28035
		Junior Engineer Junior Engineer: JE1-1 (3 WARDS) Junior Engineer: JE1-2 (3 WARDS) Junior Engineer:	35	2.79	13931
			1 3.32 Engineer: 2 6.47 3 WARDS) 32 1.30 Total 11.09 3 4.07 Engineer: 4 8.78 3 WARDS) 5 7.97 Total 20.82 33 1.18 Engineer: 34 2.26 3 WARDS) 35 2.79 Total 6.23 Engineer: 31 0.56 3 WARDS) 36 5.94 Total 7.21 Engineer: 21 1.09 22 1.48 22 5 WARDS) 24 0.84 25 0.75 0.75	59194	
Zon	e 2 (30 Wards)				
			30	0.71	23,811
		Junior Engineer:	31	0.56	38,470
		JE2-1 (3 WARDS)	36	5.94	21,612
			Total	7.21	83,893
	Assistant Engineer:		21	1.09	13661
2	AE2-1 (8 WARDS)		22	1.48	12,735
		Junior Engineer:	23	0.56	9,049
		JE2-2 (5 WARDS)	24	0.84	14,319
			25	0.75	29102
			Total	4.72	78,866
			37	4.85	26759
		Junior Engineer:	29	2.17	31458
		JE2-3 (3 WARDS)	28	1.16	21261
			Total	8.18	79478
			15	1.18	15,065

Appendix C1.6 O & M Staff Distribution for sewerage works

			37	4.85	26759
		Junior Engineer:	29	2.17	31458
		JE2-3 (3 WARDS)	28	1.16	21261
			Total	8.18	79478
			15	1.18	15,065
3	Assistant Engineer:		16	0.51	15,583
	AE2-2 (9 WARDS)		17	0.67	13,857
		Junior Engineer:	18	0.29	7,575
		JE2-4 (3 WARDS)	26	0.31	15,066
			27	0.65	16055
			Total	3.61	83,201

No	Assistant Engineer	Junior Engineer	Ward No	Area	Population
S.	De	esignation	V	Vorkload Distributio	n
			Total	6.86	81,867
				1.54	22,289
		JE2-6 (4 WARDS)	13	1.19	15451
		Junior Engineer:	12	1.72	41526 9476 12501 75252 17594 14315 12,218
	AE2-3 (7 WARDS)		10	1.32	14315
4	Assistant Engineer:		19	1.09	17594
			Total	8.49	41526 9476 12501 75252 17594 14315
		JE2-5 (4 WARDS)	20	0.74	12501
		Junior Engineer:	9	1.38	9476
-			8	4.19	41526
			6	2.18	11749

			7	11.13	27,997
			11	2.57	18,098
5	Assistant Engineer:	Junior Engineer:	48	2.56	21,540
	AE2-4 (WARDS)	JE2-7 (4 WARDS)	49	7.80	13,720
			Total	24.06	81,355

Zone 3 (9 Wards)

			38	7.45	25,654
		Junior Engineer:	43	1.95	20,193
		JE3-1 (3 WARDS)	44	1.07	16,094
			Total	10.47	61,941
	Junior Engineer:	т · р ·	45	1.16	23,479
-	Assistant Engineer:	-	52	10.78	26,552
6	AE3-1 (9 WARDS)	JE3-2 (2 WARDS)	Total	11.94	50,031
			47	2.49	18,575
			46	0.27	12,199
		Junior Engineer:	50	5.24	16,481
		JE3-3 (4 WARDS)	51	0.28	7,142
			Total	8.28	54,397

Zone 4 (7 Wards)

			39	8.68	18,139
			40	2.33	13,972
		Junior Engineer:	41	2.02	16,195
7	Assistant Engineer:	JE4-1 (4 WARDS)	42	12.23	15,767
	AE4-1 (7 WARDS)		Total	25.26	64,073
		Junior Engineer:	53	2.50	21,384
		JE4-2 (3 WARDS)	54	4.75	23,930

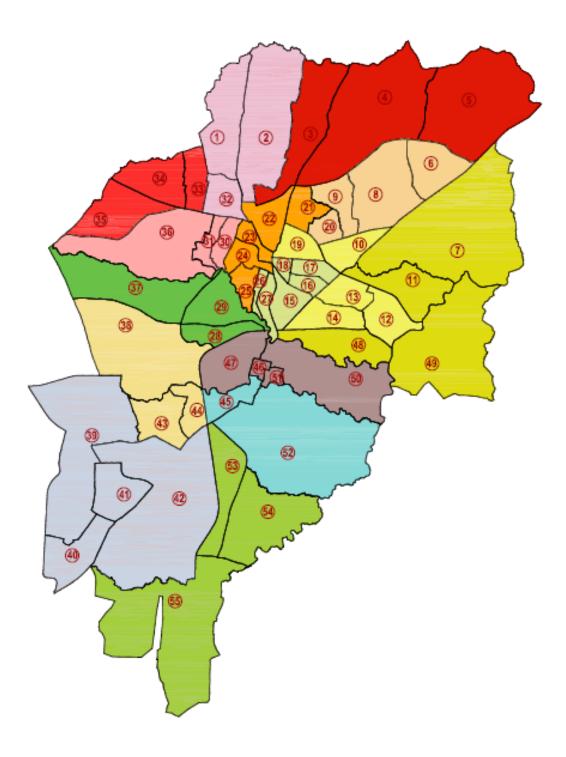
PREPARATORY SURVEY ON RANCHI SEWERAGE PROJECT

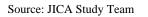
APPENDIX C1

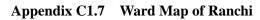
		10.20	
	Total		67.485
		1/	

Source: JICA Study Team

Ward Map of Ranchi







Appendix C1.8 Operation and Maintenance Job Descriptions of WSSW staff

Chief Engineer

- 1. Monitor and control operation & maintenance, policies, procedures, standards and schedules.
- 2. Perform executive authority with respect to financial management of operations & maintenance works.
- 3. Undertake periodic performance review/ inspection of the subordinates and provide direction, guidance in identifying deviations and resolving constraints against achieving the performance targets pertaining to the following elements:
 - Level and Quality of service delivery.
 - Monitoring for quality assurance
 - Cost reduction and Optimization of resource inputs
 - Actions to be taken relating to service interruptions and prescription of alternatives.
 - Generation data base to investigate and establish interdependence between service interruptions, systemic deficiencies and personnel failures.
 - Formulation, Implementation, monitoring and review of procedures pertaining Operations and Maintenance.
 - Standardization of procedures for advance information to consumers on service interruptions and alternatives, sanction of Estimates.
 - Issue of notices inviting tenders.
 - Evaluation of tenders.
 - Entering of agreements.
 - Preparation of budget, review and revision of budget estimates.
 - Procurement, storage and issue of materials, tools, plant and equipment.
 - Safety and Security of properties, material tools, plants and equipment Monitoring & Control
 - Compliance with prescribed servicing schedules for various machines, tools, plans and equipment designing log \ history cards
 - Preparation, Procurement, storage, updating and retrieval of utility plans.
 - Monitoring and review of personnel performance appraisal system
 - Monitor for identification of performance redundancy\wasteful practices\ skill obsolescence and correctives and in coordination with the other functions and departments

- Interfacing with personnel Department for developing appropriate skill\knowledge improvement programs
- Develop on line interface with consumer community in coordination with Head of Department of Public Relations.
- 4. Evaluate the suitability of contingency plans for service during delivery lean/draught years and cause revision where necessary.
- 5. Review periodically the physical and financial performances with reference to the targets set for each subordinate; identify the constraints in achieving the target and implementation schedules.
- 6. Monitor the functions of the Superintending Engineer, Executive Engineers and ensure appropriate reporting.
- 7. Evolve systems and structures for implementing unaccounted for water programmes and monitor the implementation
- Ensure timely preparation and approval of the Annual Work Plans, Budgets, and inputs for Financial Forecasting
- 9. Co-ordinate with other Heads of Departments in formulating manpower specifications and recruitment.
- 10. Develop procedures for performance evaluation.
- 11. Prescribe standards and procedures for inspection of installations, facilities, offices.
- 12. Participate / head various co-ordination/ review meetings and interaction with elected representatives and consumers

Superintending Engineer (Water Supply)

- 1. Carry out technical and administrative supervision of operation & maintenance procedures and schedules.
- 2. Render technical/ administrative assistance relating to operation & maintenance of water treatment plants, wells and transmission system to the Chief Engineer
- 3. Assume executive authority on maintenance of water sources.
- 4. Prescribe procedures for documenting, indexing, updating and timely retrieval of plans, plant layouts, pumping installations, treatment plants and distribution networks.
- 5. Coordinate with external organizations for resolving interface problems in maintaining water sources, interstate water transfer problems.
- 6. Install appropriate technical procedures for monitoring quality assurance systems.

- 7. Undertake review of storage position in reservoirs and drawing of raw water for treatment and report to Chief Engineer on sustainability.
- 8. Undertake review of the ground water extraction status from wells and decide on optimum drawing
- 9. Co-ordinate and monitor revenue collection functions of the Subordinate Engineer to achieve targets.
- 10. Analyze the public complaints pertaining to the jurisdiction received in and cause remedial measures for system and operational improvements.
- 11. Monitor the functions of the Executive Engineers, Assistant Engineers and ensure appropriate reporting.
- 12. Forecast individual, commercial and industrial demand for raw water and plan extraction & supply accordingly.
- 13. Undertake periodic performance review/inspection of the subordinates, and provide direction and guidance in achieving the performance targets pertaining to the following elements.
 - Water quality assurance
 - Cost reduction and optimization of resource inputs
 - Generation data base to investigate and establish interdependence between service interruptions, systemic deficiencies and personnel failures.
 - Formulation, implementation, monitoring and review of procedures pertaining operations and maintenance – quality assurance
 - Sanction of estimates, inviting and evaluating tenders, entering into agreements.
 - Preparation of budget, review and revision of budget estimates.
 - Procurement, storage and issue of materials, tools, plant and equipment.
 - Safety and security.
 - Compliance with prescribed servicing schedules for various machines, tools, plants and equipment- designing log\history cards
 - Updating treatment and transmission utility plans, source maps, canal systems
 - Monitoring and review of personnel performance appraisal system
 - Monitor for identification of performance redundancy \ wasteful practices \ skill obsolescence and correctives and in coordination with the other functions and Departments.
 - Develop online interface with industrial consumers.
 - Water distribution & pumping pattern, Head Works operations

- 14. Monitoring of supply of water to individual, commercial and industries & billing operations
- 15. Evolve systems and structures to ensure and monitor the quality of water supplied and services rendered to the consumer as per Citizen's charter and monitor implementation.
- 16. Monitor consumer complaints, redressed systems, operations, procedures and practices and initiate actions to improve efficiency of the system.
- 17. Review periodically the physical and financial performances with reference to the targets set, identify the constraints in achieving the targets and implementation schedules.
- 18. Take charge of technical and administrative control for procurement activities.
- Carry out action for inviting bids, issue of bid documents for works, equipments and purchase of materials.
- 20. Ensure timely preparation of tender documents.
- 21. Prepare agenda for appropriate authority for acceptance of the evaluated bids, cause appropriate action for issue of work order and execution of agreement.
- 22. Conduct pre-bid meetings, prepare minutes and cause communication to the concerned.
- 23. Assist the CAO in the preparation of annual budget.
- 24. Coordinate with government departments and lending agencies in the review of progress.
- 25. Cause preparation of monthly and periodical Progress Reports.
- 26. Prepare agenda for the Progress Review Meeting.
- 27. Prepare Annual Schedule of Rates.
- 28. Evaluate performance of contracts and carry out action for registration and up gradation of contractors and Vendors.

Superintending Engineer (Sewage)

- 1. Carry out technical and administrative supervision of operation & maintenance procedures and schedules.
- Render technical/ administrative assistance relating to operation & Maintenance of STP to the Chief Engineer
- 3. Prescribe procedures for documenting, indexing, updating and timely retrieval of plans, plant layouts, pumping installations, treatment plants and distribution networks.
- 4. Co-ordinate with external organizations for resolving interface problems in planning and executing works
- 5. Install appropriate technical procedures for monitoring quality assurance systems.

- 6. Analyze the public complaints pertaining to the jurisdiction received in and cause remedial measures for system and operational improvements.
- 7. Monitor the functions of the Executive Engineers, Assistant Engineers and ensure appropriate reporting.
- 8. Undertake periodic performance review/inspection of the subordinate units, and provide direction and guidance to the divisional heads in achieving the performance targets pertaining to the following elements:
 - Monitoring for quality assurance
 - Cost Reduction and Optimization of resource inputs
 - Generation data base to investigate and establish interdependence between service interruptions, systemic deficiencies and personnel failures.
 - Formulation, implementation, monitoring and review of procedures pertaining operations and maintenance
 - Sanction of estimates
 - Evaluation of tenders
 - Entering of agreements
 - Preparation of budget, review and revision of budget estimates
 - Procurement, storage and issue of materials, tools, plant and equipment
 - Safety and security of properties, material tools, plants and equipment- Monitoring & Control
 - Compliance with prescribed servicing schedules for various machines, tools, plants and equipment- designing log\history cards
 - Preparation, procurement, storage, updating and retrieval of utility plans.
 - Monitoring and review of Personnel performance appraisal system
 - Monitor for identification of performance redundancy\ wasteful practices\skill obsolescence and correctives and in coordination with the other functions and Departments.
 - Interfacing with personnel Department for developing appropriate skill\knowledge improvement programs
 - Develop on-line interface with Industrial Consumers
 - Environmental initiatives such as farm forestry
- 9. Co-ordinate and monitor revenue collection functions of the Subordinate Engineer to achieve targets.

- 10. Review periodically the physical and financial performances with reference to the targets, identify the constraints in achieving the targets and implementation schedules
- 11. Analyze the public complaints pertaining to the jurisdiction received in and cause remedial measures for system and operational improvements.
- 12. Monitor consumer complaints, redressed systems, operations, procedures and practices and initiate actions to improve efficiency of the system.
- 13. Take charge of technical and administrative control for procurement activities.
- 14. Carry out action for inviting bids, issue of bid documents for works, equipments and purchase of materials.
- 15. Ensure timely preparation of tender documents.
- 16. Prepare agenda for appropriate authority for acceptance of the evaluated bids, cause appropriate action for issue of work order and execution of agreement.
- 17. Conduct pre-bid meetings, prepare minutes and cause communication to the concerned.
- 18. Assist the CAO in the preparation of annual budget.
- 19. Coordinate with government departments and lending agencies in the review of progress.
- 20. Cause preparation of monthly and periodical Progress Reports.
- 21. Prepare agenda for the Progress Review Meeting.
- 22. Prepare Annual Schedule of Rates.
- 23. Evaluate performance of contracts and carry out action for registration and up gradation of contractors and Vendors.

Executive Engineer (Sewerage)

- 1. Carry out technical and administrative planning, scheduling, monitoring and control of the following functions:
 - collection and disposal of Sewage
 - operation & maintenance of sewage pumping stations.
 - Treatment of sewage, disposal of effluent, sludge
 - Ensuring compliance of treated effluent standards
 - Implementation and monitoring the operations pertaining to quality assurance.
 - consumer complaints on level and quality of service and their redress consumer service connections.

- norms and methods of implementation and monitoring the operations pertaining to quality assurance.
- pollution detection and control.
- metering, billing and collection.
- works implementation.
- generating data on extension of service delivery
- Documentation of defect analysis, maintenance of log cards on machines, plants and equipment in use at different workstations. Criteria for classification of machines and spares
- classification of machines and spares.
- scaling in respect of stores, tools, plants and inventory control.
- audit of fuel & energy consumption and optimization techniques.
- Safety procedures and emergency procedures.
- Compliance of pollution control board stipulations
- Execute responsibility of technical, administrative and financial functions, overseeing all O & M units in the Zone.
- Provide technical guidance to the operation & maintenance staff to ensure proper functioning of the sewerage and drainage system.
- 4. Perform supervisory responsibility of technical, administrative and financial functions with respect to the entire O&M of STP.
- 5. Coordinate with State Pollution Control Board for quality checks
- Carry out responsibility for the preparation of budget and ensure appropriate billing and collection procedures, raising timely demands, rectifying consumer accounts and achieving the collection targets.
- 7. Prepare zone sewerage and drainage plans by source, area and install matching pumping systems
- 8. Create a database for monitoring and control of service delivery.
- 9. Responsible for the implementation of established standard operating procedures relating to receipt and redress of complaints.
- 10. Ensure preparation of periodic list of defects, conduct failure analysis and ensure compliance at every workstation.
- 11. Implement the procedures pertaining to advance notification of interruptions in disruption to the sewerage services.

- 12. Ensure timely preparation of estimates, budgets, sanction of estimates etc.
- 13. Ensure implementation of prescribed procedures for indenting and receipt of material at stores.
- 14. Implement prescribed procedures for tendering and agreements of works
- 15. Facilitate preparation and getting approval from the competent authority for Notice Inviting Tenders.
- 16. Check 'Earnest Money Deposit' calculations, eligibility criteria of contractor and due date.
- 17. Check draft tender schedules and BOQ.
- 18. Arrange pre-bid meetings, prepare draft minutes and clarifications, issue bid documents to bidders.
- 19. Facilitate opening of tenders at the appointed time on the due date.
- 20. Evaluate the tenders; prepare draft evaluation report for placing before the competent authority.
- 21. Register contractors, renew/upgrade.
- 22. Prepare agenda for committees/authorities connected to the subject of contracts, tender procedure, registration of contractors etc.
- 23. Ensure implementation of procedures in respect of preparation, processing and approval of bills of payment.
- 24. Compile budget and revised estimates proposals for various projects.
- 25. Compile progress schedules and plans for the year for various projects.
- 26. Compile progress reports for review by senior officers
- 27. Compile project wise progress reports for forwarding to the government.
- 28. Prepare agenda for various progress review meetings.
- 29. Monitor the progress of projects, expenditure schedules and reimbursement claims.
- 30. Compile the annual schedule of rates.
- 31. Co-ordinate and correspond with various financial institutions regarding project funding
- 32. Compile progress and programme details for budget speeches and other meetings with the government.
- 33. Procure, index and arrange distribution of measurement books.
- 34. Carry out periodic random measurement checks and ensure recording of works and supplies.
- 35. Ensure maintenance of contractor ledger in accordance with prescribed procedure.
- 36. Ensure implementation of procedures for requisitioning funds/cash imprest; facilitate scrutinizing of accounts and approval by the Accounts Officer.
- 37. Facilitate audit of accounts at the end of prescribed accounting period and arrange for prompt address of audit objections.

- 38. Address timely processing of claims of employees and its disbursement
- 39. Undertake periodic review of manpower availability at the various workstations under charge and effect staff transfers to sustain balance
- 40. Undertake review of contactor's performance and take the needed action
- 41. Prepare action plans for disposal of redundant vehicles, equipment and scrap.
- 42. Prepare procedure for Normal/Emergency operations schedules of each source and ensure implementation.
- 43. Take personal charge of operations, render guidance to the personnel at critical places\serious breakdown in supply\ inundation during floods or other emergencies
- 44. Evolve appropriate systems\for data collection and documentation.
- 45. Co-ordinate the inspection visits of different officials /committee members
- 46. Arrange for redressal and reporting of C.M.s cell complaints/Parliamentary/ Legislative questions/Grievances of Consumer Associations on priority.
- 47. Facilitate preparation of legal briefs and monitor the progress of cases
- Facilitate preparation of reports on theft and accidents and their dispatch to relevant authorities' viz. H.O.D./Police.
- 49. Prepare and implement inspection schedules on material, machines, offices, projects, estates and operations.
- 50. Generate data on project conceptualization documents from units
- 51. Coordinate with Electricity Board, Traffic Police, Telecom Department etc, for resolving interface problems.
- 52. Preparation and periodic updating of systemic plans of the service area.
- 53. Prescribe methods and norms in respect of quality assurance, organize, implement and monitor their implementation.
- 54. Conduct periodic in-house meetings with unit staff to address issues
- 55. Conduct periodic needs assessment for skills updation of unit staff
- 56. Conduct periodic meetings with consumer forum/ open house programmes / collection campaign
- 57. Ensure communication systems and complaints cell are always operational.
- 58. Facilitate preparation and timely disbursements of staff entitlements/benefits
- 59. Ensure timely entries in the service Registers, completion and submission of documents for sanction of pensions
- 60. Carry out any other tasks as instructed by the senior officer.

Executive Engineer (Water Supply)

- 1. Initiate technical and administrative planning, scheduling, monitoring and control of the following functions:
 - augmentation, storage, treatment and distribution of water Supply.
 - operation & maintenance of water distribution stations, boosters, pumping stations.
 - leak detection and control of unaccounted for water.
 - consumer complaints on level and quality of service and their redress consumer service connections.
 - norms and methods of implementation and monitoring the operations pertaining to quality assurance.
 - Treatment of water and ensuring quality standards at treatment plant and distribution stations.
 - Operations pertaining to quality control
 - metering, billing and collection.
 - works implementation.
 - generating data on extension of service delivery
 - Documentation of defect analysis, maintenance of log cards on machines, plants and equipment in use at different workstations. Criteria for classification of machines and spares.
 - classification of machines and spares.
 - scaling in respect of stores, tools, plants and inventory control.
 - audit of fuel & energy consumption and optimization techniques.
 - Safety procedures and emergency procedures.
- Execute responsibility of technical, administrative and financial functions, overseeing all O & M units in the Zone.
- Provide technical guidance to the operation & Maintenance staff to ensure proper distribution of water systems.
- 4. Monitor, review and re-schedule inflows into service reservoirs and sumps, in accordance with delivery schedules in the relevant service area
- 5. Prepare and report to management every fortnight on the progress of the leak detection work and related issues

- 6. Review the progress of works against weekly target. Prepare draft status reports on number of leaks detected and rectified, number of house service connections/ferrules replaced and the amount of water saved.
- 7. Convene periodical meetings with the field units, review progress and problems encountered and solutions
- Carry out responsibility for the preparation of budget and ensure appropriate billing and collection procedures, raising timely demands, rectifying consumer accounts and achieving the collection targets.
- Facilitate preparation of distribution plans by source, area, time of delivery and install matching control system.
- 10. Undertake surprise checks of meters, detect unauthorized connections, usage/pilferage.
- 11. Undertake trend analysis of data on current status of water supply, billing and collection.
- 12. Create a database for monitoring and control of service delivery.
- 13. Responsible for the implementation of established standard operating procedures relating to receipt and redress of complaints.
- 14. Ensure preparation of periodic list of defects, conduct failure analysis and ensure compliance at every workstation.
- 15. Implement the procedures pertaining to advance notification of interruptions in water supply disruption to the services to public.
- 16. Ensure implementation of prescribed procedures for indenting and receipt of material for stores.
- 17. Ensure timely preparation of estimates, budgets, sanction of estimates etc
- 18. Implement prescribed procedures for tendering and agreements of works
- 19. Facilitate preparation and getting approval from the competent authority for Notice Inviting Tenders.
- 20. Check 'Earnest Money Deposit' calculations, eligibility criteria of contractor and due date.
- 21. Check draft tender schedules and BOQ.
- 22. Arrange pre-bid meetings, prepare draft minutes and clarifications, issue bid documents to bidders.
- 23. Facilitate opening of tenders at the appointed time on the due date.
- 24. Evaluate the tenders; prepare draft evaluation report for placing before the competent authority.
- 25. Register contractors, renew/upgrade.
- 26. Prepare agenda for committees/authorities connected to the subject of contracts, tender procedure, registration of contractors etc.

- 27. Ensure Implementation of procedures in respect of preparation, processing, and approval of bills of payment.
- 28. Compile budget and revised estimates proposals for various projects.
- 29. Compile progress schedules and plans for the year for various projects.
- 30. Compile progress reports for review by senior officers
- 31. Compile project wise progress reports for forwarding to the government.
- 32. Prepare agenda for various progress review meetings.
- 33. Monitor the progress of projects, expenditure schedules and reimbursement claims.
- 34. Compile the annual schedule of rates.
- 35. Co-ordinate and correspond with various financial institutions regarding project funding
- 36. Compile progress and programme details for budget speeches and other meetings with the government.
- 37. Procure, index and arrange distribution of measurement books.
- 38. Carry out periodic random measurement checks and ensure recording of works and supplies.
- 39. Ensure maintenance of contractor ledger in accordance with prescribed procedures
- 40. Facilitate audit of accounts at the end of prescribed accounting period and arrange for prompt address of audit objections.
- 41. Address timely processing of claims of employees and its disbursement
- 42. Undertake periodic review of manpower availability at the various workstations under charge and effect staff transfers to sustain balance
- 43. Address timely processing of claims of employees and its disbursement
- 44. Undertake periodic review of manpower availability at the various workstations under charge and effect staff transfers to sustain balance
- 45. Undertake review of contactor's performance and take the needed action
- 46. Prepare action plans for disposal of redundant vehicles, equipment and scrap.
- 47. Prepare procedure for Normal/Emergency operations schedules of each source and ensure implementation.
- 48. Take personal charge of operations, render guidance to the personnel at critical places/serious breakdown in supply/ inundation during floods or other emergencies
- 49. Evolve appropriate systems\for data collection and documentation.
- 50. Co-ordinate the inspection visits of different officials /committee members
- 51. Arrange for redressal and reporting of C.M.s cell complaints/Parliamentary/ Legislative questions/Grievances of Consumer Associations on priority.

- 52. Facilitate preparation of legal briefs and monitor the progress of cases
- 53. Facilitate preparation of reports on theft and accidents and their dispatch to relevant authorities' viz. H.O.D./Police.
- 54. Prepare and implement inspection schedules on material, machines, offices, projects, estates and operations.
- 55. Generate data on project conceptualization documents from units
- 56. Coordinate with Electricity Board, Traffic Police, Telecom Department etc, for resolving interface problems.
- 57. Preparation and periodic updating of systemic plans of the service area.
- 58. Prescribe methods and norms in respect of quality assurance, organize, implement and monitor their implementation.
- 59. Conduct periodic in-house meetings with unit staff to address issues
- 60. Conduct periodic needs assessment for skills updation of unit staff
- 61. Conduct periodic meetings with consumer forum/ open house programmes / collection campaign
- 62. Ensure communication systems and complaints cell are always operational.
- 63. Facilitate preparation and timely disbursements of staff entitlements/benefits
- 64. Ensure timely entries in the service Registers, completion and submission of documents for sanction of pensions
- 65. Carry out any other tasks as instructed by the senior officer.

Assistant Engineer (Sewage Treatment Plants)

- 1. Monitor and maintain records of
 - the operation of each of the treatment plant units, performance, and operational data of the sewage treatment plant.
 - the inflows into the sewage treatment plants and effluent outflows
 - the quality of the effluent to conform with the standards prescribed
- Monitor the implementation of quality control checks, ensure compliance of State Pollution Control Board norms
- 3. Initiate, organize and implement defect rectification and maintenance schedules
- 4. Monitor, guide and supervise maintenance of machines, plants, tools and other works.
- 5. Ensure proper disposal of effluent, grit, sludge etc.
- 6. Initiate timely record of measurements and check measurement of works.

- 7. Ensure timely preparation and processing of bills for onward transmission.
- 8. Assist the supervising officer in evaluating the performance of contractors.
- 9. Undertake scrutiny and sanction to the estimates.
- 10. Monitor the Unit staff's performance and render guidance to operating personnel in problem identification, action planning for their resolution, through periodic meetings
- 11. Carryout periodic physical verification of materials, tools and plants.
- 12. Coordinate with Electricity Board, and Pollution Control Board to resolve interface problems
- 13. Ensure procedures for receipt, stocking and issue of materials.
- 14. Ensure effective regulation of visitors at the source premises\workstations.
- 15. Facilitate preparation of annual/revised budgets in the unit, integrate upto next higher level and ensure timely submission for perusal and approval by the concerned.
- 16. Assist the Executive Engineer in the preparation of estimates, obtaining sanction of competent authority, calling tenders, settling contracts, procurement and issue of materials, and implementation of works.
- 17. Prepare estimates/sanction/award and implement works as per delegation.
- Assume responsibility and assist the Executive Engineer in general administration of office, labour & Staff Welfare, processing of legal matters, redressal of public grievances etc
- 19. Maintain farm forestry and other works relating to environmental safeguard.
- 20. Monitor and ensure recording of the daily supply of treated effluent to industrial consumers (if supplied).
- 21. Carry out any other tasks as instructed by the senior officer.

Assistant Engineer (Water Supply)

- 1 Carry out monitoring of water supply network and ensure sustenance of service delivery according to the prescribed scale.
- 2 Monitor service delivery during supply hours in accordance with the prescribed scale. Identify problems and plan for rectification of defects in water supply.
- 3 Initiate, organize and implement defect rectification as per citizen's charter and maintenance schedules.
- 4 Inspect and guide the day to day works during execution of the works
- 5 Monitor the implementation of quality control checks.
- 6 Monitor the leakage detection and rectification
- 7 Monitor the clogging clearance and evolve methods for rapid corrections.

- 8 Monitor the pollution ingress in water supply system and evolve methods for rapid correction.
- 9 Monitor trip sheets of water tankers.
- 10 Monitor, guide and supervise maintenance of machines, plants, tools and other works.
- 11 Formulate plans for carrying out various operations in emergency
- 12 Initiate timely check on measurement of works
- 13 Ensure timely preparation and processing of bills for onward transmission
- 14 Assist the senior officer in evaluating the performance of contractors.
- 15 Undertake scrutiny and sanction to the estimates
- 16 Monitor revenue collection, performance of collectors and ensure area targets are met.
- 17 Verify and ensure conformity with byelaws for effecting of new connection, and arrange for prompt onward transmission where necessary
- 18 Monitor the unit's performance and render guidance to operating personnel in problem identification and action planning
- 19 Guide Junior Engineers and first level supervisors in redressing the consumer grievances in their service areas
- 20 Take charge for conducting the tests and locating leaks and report the same, conducting re-tests whenever necessary till the prescribed leakage level is achieved.
- 21 Prepare estimates of water saved on implementation of the programme and prepared report about the tests conducted in various sub districts with the result and rectification of the leaks, consolidate the measurements recorded by field JE's and furnish the bills for payment
- 22 Monitor imprest accounts
- 23 Carryout periodic physical verification of materials, tools and plants.
- 24 Co-ordinate with Electricity Board, Telephones, and Traffic Police to resolve interface problems
- 25 Monitor the maintenance status
- 26 Report to Executive Engineer on day to day function besides appraising to technical & financial aspects.
- 27 Carry out any other tasks as instructed by the senior officer.

Assistant Engineer (Drainage & Sewerage)

- 1 Ensure sewer systems perform efficiently and ensure cleaning machines are maintained in proper working condition.
- 2 Monitor the maintenance status logbooks and other records in the concerned units and Pumping stations and render technical guidance on operation & maintenance.
- 3 Carryout periodic service inspection as per schedule on
 - i. Ventilators, manhole covers
 - ii. Condition of sump/UGT
 - iii. Sewage Pumping Stations
- 4 Ensure procedures for receipt, stocking and issue of materials.
- 5 Ensure effective regulation of visitors at the source premises workstations.
- 6 Formulate plans for carrying out various operations in emergency
- 7 Recommend the methods to be adopted and equipment to be deployed to suit field conditions.
- 8 Formulate and monitor cleaning schedules for tanks
- 9 Undertake periodic assessment of service delivery in the concerned sections, identify the holdup factors and initiate measures for restoring the service levels.
- 10 Monitor the serviceability status of meters
- 11 Monitor the implementation of Leak detection and rectification works.
- 12 Monitor revenue collection, performance of collectors and ensure area targets are met.
- 13 Cause preparation of annual/ revised budgets in each subordinate unit, integrate upto next higher level and ensure timely submission for perusal and approval by the concerned division.
- 14 Cause preparation of proposals for extension of service to new areas.
- 15 Inspect and guide the day to day works during execution of the works
- 16 Prepare estimates / sanction/ award and implement works as per delegation
- 17 Assist the Executive Engineer in the preparation of estimates, obtaining sanction of competent authority, calling tenders, settling contracts, procurement and issue of materials and implementation of works
- 18 Assist the Executive Engineer in general administration of the area office, labour & staff welfare, processing of legal matters, redressal of public grievances etc
- 19 Take charge of data collection and complaints monitoring
- 20 Report to Executive Engineer on day to day function besides appraising to technical & financial aspects.
- 21 Carry out any other tasks as instructed by the senior officer.

Junior Engineer (Sewerage)

- 1 Initiate action to identify defects in the sewerage system & implement rectification works
- 2 Undertake regular inspection visits in the service wards, identify problems with respect to sewerage, and initiate repairs or replacement (manhole covers) as necessary
- 3 Attend to the consumer complaints promptly adhering to the norms in the citizen's charter and according to instructions in force.
- 4 Ensure the complaints monitoring system is implemented properly by timely feedback of status of complaints.
- 5 Analyze recurring complaints for their causes and initiate steps to prevent such recurrence.
- 6 Follow established procedures and guidelines in the citizens Charter in providing consumer service connections after appropriate sanctions are accorded.
- 7 Prepare/Update the service area map with all details of services, sewers, scour points, by pass arrangements etc.
- 8 Maintain basic records and registers prescribed.
- 9 Implement prescribed measures on quality standards checks.
- 10 Ensure detection and rectification of pollution on priority
- 11 Cause timely detection and rectification of clogging and clearance in the concerned service area.
- 12 Initiate action to rectify the clogging noticed in the consumer premises by issuing notice etc
- 13 Monitor and undertake supervisory control on the progress of various ongoing works in the jurisdiction and ensure implementation of the prescribed norms on quality.
- 14 Supervise, measure, record and ensure timely submission of bills for payment
- 15 Undertake periodic review and ensure updating of utilities and systemic plans
- 16 Ensure co-ordination with other service agencies.
- 17 Maintain up-to-date record of stores, stock and material accounts.
- 18 Assist in the preparation of technical reports as required by Assistant Engineer/Executive Engineer.
- 19 Ensure implementation of prescribed preventive maintenance schedules and fire safe operations of plant, machinery, equipment
- 20 Ensure safe operating conditions for sewer cleaning crews.
- 21 Ensure reception and accommodation of consumers at the office and cash collection centre's
- 22 Ensure the physical and financial targets in respect of works and Revenue collections are achieved

- 23 Ensure and effect disconnection of services for default in payments during vacancy of the property such as demolition/reconstruction as per the existing norms & procedures.
- 24 Identify problems in operations, maintenance and initiate correctives and suggest improvements for implementation.
- 25 Assist Executive Engineer to organize consumer meets, identify consumer problems and ensure timely corrections and follow up.
- 26 Maintain imprest accounts and render accounts promptly
- 27 Maintain accounts of materials, stores and tools & plants
- 28 Ensure the RMCs property is not encroached upon
- 29 Ensure sewer obstructions are removed quickly
- 30 Ensure cleaning/ de-silting/disinfection of drains
- 31 Arrange to clear the septic tanks of consumers on request and on compliance of formalities.
- 32 Maintain master data of sewer connections, consumers, meters, properly owners, institutions etc.
- 33 Undertake the opening, timely recording and maintenance of:
 - i. Attendance register
 - ii. Inspection register
 - iii. Work order book
 - iv. Material at site accounts register
 - v. Tools & plants register
 - vi. Pay books
 - vii. Log books
 - viii. Test register
 - ix. Bills register
 - x. Progress register and any other register prescribed

Junior Engineer (Water supply)

- 1. Initiate & implement action for equitable supply of water in service areas
- 2. Initiate action to identify defects in the water supply system & implement rectification works
- 3. Undertake regular inspection visits in the service wards, identify problems with respect to water supply and initiate repairs as necessary

- 4. Attend to the consumer complaints promptly adhering to the norms in the citizen's charter and according to instructions in force.
- 5. Ensure the complaints monitoring system is implemented properly by timely feedback of status of complaints.
- 6. Analyze recurring complaints for their causes and initiate steps to prevent such recurrence.
- 7. Follow established procedures and guidelines in the citizens Charter in providing consumer service connections after appropriate sanctions are accorded.
- 8. Schedule and monitor the service delivery timings in the areas concerned to maintain water supply within the unit's jurisdiction in consultation with Assistant Engineer.
- Detect illegal connections/actions by the consumers and initiate proceedings and rectifications through Executive Engineer.
- 10. Prepare/ Update the service area map with all details of services, water mains, hydrants, bye pass arrangements etc.
- 11. Maintain basic records and registers prescribed.
- 12. Implement prescribed measures on quality standards checks.
- 13. Ensure detection and rectification of pollution on priority
- 14. Cause timely detection and rectification of leakage's and clearance in the concerned service area.
- 15. Initiate action to rectify the leakage noticed in the consumer premises by issuing notice etc
- 16. Monitor and undertake supervisory control on the progress of various ongoing works in the jurisdiction and ensure implementation of the prescribed norms on quality.
- 17. Supervise, measure, record and ensure timely submission of bills for payment
- 18. Undertake periodic review and ensure updating of utilities and systemic plans
- 19. Ensure co-ordination with other service agencies.
- 20. Maintain up-to-date record of stores, stock and material accounts.
- 21. Assist in the preparation of technical reports as required by Assistant Engineer/Executive Engineer.
- 22. Ensure implementation of prescribed preventive maintenance schedules and fire safe operations of plant, machinery, equipment
- 23. Schedule meter readings in the service area ensure compliance relating to meter reading, billing, ledger entries and service of bills
- 24. Monitor schedules of mobile water supply arrangements on a daily basis. Ensure timely supply of water to the static tanks. Ensure immediate repairs/ replacement of leaky tanks

- 25. Repair the public fountains promptly
- 26. Ensure cleaning/ de-silting/disinfection of public open wells in use
- 27. Ensure reception and accommodation of consumers at the office and cash collection centre's
- 28. Ensure the physical and financial targets in respect of works and Revenue collections are achieved
- 29. Ensure and effect disconnection of services for default in payments during vacancy of the property such as demolition/reconstruction as per the existing norms & procedures.
- 30. Identify problems in operations, maintenance and initiate correctives and suggest improvements for implementation.
- 31. Assist Executive Engineer to organize consumer meets, identify consumer problems and ensure timely corrections and follow up.
- 32. Maintain imprest accounts and render accounts promptly
- 33. Maintain accounts of materials, stores and tools & plants
- 34. Ensure the RMCs property is not encroached upon
- 35. Maintain master data of water connections, consumers, meters, properly owners, institutions etc.
- 36. Undertake the opening, timely recording and maintenance of:
 - i. Attendance register
 - ii. Inspection register
 - iii. Work order book
 - iv. Material at site accounts register
 - v. Tools & plants register
 - vi. Pay books
 - vii. Log books
 - viii. Test register
 - ix. Bills register
 - x. Progress register and any other register prescribed

Appendix D1

CHAPTER D1 ECONOMIC AND FINANCIAL EVALUATION

Revenue of Water Charge Append	IA 1/1.1																		
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Population in RMC Service Area		1,197,910	1,297,578	1,313,279	1,329,169	1,345,252	1,361,530	1,378,004	1,394,678	1,411,554	1,428,634	1,445,920	1,463,416	1,481,123	1,499,045	1,517,183	1,535,541	1,603,224	1,622,623
Coverage Ratio		50%	50%	50%	53%	56%	59%	62%	65%	68%	71%	74%	77%	80%	80%	80%	80%	80%	80%
Consumption per capita (I/day) Water Demand for Domestic Use (1000 m3/year)		135.0	135.0	135.0 32,356	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0 55,525	135.0	135.0	135.0	135.0	135.0	135.0
Charged Water Consumption (excl. well area and slum		29,514	31,969	32,330	34,712	37,121	39,583	42,099	44,670	47,297	49,981	52,723	55,525	58,386	59,092	59,807	60,531	63,199	63,964
area)	45%	13,281	14,386	14,560	15,621	16,704	17,812	18,944	20,101	21,284	22,491	23,725	24,986	26,274	26,592	26,913	27,239	28,440	28,784
Tariff (Rs./m3)	4.570	6.0	6.0	7.5	7.5	7.5	9.0	9.0	20,101	9.0	9.0	9.0	24,700	9.0	9.0	20,713	9.0	9.0	9.0
Biiled Charge (million Rs.)		79.7	86.3	109.2	117.2	125.3	160.3	170.5	180.9	191.6	202.4	213.5	224.9	236.5	239.3	242.2	245.2	256.0	259.1
bired charge (minton Ks.)		17.1	00.5	107.2	117.2	125.5	100.5	170.5	100.5	171.0	202.4	215.5	224.7	230.3	437.3	242.2	243.2	250.0	237.1
	1.00/	1 101	1.070	1.004	1 200	1 405	1 502	1 (04	1 707	1.002	1.000	0.100	0.001	0.005	2.264	0.000	0.401	2 520	0.550
Water Demand for Organizations (1000 m3/year) Tariff (Rs./m3)	4.0%	1,181 10.0	1,279 10.0	1,294 12.5	1,388	1,485	1,583 15.0	1,684	1,787	1,892	1,999 15.0	2,109	2,221	2,335	2,364	2,392	2,421 15.0	2,528	2,559
Biled Charge for Ortanizations (million Rs.)		11.8	12.8	16.2	17.4	18.6	23.7	25.3	26.8	28.4	30.0	31.6	33.3	35.0	35.5	35.9	36.3	37.9	38.4
																			L
Water Demand for Commercial/Industries (1000 m3/year)	16.0%	4,722	5,115	5,177	5,554	5,939	6,333	6,736	7,147	7,568	7,997	8,436	8,884	9,342	9,455	9,569	9,685	10,112	10,234
Tariff (Rs./m3) Biiled Charge for Commercial/Industries (million Rs.)		15.0 70.8	15.0 76.7	18.8 97.1	18.8 104.1	18.8 111.4	22.5 142.5	22.5 151.6	22.5 160.8	22.5 170.3	22.5 179.9	22.5 189.8	199.9	22.5 210.2	22.5 212.7	22.5 215.3	22.5 217.9	22.5 227.5	230.3
Total Billed Charge (million Rs.)		162.3	175.8	222.4	238.6	255.2	326.5	347.3	368.5	390.2	412.3	435.0	458.1	481.7	487.5	493.4	499.4	521.4	527.7
Collection Rate Total Collected Charge (million Rs.)		55% 89.3	60% 105.5	65% 144.6	70% 167.0	191.4	80% 261.2	85% 295.2	90% 331.7	90% 351.2	90% 371.1	90% 391.5	<u>90%</u> 412.3	90% 433.5	90% 438.8	90% 444.1	90% 449.4	90% 469.3	90% 474.9
										•									
Revenue of Sanitation Charge (in Zone2) Coverage Rater of Sewerage Service	60%	of Water	Charge				52%	Populatio	n Rate of 2 26%	Zone2 in w 32%	hole Rancl 38%	ni 44%	50%	56%	62%	68%	74%	80%	80%
Collected Sanitation Charge									41.4	51.6	62.0	72.6	83.5	94.7	106.1	117.8	129.7	146.4	148.2
Revenue of TAX	(unit: million	Rs.)																	
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Collection Rate		55%	60%	65%	70%	75%	80%	85%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Total												10.0							
Billed Amount	-	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5
Collected Amount		23.4	25.5	27.6	29.8	31.9	34.0	36.1	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3
Calculation of Sewerage Treatment Amount (in Zone2)		2015	2016	2017	2018	2019	2020	2021	2022	2022	2024	2025	2026	2027	2028	2029	2030	2021	2032
Domestic Consumption (1000 m3/year)		2015	2016	2017	2018	2019	2020	2021	2022	2023 24,594	2024	2025	2026	30,361	30,728	31,100	31,476	2031 32,864	33,261
Organizational Consumption (1000 m3/year)									929	984	1,040	1,097	1,155	1,214	1,229	1,244	1,259	1,315	1,330
Industrial Consumption (1000 m3/year)									3,717	3,935	4,158	4,387	4,620	4,858	4,916	4,976	5,036	5,258	5,322
Total Consumption (1000 m3/year)									27,874	29,513	31,188	32,899	34,647	36,433	36,874	37,320	37,771	39,436	39,913
Coverage Rater of Sewerage Service									30%	40%	50%	60%	70%	80%	80%	80%	80%	80%	80%
Freatment Water Amount (1000 m3/year)									8,362	11,805	15,594	19,740	24,253	29,146	29,499	29,856	30,217	31,549	31,931
Treatment Water Amount (MLD)									22.9	32.3	42.7	54.1	66.4	79.9	80.8	81.8	82.8	86.4	87.5
Expenditure	O&M Cost	1.240	million Rs	./year/ML	D														
•	NPV	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Cost - Capital Investment Cost	-7,948	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2
- Existing Capital Cost	-5,784	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0	-602.0
- Project Cost	-2,164	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2
Cost - O&M Cost		-449.1	-449.1	-449.1	-449.1	-449.1	-449.1	-449.1	-497.4	-528.9	-596.2	-610.3	-625.6	-642.2	-643.4	-644.6	-645.9	-650.4	-651.7
- RMC (existing)	-166	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3
- DWSD (existing)	-3,993	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6
- Proposed Labor Cost (additional)	-365	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6
- Project O&M cost (treatment)	-796								-28.4	-40.1	-53.0	-67.1	-82.4	-99.0	-100.2	-101.4	-102.7	-107.2	-108.5
- Project O&M cost (electricity)	-349								-19.9	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7
Total Cost	-13,060	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1324.6	-1356.1	-1423.4	-1437.5	-1452.8	-1469.4	-1470.6	-1471.8	-1473.1	-1477.6	-1478.9
	d Conitation 6	Services																	
Balance of Revenue and Expenditure of Water Supply an	u Samtanon S	2015	2016	2017	2018	2019	2020	2021	2022		2024	2025	2026	2027	2028	2029	2030	2031	2032
Balance of Revenue and Expenditure of Water Supply an			1 1 1 1 0	172.2	196.8	223.3	295.2	331.3	411.3	441.0	471.4	502.3	534.0	566.5	583.1	600.1	617.4	653.9	661.4
Revenue	3,705	112.7	131.0		167.0	191.4	261.2	295.2	331.7	351.2	371.1	391.5	412.3	433.5	438.8	444.1	449.4	469.3	474.9
Revenue - Water Charge	3,705 2,872	112.7 89.3	105.5	144.6				0.0	41.4	51.6	62.0	72.6	83.5	94.7	106.1	117.8	129.7	146.4	148.2
Revenue - Water Charge - Sanitation Charge	3,705 2,872 510	112.7 89.3 0.0	105.5 0.0	0.0	0.0	0.0	0.0											38.3	38.3
Revenue - Water Charge - Sanitation Charge - TAX	3,705 2,872 510 322	112.7 89.3 0.0 23.4	105.5 0.0 25.5	0.0 27.6	0.0 29.8	31.9	34.0	36.1	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	4.455	1 450 0
Revenue - Water Charge - Sanitation Charge - TAX Expenditure	3,705 2,872 510 322 -13,060	112.7 89.3 0.0 23.4 -1276.3	105.5 0.0 25.5 -1276.3	0.0 27.6 -1276.3	0.0 29.8 -1276.3	31.9 -1276.3	34.0 -1276.3	-1276.3	-1324.6	-1356.1	-1423.4	-1437.5	-1452.8	-1469.4	-1470.6	-1471.8	-1473.1	-1477.6	
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX	3,705 2,872 510 322 -13,060 -7,948	112.7 89.3 0.0 23.4 -1276.3 -827.2	105.5 0.0 25.5 -1276.3 -827.2	0.0 27.6 -1276.3 -827.2	0.0 29.8 -1276.3 -827.2	31.9 -1276.3 -827.2	34.0 -1276.3 -827.2	-1276.3 -827.2	-1324.6 -827.2	-1356.1 -827.2	-1423.4 -827.2	-1437.5 -827.2	-1452.8 -827.2	-1469.4 -827.2	-1470.6 -827.2	-1471.8 -827.2	-1473.1 -827.2	-827.2	-827.2
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost	3,705 2,872 510 322 -13,060 -7,948 -5,112	112.7 89.3 0.0 23.4 -1276.3 -827.2 -449.1	105.5 0.0 25.5 -1276.3 -827.2 -449.1	0.0 27.6 -1276.3 -827.2 -449.1	0.0 29.8 -1276.3 -827.2 -449.1	31.9 -1276.3 -827.2 -449.1	34.0 -1276.3 -827.2 -449.1	-1276.3 -827.2 -449.1	-1324.6 -827.2 -497.4	-1356.1 -827.2 -528.9	-1423.4 -827.2 -596.2	-1437.5 -827.2 -610.3	-1452.8 -827.2 -625.6	-1469.4 -827.2 -642.2	-1470.6 -827.2 -643.4	-1471.8 -827.2 -644.6	-1473.1 -827.2 -645.9	-827.2 -650.4	-827.2 -651.7
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance	3,705 2,872 510 322 -13,060 -7,948	112.7 89.3 0.0 23.4 -1276.3 -827.2 -449.1 -1163.6	105.5 0.0 25.5 -1276.3 -827.2 -449.1 -1145.3	0.0 27.6 -1276.3 -827.2 -449.1 -1104.1	0.0 29.8 -1276.3 -827.2 -449.1 -1079.5	31.9 -1276.3 -827.2 -449.1 -1053.0	34.0 -1276.3 -827.2 -449.1 -981.1	-1276.3 -827.2 -449.1 -945.0	-1324.6 -827.2 -497.4 -913.2	-1356.1 -827.2 -528.9 -915.1	-1423.4 -827.2 -596.2 -952.0	-1437.5 -827.2 -610.3 -935.1	-1452.8 -827.2 -625.6 -918.8	-1469.4 -827.2 -642.2 -903.0	-1470.6 -827.2 -643.4 -887.5	-1471.8 -827.2 -644.6 -871.7	-1473.1 -827.2 -645.9 -855.7	-827.2 -650.4 -823.7	-827.2 -651.7 -817.5
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance Coverage Rate of Total Cost	3,705 2,872 510 322 -13,060 -7,948 -5,112	112.7 89.3 0.0 23.4 -1276.3 -827.2 -449.1 -1163.6 9%	105.5 0.0 25.5 -1276.3 -827.2 -449.1 -1145.3 10%	0.0 27.6 -1276.3 -827.2 -449.1 -1104.1 13%	0.0 29.8 - 1276.3 -827.2 -449.1 -1079.5 15%	31.9 -1276.3 -827.2 -449.1 -1053.0 17%	34.0 -1276.3 -827.2 -449.1 -981.1 23%	-1276.3 -827.2 -449.1 -945.0 26%	-1324.6 -827.2 -497.4 -913.2 31%	-1356.1 -827.2 -528.9 -915.1 33%	-1423.4 -827.2 -596.2 -952.0 33%	-1437.5 -827.2 -610.3 -935.1 35%	-1452.8 -827.2 -625.6 -918.8 37%	-1469.4 -827.2 -642.2 -903.0 39%	-1470.6 -827.2 -643.4 -887.5 40%	-1471.8 -827.2 -644.6 -871.7 41%	-1473.1 -827.2 -645.9 -855.7 42%	-827.2 -650.4 -823.7 44%	-827.2 -651.7 -817.5 45%
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance Coverage Rate of Total Cost Coverage Rate of O&M Cost	3,705 2,872 510 322 -13,060 -7,948 -5,112	112.7 89.3 0.0 23.4 -1276.3 -827.2 -449.1 -1163.6 9% 25%	105.5 0.0 25.5 - 1276.3 -827.2 -449.1 -1145.3 10% 29%	0.0 27.6 -1276.3 -827.2 -449.1 -1104.1 13% 38%	0.0 29.8 - 1276.3 -827.2 -449.1 -1079.5 15% 44%	31.9 -1276.3 -827.2 -449.1 -1053.0 17% 50%	34.0 -1276.3 -827.2 -449.1 -981.1 23% 66%	-1276.3 -827.2 -449.1 -945.0 26% 74%	-1324.6 -827.2 -497.4 -913.2 31% 83%	-1356.1 -827.2 -528.9 -915.1 33% 83%	-1423.4 -827.2 -596.2 -952.0 33% 79%	-1437.5 -827.2 -610.3 -935.1 35% 82%	-1452.8 -827.2 -625.6 -918.8 37% 85%	-1469.4 -827.2 -642.2 -903.0 39% 88%	-1470.6 -827.2 -643.4 -887.5 40% 91%	-1471.8 -827.2 -644.6 -871.7 41% 93%	-1473.1 -827.2 -645.9 -855.7 42% 96%	-827.2 -650.4 -823.7 44% 101%	-827.2 -651.7 -817.5 45% 101%
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance Coverage Rate of Total Cost Coverage Rate of O&M Cost Coverage Rate of Water Supply Total Cost	3,705 2,872 510 322 -13,060 -7,948 -5,112	112.7 89.3 0.0 23.4 -1276.3 -827.2 -449.1 -1163.6 9% 25% 10%	105.5 0.0 25.5 -1276.3 -827.2 -449.1 -1145.3 10% 29% 12%	0.0 27.6 -1276.3 -827.2 -449.1 -1104.1 13% 38% 15%	0.0 29.8 - 1276.3 -827.2 -449.1 -1079.5 15% 44% 18%	31.9 -1276.3 -827.2 -449.1 -1053.0 17% 50% 20%	34.0 -1276.3 -827.2 -449.1 -981.1 23% 66% 27%	-1276.3 -827.2 -449.1 -945.0 26% 74% 30%	-1324.6 -827.2 -497.4 -913.2 31% 83% 34%	-1356.1 -827.2 -528.9 -915.1 33% 83% 36%	-1423.4 -827.2 -596.2 -952.0 33% 79% 38%	-1437.5 -827.2 -610.3 -935.1 35% 82% 40%	-1452.8 -827.2 -625.6 -918.8 37% 85% 42%	-1469.4 -827.2 -642.2 -903.0 39% 88% 44%	-1470.6 -827.2 -643.4 -887.5 40% 91% 45%	-1471.8 -827.2 -644.6 -871.7 41% 93% 45%	-1473.1 -827.2 -645.9 -855.7 42% 96% 46%	-827.2 -650.4 -823.7 44% 101% 48%	-827.2 -651.7 -817.5 45% 101% 48%
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance Coverage Rate of Total Cost Coverage Rate of O&M Cost Coverage Rate of Water Supply Total Cost Coverage Rate of Water Supply O&M Cost	3,705 2,872 510 322 -13,060 -7,948 -5,112	1112.7 89.3 0.0 23.4 -1276.3 -827.2 -449.1 -1163.6 9% 25% 10% 23%	105.5 0.0 25.5 -1276.3 -827.2 -449.1 -1145.3 10% 29% 12% 27%	0.0 27.6 -1276.3 -827.2 -449.1 -1104.1 13% 38% 15% 37%	0.0 29.8 -1276.3 -827.2 -449.1 -1079.5 15% 44% 18% 42%	31.9 -1276.3 -827.2 -449.1 -1053.0 17% 50% 20% 48%	34.0 -1276.3 -827.2 -449.1 -981.1 23% 66% 27% 64%	-1276.3 -827.2 -449.1 -945.0 26% 74% 30% 72%	-1324.6 -827.2 -497.4 -913.2 31% 83% 34% 81%	-1356.1 -827.2 -528.9 -915.1 33% 83% 36% 85%	-1423.4 -827.2 -596.2 -952.0 33% 79% 38% 85%	-1437.5 -827.2 -610.3 -935.1 35% 82% 40% 89%	-1452.8 -827.2 -625.6 -918.8 37% 85% 42% 94%	-1469.4 -827.2 -642.2 -903.0 39% 88% 44% 98%	-1470.6 -827.2 -643.4 -887.5 40% 91% 45% 99%	-1471.8 -827.2 -644.6 -871.7 41% 93% 45% 101%	-1473.1 -827.2 -645.9 -855.7 42% 96% 46% 102%	-827.2 -650.4 -823.7 44% 101% 48% 106%	-827.2 -651.7 -817.5 45% 101% 48% 107%
Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance Coverage Rate of Total Cost Coverage Rate of O&M Cost	3,705 2,872 510 322 -13,060 -7,948 -5,112	112.7 89.3 0.0 23.4 -1276.3 -827.2 -449.1 -1163.6 9% 25% 10%	105.5 0.0 25.5 -1276.3 -827.2 -449.1 -1145.3 10% 29% 12%	0.0 27.6 -1276.3 -827.2 -449.1 -1104.1 13% 38% 15%	0.0 29.8 - 1276.3 -827.2 -449.1 -1079.5 15% 44% 18%	31.9 -1276.3 -827.2 -449.1 -1053.0 17% 50% 20%	34.0 -1276.3 -827.2 -449.1 -981.1 23% 66% 27%	-1276.3 -827.2 -449.1 -945.0 26% 74% 30%	-1324.6 -827.2 -497.4 -913.2 31% 83% 34%	-1356.1 -827.2 -528.9 -915.1 33% 83% 36%	-1423.4 -827.2 -596.2 -952.0 33% 79% 38%	-1437.5 -827.2 -610.3 -935.1 35% 82% 40%	-1452.8 -827.2 -625.6 -918.8 37% 85% 42%	-1469.4 -827.2 -642.2 -903.0 39% 88% 44%	-1470.6 -827.2 -643.4 -887.5 40% 91% 45%	-1471.8 -827.2 -644.6 -871.7 41% 93% 45%	-1473.1 -827.2 -645.9 -855.7 42% 96% 46%	-827.2 -650.4 -823.7 44% 101% 48%	-827.2 -651.7 -817.5 45% 101% 48%

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2033	2034	2035
,642,257	1,662,128	1,682,240
80%	80%	80%
135.0	135.0	135.0
64,738	65,521	66,314
29,132	29,484	29,841
9.0	9.0	9.0
262.2	265.4	268.6
2,590	2,621	2,653
15.0 38.9	15.0	15.0
30.9	39.3	39.8
10,358	10,483	10,610
22.5	22.5	22.5
233.1	235.9	238.7
534.1	540 5	5 47 1
534.1 90%	540.5 90%	547.1 90%
480.7	486.5	492.4
10017	10012	.,
80%	80%	80%
150.0	151.8	153.6
2033	2034	2035
90%	90%	90%
42.5	42.5	42.5
38.3	38.3	38.3
2033	2034	2035
33,664	34,071	34,483
1,347	1,363	1,379
5,386	5,451	5,517
40,396	40,885	41,380
80%	80%	80%
32,317 88.5	32,708 89.6	33,104 90.7
00.3	69.0	90.7
2033	2034	2035
-827.2	-827.2	-827.2
-602.0	-602.0	-602.0
-225.2 -653.0	-225.2 -654.3	-225.2 -655.7
-17.3	-17.3	-17.3
-415.6	-415.6	-415.6
-70.6	-70.6	-70.6
-109.8	-111.1	-112.5
-39.7	-39.7	-39.7
1480.2	-1481.5	-1482.9
	-1-01.0	1734.7
2033	2034	2035
668.9 480.7	676.5 486.5	684.2 492.4
150.0	480.3	153.6
38.3	38.3	38.3
1480.2	-1481.5	-1482.9
-827.2	-827.2	-827.2
-653.0	-654.3	-655.7
-811.3	-805.0	-798.6
45%	46%	46%
102% 49%	103% 49%	104% 50%
108%	110%	111%
37%	38%	38%
88%	88%	89%

| Revenue of Water Charge | | | |
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| | | 2015 | 2016 | 2017
 | 2018 | 2019 | 2020 | 2021

 | 2022 | 2023 | 2024
 | 2025 | 2026 | 2027 | 2028 | 2029
 | 2030 | 2031 | 2032 | 2033
 | 2034 | 2035 |
| Total Population in RMC Service Area | | 1,197,910 | 1,297,578 | 1,313,279
 | 1,329,169 | 1,345,252 | 1,361,530 | 1,378,004

 | 1,394,678 | 1,411,554 | 1,428,634
 | 1,445,920 | 1,463,416 | 1,481,123 | 1,499,045 | 1,517,183
 | 1,535,541 | 1,603,224 | 1,622,623 | 1,642,257
 | 1,662,128 | 1,682,240 |
| Coverage Ratio | | 50% | 50% | 50%
 | 53% | 56% | 59% | 62%

 | 65% | 68% | 71%
 | 74% | 77% | 80% | 80% | 80%
 | 80% | 80% | 80% | 80%
 | 80% | 80% |
| Consumption per capita (l/day) | | 135.0 | 135.0 | 135.0
 | 135.0 | 135.0 | 135.0 | 135.0

 | 135.0 | 135.0 | 135.0
 | 135.0 | 135.0 | 135.0 | 135.0 | 135.0
 | 135.0 | 135.0 | 135.0 | 135.0
 | 135.0 | 135.0 |
| Water Demand for Domestic Use (1000 m3/year) | | 29,514 | 31,969 | 32,356
 | 34,712 | 37,121 | 39,583 | 42,099

 | 44,670 | 47,297 | 49,981
 | 52,723 | 55,525 | 58,386 | 59,092 | 59,807
 | 60,531 | 63,199 | 63,964 | 64,738
 | 65,521 | 66,314 | | |
| Charged Water Consumption (excl. well area and slum | | | |
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 | | |
| area) | 45% | 13,281 | 14,386 | 14,560
 | 15,621 | 16,704 | 17,812 | 18,944

 | 20,101 | 21,284 | 22,491
 | 23,725 | 24,986 | 26,274 | 26,592 | 26,913
 | 27,239 | 28,440 | 28,784 | 29,132
 | 29,484 | 29,841 |
| Tariff (Rs /m3) | | 6.0 | 6.0 | 9.0
 | 9.0 | 9.0 | 12.0 | 12.0

 | 12.0 | 12.0 | 12.0
 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0
 | 12.0 | 12.0 | 12.0 | 12.0
 | 12.0 | 12.0 |
| Biiled Charge dor Domestic Use (million Rs.) | | 79.7 | 86.3 | 131.0
 | 140.6 | 150.3 | 213.7 | 227.3

 | 241.2 | 255.4 | 269.9
 | 284.7 | 299.8 | 315.3 | 319.1 | 323.0
 | 326.9 | 341.3 | 345.4 | 349.6
 | 353.8 | 358.1 | | |
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| Water Demand for Organizations (1000 m3/year) | 4.0% | 1,181 | 1,279 | 1,294
 | 1,388 | 1,485 | 1,583 | 1,684

 | 1,787 | 1,892 | 1,999
 | 2,109 | 2,221 | 2,335 | 2,364 | 2,392
 | 2,421 | 2,528 | 2,559 | 2,590
 | 2,621 | 2,653 |
| Tariff (Rs /m3) | | 10.0 | 10.0 | 15.0
 | 15.0 | 15.0 | 20.0 | 20.0

 | 20.0 | 20.0 | 20.0
 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0
 | 20.0 | 20.0 | 20.0 | 20.0
 | 20.0 | 20.0 |
| Biiled Charge for Ortanizations (million Rs.) | | 11.8 | 12.8 | 19.4
 | 20.8 | 22.3 | 31.7 | 33.7

 | 35.7 | 37.8 | 40.0
 | 42.2 | 44.4 | 46.7 | 47.3 | 47.8
 | 48.4 | 50.6 | 51.2 | 51.8
 | 52.4 | 53.1 | | |
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| Water Demand for Commercial/Industries (1000 m3/year) | 16.0% | 4,722 | 5,115 | 5,177
 | 5,554 | 5,939 | 6,333 | 6,736

 | 7,147 | 7,568 | 7,997
 | 8,436 | 8,884 | 9,342 | 9,455 | 9,569
 | 9,685 | 10,112 | 10,234 | 10,358
 | 10,483 | 10,610 |
| Tariff (Rs./m3) | | 15.0 | 15.0 | 22.5
 | 22.5 | 22.5 | 30.0 | 30.0

 | 30.0 | 30.0 | 30.0
 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0
 | 30.0 | 30.0 | 30.0 | 30.0
 | 30.0 | 30.0 |
| Biiled Charge for Commercial/Industries (million Rs.) | | 70.8 | 76.7 | 116.5
 | 125.0 | 133.6 | 190.0 | 202.1

 | 214.4 | 227.0 | 239.9
 | 253.1 | 266.5 | 280.3 | 283.7 | 287.1
 | 290.6 | 303.4 | 307.0 | 310.7
 | 314.5 | 318.3 | | |
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| Total Billed Charge (million Rs.) | | 162.3 | 175.8 | 266.9
 | 286.4 | 306.2 | 435.4 | 463.1

 | 491.4 | 520.3 | 549.8
 | 580.0 | 610.8 | 642.2 | 650.0 | 657.9
 | 665.8 | 695.2 | 703.6 | 712.1
 | 720.7 | 729.5 |
| Collection Rate | | 55% | 60% | 65%
 | 70% | 75% | 80% | 85%

 | 90% | 90% | 90%
 | 90% | 90% | 90% | 90% | 90%
 | 90% | 90% | 90% | 90%
 | 90% | 90% |
| Total Collected Charge (million Rs.) | | 89.3 | 105.5 | 173.5
 | 200.5 | 229.7 | 348.3 | 393.6

 | 442.2 | 468.3 | 494.8
 | 522.0 | 549.7 | 578.0 | 585.0 | 592.1
 | 599.3 | 625.7 | 633.2 | 640.9
 | 648.7 | 656.5 |
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| Revenue of Sanitation Charge (in Zone2) | 60% | of Water C | harge |
 | | | 52% | Populatio

 | n Rate of Z | one2 in wh | ole Ranch
 | ıi | | | |
 | | | |
 | | |
| Coverage Rater of Sewerage Service | | | |
 | | | |

 | 26% | 32% | 38%
 | 44% | 50% | 56% | 62% | 68%
 | 74% | 80% | 80% | 80%
 | 80% | 80% | | |
| Collected Sanitation Charge | | | |
 | | | |

 | 55.2 | 68.8 | 82.6
 | 96.8 | 111.4 | 126.2 | 141.5 | 157.0
 | 172.9 | 195.2 | 197.6 | 200.0
 | 202.4 | 204.8 | | |
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| Revenue of TAX | (unit: million | Rs.) | |
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 | | | |
 | | |
| | | 2015 | 2016 | 2017
 | 2018 | 2019 | 2020 | 2021

 | 2022 | 2023 | 2024
 | 2025 | 2026 | 2027 | 2028 | 2029
 | 2030 | 2031 | 2032 | 2033
 | 2034 | 2035 |
| Collection Rate | | 55% | 60% | 65%
 | 70% | 75% | 80% | 85%

 | 90% | 90% | 90%
 | 90% | 90% | 90% | 90% | 90%
 | 90% | 90% | 90% | 90%
 | 90% | 90% | | |
| Total | | | |
 | | | |

 | | | | |
 | | | | |
 | | | |
 | | |
| Billed Amount | | 42.5 | 42.5 | 42.5
 | 42.5 | 42.5 | 42.5 | 42.5

 | 42.5 | 42.5 | 42.5
 | 42.5 | 42.5 | 42.5 | 42.5 | 42.5
 | 42.5 | 42.5 | 42.5 | 42.5
 | 42.5 | 42.5 |
| Collected Amount | | 23.4 | 25.5 | 27.6
 | 29.8 | 31.9 | 34.0 | 36.1

 | 38.3 | 38.3 | 38.3
 | 38.3 | 38.3 | 38.3 | 38.3 | 38.3
 | 38.3 | 38.3 | 38.3 | 38.3
 | 38.3 | 38.3 |
| Concerca Amount | 1 | 20.4 | 20.0 | 27.0
 | 27.0 | 51.7 | 54.0 | 50.1

 | 50.5 | 50.5 | 50.5
 | 50.5 | 50.5 | 50.5 | 50.5 | 50.5
 | 50.5 | 50.5 | 50.5 | 50.5
 | 50.5 | 50.5 | | |
| Calculation of Sewerage Treatment Amount (in Zone2) | | | |
 | | | |

 | | | | |
 | | | | |
 | | | |
 | | |
| Calculation of Sewerage Treatment Amount (in 20102) | | 2015 | 2016 | 2017
 | 2018 | 2019 | 2020 | 2021

 | 2022 | 2023 | 2024
 | 2025 | 2026 | 2027 | 2028 | 2029
 | 2030 | 2031 | 2032 | 2033
 | 2034 | 2035 |
| Domestic Consumption (1000 m3/year) | | 2010 | 2010 | 2017
 | 2010 | 2017 | 2020 | 2021

 | 23.228 | 24,594 | 25,990
 | 27,416 | 28,873 | 30,361 | 30,728 | 31,100
 | 31,476 | 32,864 | 33,261 | 33,664
 | 34,071 | 34,483 | | |
| Organizational Consumption (1000 m3/year) | | | |
 | | | |

 | 929 | 24, <i>39</i> 4
984 | 1,040
 | 1,097 | 1,155 | 1,214 | 1,229 | 1,244
 | 1,259 | 1,315 | 1,330 | 1,347
 | 1,363 | 1,379 | | |
| Industrial Consumption (1000 m3/year) | | | |
 | | | |

 | 3,717 | 3,935 | 4,158
 | 4,387 | 4,620 | 4,858 | 4,916 | 4,976
 | 5,036 | 5,258 | 5,322 | 5,386
 | 5,451 | 5,517 | | |
| Total Consumption (1000 m3/year) | | | |
 | | | |

 | 27,874 | 29,513 | 31,188
 | 32,899 | 34,647 | 36,433 | 36,874 | 37,320
 | 37,771 | 39,436 | | |
 | 40,885 | 41,380 |
| | | | |
 | | | |

 | | |
 | 32,099 | 54,047 | 30,433 | 50,074 | 57,520
 | | | | |
 | | |
| | | | |
 | | | |

 | | |
 | 600/ | 700/ | 200/ | 200/ | 200/
 | | | 39,913 | 40,396
 | , | | | |
| Coverage Rater of Sewerage Service | | | |
 | | | |

 | 30% | 40% | 50%
 | 60% | 70% | 80% | 80% | 80%
 | 80% | 80% | 80% | 80%
 | 80% | 80% | | |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year) | | | |
 | | | |

 | 30%
8,362 | 40%
11,805 | 50%
15,594
 | 19,740 | 24,253 | 29,146 | 29,499 | 29,856
 | 80%
30,217 | 80%
31,549 | 80%
31,931 | 80%
32,317
 | 80%
32,708 | 80%
33,104 | | |
| Coverage Rater of Sewerage Service | | | |
 | | | |

 | 30% | 40% | 50%
 | | | | |
 | 80% | 80% | 80% | 80%
 | 80% | 80% | | |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year)
Treatment Water Amount (MLD) | | 1.240 | |
 | | | |

 | 30%
8,362 | 40%
11,805 | 50%
15,594
 | 19,740 | 24,253 | 29,146 | 29,499 | 29,856
 | 80%
30,217 | 80%
31,549 | 80%
31,931 | 80%
32,317
 | 80%
32,708 | 80%
33,104 |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year) | O&M Cost | 1.240 | 1 | ./year/ML
 | | 2010 | 2020 | 2001

 | 30%
8,362
22.9 | 40%
11,805
32.3 | 50%
15,594
42.7
 | 19,740
54.1 | 24,253
66.4 | 29,146
79.9 | 29,499
80.8 | 29,856
81.8
 | 80%
30,217
82.8 | 80%
31,549
86.4 | 80%
31,931
87.5 | 80%
32,317
88.5
 | 80%
32,708
89.6 | 80%
33,104
90.7 |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year)
Treatment Water Amount (MLD)
Expenditure | NPV | 2015 | 2016 | 2017
 | 2018 | 2019 | 2020 | 2021

 | 30%
8,362
22.9
2022 | 40%
11,805
32.3
2023 | 50%
15,594
42.7
2024
 | 19,740
54.1
2025 | 24,253
66.4
2026 | 29,146
79.9
2027 | 29,499
80.8
2028 | 29,856
81.8
2029
 | 80%
30,217
82.8
2030 | 80%
31,549
86.4
2031 | 80%
31,931
87.5
2032 | 80%
32,317
88.5
2033
 | 80%
32,708
89.6
2034 | 80%
33,104
90.7
2035 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost | NPV
-7,948 | 2015
-827.2 | 2016
-827.2 | 2017
-827.2
 | 2018
-827.2 | -827.2 | -827.2 | -827.2

 | 30%
8,362
22.9
2022
-827.2 | 40%
11,805
32.3
2023
-827.2 | 50%
15,594
42.7
2024
-827.2
 | 19,740
54.1
2025
-827.2 | 24,253
66.4
2026
-827.2 | 29,146
79.9
2027
-827.2 | 29,499
80.8
2028
-827.2 | 29,856
81.8
2029
-827.2
 | 80%
30,217
82.8
2030
-827.2 | 80%
31,549
86.4
2031
-827.2 | 80%
31,931
87.5
2032
-827.2 | 80%
32,317
88.5
2033
-827.2
 | 80%
32,708
89.6
2034
-827.2 | 80%
33,104
90.7
2035
-827.2 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost | NPV
-7,948
-5,784 | 2015
-827.2
-602.0 | 2016
-827.2
-602.0 | 2017
-827.2
-602.0
 | 2018
-827.2
-602.0 | -827.2
-602.0 | -827.2
-602.0 | -827.2
-602.0

 | 30%
8,362
22.9
2022
-827.2
-602.0 | 40%
11,805
32.3
2023
-827.2
-602.0 | 50%
15,594
42.7
2024
-827.2
-602.0
 | 19,740
54.1
2025
-827.2
-602.0 | 24,253
66.4
2026
-827.2
-602.0 | 29,146
79.9
2027
-827.2
-602.0 | 29,499
80.8
2028
-827.2
-602.0 | 29,856
81.8
2029
-827.2
-602.0
 | 80%
30,217
82.8
2030
-827.2
-602.0 | 80%
31,549
86.4
2031
-827.2
-602.0 | 80%
31,931
87.5
2032
-827.2
-602.0 | 80%
32,317
88.5
2033
-827.2
-602.0
 | 80%
32,708
89.6
2034
-827.2
-602.0 | 80%
33,104
90.7
2035
-827.2
-602.0 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost | NPV
-7,948 | 2015
-827.2
-602.0
-225.2 | 2016
-827.2
-602.0
-225.2 | 2017
-827.2
-602.0
-225.2
 | 2018
-827.2
-602.0
-225.2 | -827.2
-602.0
-225.2 | -827.2
-602.0
-225.2 | -827.2
-602.0
-225.2

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
 | 19,740
54.1
2025
-827.2
-602.0
-225.2 | 24,253
66.4
2026
-827.2
-602.0
-225.2 | 29,146
79.9
2027
-827.2
-602.0
-225.2 | 29,499
80.8
2028
-827.2
-602.0
-225.2 | 29,856
81.8
2029
-827.2
-602.0
-225.2
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2 | 80%
31,549
86.4
2031
-827.2
-602.0
-225.2 | 80%
31,931
87.5
2032
-827.2
-602.0
-225.2 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
 | 80%
32,708
89.6
2034
-827.2
-602.0
-225.2 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost | NPV
-7,948
-5,784
-2,164 | 2015
-827.2
-602.0
-225.2
-449.1 | 2016
-827.2
-602.0
-225.2
-449.1 | 2017
-827.2
-602.0
-225.2
-449.1
 | 2018
-827.2
-602.0
-225.2
-449.1 | -827.2
-602.0
-225.2
-449.1 | -827.2
-602.0
-225.2
-449.1 | -827.2
-602.0
-225.2
-449.1

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
 | 19,740
54.1
2025
-827.2
-602.0 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2 | 29,499
80.8
2028
-827.2
-602.0
-225.2
-643.4 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9 | 80%
31,549
86.4
2031
-827.2
-602.0
-225.2
-650.4 | 80%
31,931
87.5
2032
-827.2
-602.0
-225.2
-651.7 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
 | 80%
32,708
89.6
2034
-827.2
-602.0
-225.2
-654.3 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) | NPV
-7,948
-5,784
-2,164
-166 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3 | -827.2
-602.0
-225.2
-449.1
-17.3 | -827.2
-602.0
-225.2
-449.1
-17.3 | -827.2
-602.0
-225.2
-449.1
-17.3

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3 | 29,499
80.8
2028
-827.2
-602.0
-225.2
-643.4
-17.3 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3 | 80%
31,549
86.4
2031
-827.2
-602.0
-225.2
-650.4
-17.3 | 80%
31,931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
 | 80%
32,708
89.6
2034
-827.2
-602.0
-225.2
-654.3
-17.3 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) | NPV
-7,948
-5,784
-2,164
-166
-3,993 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6 | 29,499
80.8
2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6 | 80%
31,549
86.4
2031
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6 | 80%
31,931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
 | 80%
32,708
89.6
2034
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3 | -827.2
-602.0
-225.2
-449.1
-17.3 | -827.2
-602.0
-225.2
-449.1
-17.3 | -827.2
-602.0
-225.2
-449.1
-17.3

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6 | 29,499
80.8
2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6 | 80%
31,549
86.4
2031
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6 | 80%
31,931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
 | 80%
32,708
89.6
2034
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - Proposed Labor Cost (teatment) - Project O&M cost (treatment) | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
-53.0
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0 | 29,499
80.8
2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-100.2 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-101.4
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2 | 80%
31.931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-109.8
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1 | 80%
33,104
90.7
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6 | 29,499
80.8
2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6 | 80%
31,549
86.4
2031
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6 | 80%
31,931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
 | 80%
32,708
89.6
2034
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) - Project O&M cost (reatment) - Project O&M cost (electricity) | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
-53.0
-39.7
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-70.6
-67.1
-39.7 | 24,253
66.4
2026
- 827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4
-39.7 | 29,146
79.9
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-39.7 | 29,499
80.8
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7 | 2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-101.4
-39.7
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7
-39.7 | 80%
31,549
86.4
-2031
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7 | 80%
31.931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-109.8
-39.7
 | 80%
32,708
89.6
-2034
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7 | 80%
33,104
90.7
-2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - Proposed Labor Cost (teatment) - Project O&M cost (treatment) | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
-53.0
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0 | 29,499
80.8
2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-100.2 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-101.4
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2 | 80%
31.931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-109.8
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1 | 80%
33,104
90.7
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5 |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year)
Treatment Water Amount (MLD)
Expenditure
Cost - Capital Investment Cost
- Existing Capital Cost
- Project Cost
Cost - O&M Cost
- RMC (existing)
- DWSD (existing)
- Proposed Labor Cost (additional)
- Project O&M cost (reatment)
- Project O&M cost (electricity)
Total Cost | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
-53.0
-39.7
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-70.6
-67.1
-39.7 | 24,253
66.4
2026
- 827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4
-39.7 | 29,146
79.9
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-39.7 | 29,499
80.8
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7 | 2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-101.4
-39.7
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7
-39.7 | 80%
31,549
86.4
-2031
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7 | 80%
31.931
87.5
2032
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-109.8
-39.7
 | 80%
32,708
89.6
-2034
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) - Project O&M cost (reatment) - Project O&M cost (electricity) | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
415.6
-16.2
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-518.4
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-1410.5 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-70.6
-67.1
-39.7
-1437.5 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4
-39.7
-1452.8 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-39.7
-1469.4 | 29,499
80.8
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-70.6
-101.4
-39.7
-1471.8
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-70.6
-70.6
-70.7
-39.7
-1473.1 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-70.6
-107.2
-39.7
-1477.6 | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9 | 80%
32,317
88.5
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-70.6
-70.8
-39.7
-1480.2
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-17.3
-17.3
-17.3
-111.1
-39.7
-1415.6 | 80%
33,104
90.7
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9 |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year)
Treatment Water Amount (MLD)
Expenditure
Cost - Capital Investment Cost
- Existing Capital Cost
- Project Cost
Cost - O&M Cost
- RMC (existing)
- DWSD (existing)
- Proposed Labor Cost (additional)
- Project O&M cost (reatment)
- Project O&M cost (electricity)
Total Cost | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2016 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2017
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-17.3
-15.6
-16.2
-1276.3
2018 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-1410.5
2023 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
2024
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-17.3
-17.6
-70.6
-70.6
-70.6
-70.7
-1437.5
2025 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-70.6
-70.6
-70.6
-70.6
-82.4
-39.7
-1452.8 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-70.6
-99.0
-39.7
-1469.4
2027 | 29,499
80.8
-2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-70.6
-70.6
-70.6
-101.4
-39.7
-1471.8
2029
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-70.6
-102.7
-39.7
-1473.1
2030 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7
-1477.6
2031 | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
2032 | 80%
32,317
88.5
-2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-70.6
-109.8
-39.7
-1480.2
2033
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7
-1481.5
2034 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7 |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year)
Treatment Water Amount (MLD)
Expenditure
Cost - Capital Investment Cost
- Existing Capital Cost
- Project Cost
Cost - O&M Cost
- RMC (existing)
- DWSD (existing)
- Proposed Labor Cost (additional)
- Project O&M cost (reatment)
- Project O&M cost (electricity)
Total Cost | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-115.6
-16.2
-1276.3
2018
230.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2019
261.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2020
382.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
2021
429.8

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022
535.7 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
40.1
-39.7
-1410.5
2023
575.3 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-115.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-99.0
-39.7
-1469.4
2027
742.5 | 29,499
80.8
-2028
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6
2028
764.8 | 29,856
81.8
2029
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-101.4
-39.7
-1471.8
2029
787.3
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7
-39.7
-1473.1
2030
810.4 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7
-1477.6
2031
859.1 | 80%
31,931
87.5
-2032
-602.0
-225.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
-2032
869.1 | 80%
32,317
88.5
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-70.6
-70.8
-39.7
-1480.2
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-17.3
-17.3
-17.3
-111.1
-39.7
-1415.6 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-70.6
-112.5
-39.7
-1482.9
2035
899.6 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (electricity) Total Cost Balance of Revenue and Expenditure of Water Supply an | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2016 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2017
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-17.3
-15.6
-16.2
-1276.3
2018 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-1410.5
2023 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
2024
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-17.3
-17.6
-70.6
-70.6
-70.6
-70.7
-1437.5
2025 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-70.6
-70.6
-70.6
-70.6
-82.4
-39.7
-1452.8 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-70.6
-99.0
-39.7
-1469.4
2027 | 29,499
80.8
-2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-70.6
-70.6
-70.6
-101.4
-39.7
-1471.8
2029
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-70.6
-102.7
-39.7
-1473.1
2030 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7
-1477.6
2031 | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
2032 | 80%
32,317
88.5
-2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-70.6
-109.8
-39.7
-1480.2
2033
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7
-1481.5
2034 | 80%
33,104
90.7
-2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9
2035 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - Proposed Labor Cost (additional) - Project O&M cost (electricity) - Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015
112.7 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-17.3
-16.2
-1276.3
2016
131.0 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-2017
2017
201.1
173.5
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-115.6
-16.2
-1276.3
2018
230.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2019
261.6 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
2020
382.3
348.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
2021
429.8

 | 30%
8,362
22.9
2022
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022
535.7 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
40.1
-39.7
-1410.5
2023
575.3 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
2024
615.7
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-115.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-99.0
-39.7
-1469.4
2027
742.5 | 29,499
80.8
-2028
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6
2028
764.8 | 29,856
81.8
2029
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-101.4
-39.7
-1471.8
2029
787.3
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7
-39.7
-1473.1
2030
810.4 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7
-1477.6
2031
859.1 | 80%
31,931
87.5
-2032
-602.0
-225.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
-2032
869.1 | 80%
32,317
88.5
2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-70.6
-70.6
-70.9
-109.8
-39.7
-1480.2
2033
879.2
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7
-1481.5
-2034
889.3 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1182.9
2035
899.6 |
| Coverage Rater of Sewerage Service
Treatment Water Amount (1000 m3/year)
Treatment Water Amount (MLD)
Expenditure
Cost - Capital Investment Cost
- Existing Capital Cost
- Project Cost
Cost - O&M Cost
- RMC (existing)
- DWSD (existing)
- Proposed Labor Cost (additional)
- Project O&M cost (treatment)
- Project O&M cost (electricity)
Total Cost
Balance of Revenue and Expenditure of Water Supply an
Revenue
- Water Charge | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730
3,727 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015
112.7
89.3 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2016
131.0
105.5 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-2017
2017
201.1
173.5
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2018
230.2
200.5 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
2019
261.6
229.7 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
2020
382.3
348.3
0.0 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
2021
429.8
393.6

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022
535.7
442.2 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-415.5
-70.6
-40.1
-39.7
-39.7
-410.5
-39.7
-410.5
-39.7
-39.7
-410.5
-39.7
-410.5
-39.7
-410.5
-39.7
-410.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
-40.5
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-40.5 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
2024
615.7
494.8
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0
522.0 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3
549.7 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-99.0
-39.7
-39.7
-1469.4
2027
742.5
578.0 | 29,499
80.8
-2028
-602.0
-225.2
-643.4
-17.3
-115.6
-70.6
-100.2
-39.7
-1470.6
2028
764.8
585.0 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-17.3
-415.6
-70.6
-101.4
-39.7
-101.4
-39.7
-1471.8
2029
787.3
592.1
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-102.7
-39.7
-1473.1
2030
810.4
599.3 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7
-1477.6
2031
859.1
625.7 | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
-1478.9
2032
869.1
633.2 | 80%
32,317
88.5
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-109.8
-39.7
-1480.2
-1480.2
2033
879.2
640.9
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-111.1
-39.7
-1481.5
-1481.5
2034
889.3
648.7 | 80%
33,104
90.7
-2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9
-0035
899.6
656.5 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (electricity) - Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730
3,727
681 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015
112.7
89.3
0.0 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
2016
131.0
105.5
0.0 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2017
2017
2011
173.5
0.0
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2018
2018
2018
230.2
200.5
0.0 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2019
261.6
229.7
0.0 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
2020
382.3
348.3
0.0 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-2021
429.8
393.6
0.0

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-288.4
-17.3
-415.6
-70.6
-288.4
-19.9
-1379.0
2022
535.7
442.2
55.2 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-1410.5
2023
575.3
468.3
68.8 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
2024
615.7
494.8
82.6
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-17.3
-17.3
-415.6
-70.6
-70.6
-70.6
-70.6
-70.7
-415.5
2025
522.0
96.8 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3
549.7
111.4 | 29,146
79.9
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-39.7
-1469.4
-2027
742.5
578.0
126.2 | 29,499
80.8
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
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81.8
2029
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-225.2
-644.6
-70.6
-101.4
-39.7
-101.4
-39.7
-1471.8
2029
787.3
592.1
157.0
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.0
-70.6
-102.7
-39.7
-11473.1
2030
810.4
599.3
172.9 | 80%
31,549
86.4
-827.2
-602.0
-225.2
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-39.7 | 80%
31,931
87.5
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-70.6 | 80%
32,317
88.5
-827.2
-602.0
-225.2
-652.0
-17.3
-415.6
-70.6
-109.8
-39.7
-1480.2
-1480.2
2033
879.2
640.9
200.0
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7
-1481.5
-2034
889.3
648.7
202.4 | 80%
33,104
90.7
-2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9
2035
899.6
656.5
204.8 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - Proposed Labor Cost (additional) - Project O&M cost (reatment) - Project O&M cost (cleatment) - Project O&M cost (electricity) Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge - TAX | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730
3,727
681
322 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
Services
2015
112.7
89.3
0.0
0
23.4 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-2016
131.0
105.5
0.00
25.5 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
2017
2017
173.5
0.0
27.6
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
415.6
-16.2
-1276.3
2018
2018
2018
200.2
200.5
0.0
29.8 | -827.2
-602.0
-225.2
-449.1
-17.3
-17.3
-115.6
-16.2
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-1276.3
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-1276.3 | -827.2
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 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022
535.7
442.2
55.2
38.3 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-1410.5
2023
575.3
468.3
68.8
38.3 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-596.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
2024
615.7
494.8
82.6
38.3
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-17.3
-17.3
-415.6
-70.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0
522.0
96.8
38.3 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3
549.7
1111.4
38.3 | 29,146
79.9
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-39.7
-1469.4
2027
742.5
578.0
2027
742.5
578.0
2126.2
38.3 | 29,499
80.8
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
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-70.6
-70.7
-101.4
-39.7
-1471.8
2029
787.3
592.1
157.0
38.3
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7
-39.7
-1473.1
2030
810.4
599.3
172.9
38.3 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-602.0
-225.2
-602.0
-225.2
-602.0
-70.6
-70.6
-70.6
-70.6
-70.6
-107.2
-39.7
-1477.6
2031
859.1
625.7
195.2
38.3 | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
2032
869.1
633.2
197.6
38.3 | 80%
32,317
88.5
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-70.6
-109.8
-39.7
-1480.2
2033
879.2
640.9
200.0
38.3
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7
-1481.5
-2034
889.3
648.7
202.4
38.3 | 80%
33,104
90.7
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9
2035
899.6
656.5
204.8
38.3 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (electricity) Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge - TAX Expenditure | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730
3,727
-681
3,222
-13,108 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015
112.7
89.3
0.00
23.4
-1276.3 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-17.3
-115.6
-16.2
-16.2
-1276.3
-1276.3 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2017
2017
201.1
173.5
0.0
0
0
0
0
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0
27.6
-1276.3
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
415.6
-16.2
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2018
230.2
200.5
0.0
0
29.8
-1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-1276.3
-1276.3
-1276.3
-1276.3 | -827.2 -602.0 -225.2 -449.1 -17.3 -415.6 -16.2 -10.3 2020 382.3 348.3 0.00 34.0 -1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-17.3
-15.6
-16.2
-1276.3
-1276.3
-1276.3
-1276.3

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022
535.7
442.2
555.2
38.3
-1379.0 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-783.3
-17.3
-415.6
-70.6
-70.6
-40.1
-39.7
-1410.5
2023
575.3
468.3
68.8
38.3
-1410.5 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-115.6
-70.6
-53.0
-39.7
-1423.4
2024
615.7
494.8
894.8
38.3
-1423.4
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
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-67.1
-39.7
-1437.5
2025
657.0
522.0
96.8
38.3
-33.7
-1437.5 | 24,253
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-602.0
-225.2
-625.6
-770.6
-82.4
-39.7
-1452.8
2026
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38.3
-1452.8 | 29,146
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2027
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-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-99.0
-39.7
-39.7
-1469.4
2027
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38.3
-1469.4 | 29,499
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-2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6
-2028
764.8
585.0
141.5
38.3
-1470.6 | 29,856
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2029
-827.2
-602.0
-225.2
-644.6
-70.6
-101.4
-39.7
-101.4
-39.7
2029
787.3
592.1
157.0
38.3
-1471.8
 | 80%
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-827.2
-602.0
-225.2
-645.9
-17.3
-147.6
-70.6
-70.6
-70.6
-70.6
-70.7
-39.7
-1473.1
2030
810.4
599.3
172.9
38.3
-1473.1 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-70.6
-107.2
-39.7
-1477.6
2031
859.1
625.7
195.2
38.3
-1477.6 | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-70.6
-108.5
-39.7
-1478.9
2032
869.1
633.2
197.6
38.3
-1478.9 | 80%
32,317
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-602.0
-225.2
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-17.3
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-70.6
-70.6
-70.6
-70.6
-70.8
-39.7
-1480.2
2033
879.2
640.9
200.0
38.3
-1480.2
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-17.3
-17.3
-111.1
-39.7
-1481.5
2034
889.3
648.7
2024
889.3
-648.7
2024
-38.3
-1481.5 | 80%
33,104
90.7
-2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9
2035
899.6
656.5
204.8
38.3
-1482.9 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (electricity) Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730
3,727
681
3,222
-13,108
-7,948 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015
112.7
89.3
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23.4
-1276.3
-225.2
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-12 | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-1276.3
-1276.3
-1276.3
-1276.3
-827.2 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
2017
2017
2017
2017
2017
2017
-1276.3
-1276.3
-1276.3
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
-17.3
-117.6
-16.2
-1276.3
2018
230.2
200.5
0.0
29.8
-1276.3
-827.2 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-2019
261.6
229.7
0.0
31.9
-1276.3
-827.2 | -827.2 -602.0 -225.2 -449.1 -17.3 -415.6 -16.2 -10.2 -1276.3 2020 382.3 348.3 0.0 34.0 -1276.3 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-2021
429.8
393.6
0.0
36.1
-1276.3
-827.2

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
2022
535.7
442.2
535.7
442.2
535.3
-1379.0
-827.2 | 40%
11,805
32.3
-827.2
-602.0
-225.2
-783.3
-177.3
-177.3
-415.6
-70.6
-40.1
-39.7
-1410.5
2023
575.3
468.3
68.8
38.3
-1410.5
-827.2 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-17.3
-17.3
-17.3
-17.3
-39.7
-1423.4
2024
615.7
494.8
82.6
38.3
-1423.4
-827.2
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-115.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0
522.0
96.8
38.3
38.3
-1437.5
-827.2 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-70.6
-70.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3
549.7
111.4
38.3
-1452.8
-827.2 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-99.0
-39.7
-39.7
-39.7
-39.7
-39.7
-39.7
-39.7
-39.7
-39.7
-39.7
-39.5
-39.3
-39.7
-1469.4
-2027
-742.5
578.0
126.2
-38.3
-1469.4
-38.3
-1469.4
-38.3
-1469.4
-38.3 | 29,499
80.8
-2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6
-2028
764.8
585.0
141.5
38.3
-1470.6
-827.2 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-70.6
-70.6
-70.6
-70.6
-70.7
-101.4
-39.7
-101.4
-39.7
2029
787.3
592.1
157.0
38.3
-1471.8
-38.3
-417.0
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-465.9
-17.3
-415.6
-70.6
-70.6
-102.7
-39.7
-1473.1
2030
810.4
599.3
172.9
38.3
-1473.1
-827.2 | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-107.2
-39.7
-1477.6
2031
859.1
625.7
195.2
38.3
-1477.6
-827.2
-650.4 | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
-2032
869.1
-633.2
197.6
-38.2
-39.7
-1478.9
-827.2 | 80%
32,317
88.5
-2033
-827.2
-602.0
-225.2
-653.0
-17.3
-415.6
-70.6
-70.6
-70.6
-70.6
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-70.6
-70.6
-70.6
-70.7
-1480.2
-39.7
-1480.2
-39.3
-1480.2
-39.7
-2
-445.5
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-111.1
-39.7
-1481.5
-2034
889.3
648.7
2034
889.3
648.7
2034
-1481.5
-827.2 | 80%
33,104
90.7
2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9
2035
899.6
6556.5
204.8
38.3
-33.1482.9
-827.2 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (clectricity) - Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730
3,727
681
322
-13,108
-7,948
-7,948
-7,948
-7,948
-7,948
-7,948 | 2015
-827.2
-602.0
-225.2
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Services
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112.7
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-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-2016
131.0
105.5
0.0
25.5
-1276.3
-827.2
-449.1
-1145.3 | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-16.2
-1276.3
-2017
201.1
173.5
0.0
27.6
-1276.3
-827.2
-449.1
-1075.2
 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
415.6
-16.2
-1276.3
2018
200.5
0.0
29.8
-1276.3
-827.2
-449.1
-1046.1 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-1276.3
-2019
261.6
229.7
0.0
31.9
-1276.3
-827.2
-827.2
-449.1
-1014.7 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-1276.3
-2020
382.3
348.3
0.0
34.0
-1276.3
-827.2
-449.1
-894.0 | -827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
-1276.3
-2021
429.8
393.6
0.0
36.1
-1276.3
-827.2
-449.1
-846.5

 | 30%
8,362
22.9
-827.2
-602.0
-255.2
-70.6
-285.4
-17.3
-415.6
-70.6
-288.4
-19.9
-1379.0
-2022
535.7
-442.2
55.2
38.3
-1379.0
-827.2
-551.8
-843.3 | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-415.6
-70.6
-40.1
-39.7
-415.6
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-415.6
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-40.1
-57.3
-415.6
-70.5
-57.3
-45.3
-8.8
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-8.8
-8.8
-8.8 | 50%
15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-53.0
-39.7
-1423.4
2024
615.7
494.8
82.6
38.3
-1423.4
-827.2
-596.2
-596.2
-596.2
-807.7
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-17.3
-14.5
-70.6
-67.1
-39.7
-41437.5
2025
657.0
522.0
96.8
38.3
-1437.5
-827.2
-610.3 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-415.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3
549.7
111.4
38.3
-1452.8
-827.2
-625.6
-753.4 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-397
-397
-1469.4
-2027
742.5
578.0
126.2
38.3
-1469.4
-827.2
-642.2
-726.9 | 29,499
80.8
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-100.2
-39.7
-1470.6
-1470.6
-858.0
141.5
38.3
-1470.6
-827.2
-643.4
-705.8 | 2029
-827.2
-602.0
-225.2
-644.6
-70.6
-101.4
-39.7
-1471.8
2029
787.3
592.1
157.0
38.3
-1471.8
-827.2
-644.6
-684.5
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-415.6
-70.6
-102.7
-39.7
-1473.1
2030
810.4
599.3
172.9
38.3
-1473.1
-827.2
-645.9
-662.7 | 80%
31,549
86.4
-2031
-827.2
-602.0
-225.2
-602.0
-225.2
-17.3
-415.6
-70.6
-107.2
-39.7
-107.2
-39.7
-107.2
-39.7
-107.6
-2031
859.1
625.7
195.2
38.3
-1477.6
-827.2
-650.4
-127.6
-827.2
-650.4
-827.2
-650.4
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-70.7
-70.7
-70.7
-70.7
-70.7
-70.7
-70.7
-70. | 80%
31,931
87.5
-827.2
-602.0
-225.2
-602.0
-225.2
-602.0
-225.2
-602.0
-225.2
-602.0
-70.6
-108.5
-39.7
-1478.9
-2032
869.1
633.2
197.6
38.3
-1478.9
-827.2
-651.7
-609.8 | 80%
32,317
88.5
-827.2
-602.0
-225.2
-652.0
-17.3
-415.6
-70.6
-109.8
-39.7
-1480.2
-2033
879.2
640.9
200.0
38.3
-1480.2
-827.2
-653.0
-601.0
 | 80%
32,708
89.6
-827.2
-602.0
-225.2
-654.3
-17.3
-415.6
-70.6
-1111.1
-39.7
-1481.5
-2034
889.3
648.7
202.4
38.3
-1481.5
-827.2
-654.3
-592.2 | 80%
33,104
90.7
-2035
-827.2
-602.0
-225.2
-655.7
-17.3
-415.6
-70.6
-112.5
-39.7
-1482.9
-1482.9
-2035
899.6
655.5
204.8
38.3
-1482.9
-827.2
-655.7
-583.3 |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - DWSD (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (cleatment) - Project O&M cost (electricity) - Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - Q&M Cost Balance Coverage Rate of Total Cost | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
-796
-349
-13,108
d Sanitation S
4,730
3,727
681
322
-13,108
-7,948
-7,948
-7,948
-7,948
-7,948
-7,948 | 2015
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
Services
2015
112.7
-89.3
0.0
23.4
-1276.3
-827.2
-449.1
-1163.6
9% | 2016
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-16.2
-1276.3
-1276.3
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-449.1
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2018
200.5
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29.8
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-827.2
-449.1
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18% | -827.2
-602.0
-225.2
-449.1
-17.3
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-20% | -827.2
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-30% | -827.2 -602.0 -225.2 -49.1 -17.3 -415.6 -16.2 -10.2 -1276.3 2021 429.8 393.6 0.0 36.1 -1276.3 -827.2 -449.1 -846.5 34%

 | 30%
8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-285.4
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-19.9
-1379.0
-2022
535.7
-442.2
55.2
38.3
-1379.0
-827.2
-551.2
38.3
-1379.0 | 40%
11,805
32.3
-827.2
-602.0
-255.2
-583.3
-17.3
-415.6
-70.6
-40.1
-39.7
-1410.5
575.3
468.3
68.8
38.3
-1410.5
-827.2
-583.3
-835.2
-835.2
-41%
 | 50%
15,594
42,7
-827,2
-602,0
-225,2
-17,3
-415,6
-70,6
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-1423,4
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-225.2
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-415.6
-70.6
-67.1
-39.7
-1437.5
527.0
96.8
38.3
-1437.5
-827.2
-610.3
-780.4
46% | 24,253
66.4
2026
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3
549.7
1111.4
38.3
-1452.8
-827.2
-625.6
-753.4
-827.2
-625.6 | 29,146
79.9
2027
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-39.7
-1469.4
2027
742.5
547.80
126.2
38.3
-1469.4
-827.2
-642.2
-726.9
51% | 29,499
80.8
-827.2
-602.0
-225.2
-413.6
-70.6
-70.6
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-39.7
-39.7
-1470.6
-828
588.0
141.5
38.3
-1470.6
-827.2
-643.4
-705.8
52%
 | 29,856
81.8
2029
-827.2
-602.0
-225.2
-445.6
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-415.6
-70.6
-102.7
-39.7
-1473.1
2030
810.4
599.3
172.9
38.3
172.9
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-827.2
-662.7
55% | 80%
31,549
86.4
-827.2
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31,931
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59%
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32,317
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200.0
38.3
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-653.0
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59% | 80%
32,708
89.6
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889.3
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38.3
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-60% | 80%
33,104
90.7
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655.5
204.8
38.3
-1482.9
-827.2
-655.7
-583.3
61% |
| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - DWSD (existing) - Proposed Labor Cost (additional) - Project O&M cost (reatment) - Project O&M cost (electricity) Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - O&M Cost Balance Coverage Rate of Total Cost Coverage Rate of O&M Cost Coverage Rate of Coverage Rate OVERAGE Coverage Rate OVE | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
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-13,108
d Sanitation S
4,730
3,727
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322
-13,108
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-827.2
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-17.3
-415.6
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-1276.3
Services
2015
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-827.2
-449.1
-116.3
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-827.2
-602.0
-225.2
-449.1
-17.3
415.6
-16.2
-1276.3
2016
131.0
105.5
0.0
25.5
-1276.3
-827.2
-449.1
-1145.3
10%
29% | 2017
-827.2
-602.0
-225.2
-449.1
-17.3
-415.6
-16.2
-1276.3
-1276.3
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-1276.3
-827.2
-449.1
-1075.2
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-1075.2 | 2018
-827.2
-602.0
-225.2
-449.1
-17.3
415.6
-16.2
-1276.3
2018
200.5
0.0
29.8
-1276.3
-827.2
449.1
-1046.1
18%
51% | -827.2
-602.0
-225.2
-449.1
-17.3
-17.5
-16.2
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58%
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 | 30%
8,362
22.9
-827.2
-602.0
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-415.6
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-1379.0
-1379.0
-827.2
-55.2
38.3
-1379.0
-827.2
-551.8
-841.3
-843.3
39%
97% | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
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-415.6
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-40.1
-39.7
-415.6
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-75.3
468.3
-68.8
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15,594
42.7
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-827.2
-602.0
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-39.7
-1423.4
2024
615.7
494.8
82.6
38.3
-1423.4
-827.2
-596.2
-807.7
43%
103%
 | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0
522.0
96.8
38.3
-1437.5
-827.2
-610.3
-780.4
46%
108% | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-77.3
-1452.8
2026
699.3
549.7
1111.4
38.3
-1452.8
-827.2
-625.6
-753.4
48%
112% | 29,146
79.9
2027
-827.2
-602.0
-225.2
-17.3
-415.6
-70.6
-99.0
-39.7
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-39 | 29,499
80.8
-2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-39.7
-1470.6
-2028
764.8
585.0
141.5
-38.3
-1470.6
-827.2
-643.4
-705.8
-529.6
-119% | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-70.6
-70.6
-101.4
-39.7
-101.4
-39.7
-101.4
-39.7
-101.4
-39.7
-1471.8
-2029
787.3
592.1
157.0
38.3
-1471.8
-827.2
-644.6
-684.5
535%
122%
 | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-645.9
-17.3
-117.3
-116.6
-70.6
-70.6
-70.6
-70.6
-70.7
-39.7
-1473.1
2030
810.4
599.3
172.9
38.3
-1473.1
-827.2
-665.9
-665.7
55%
255% | 80%
31,549
86.4
-827.2
-602.0
-225.2
-50.4
-17.3
-415.6
-70.6
-70.6
-107.2
-39.7
-1477.6
-2031
859.1
625.7
-38.3
-1477.6
-827.2
-660.4
-618.5
58%
132% | 80%
31,931
87.5
-827.2
-602.0
-225.2
-651.7
-17.3
-415.6
-70.6
-108.5
-39.7
-1478.9
2032
869.1
633.2
197.6
38.3
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| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (electricity) Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Sanitation Charge - TAX Expenditure - CAPEX - QAM Cost Balance Coverage Rate of Total Cost Coverage Rate of O&M Cost | NPV
-7,948
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33,104
90.7
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-225.2
-655.7
-17.3
-112.5
-39.7
-1482.9
-2035
899.6
656.5
204.8
-38.3
-1482.9
-2035
-204.8
-38.3
-1482.9
-827.2
-655.7
-583.3
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8,362
22.9
-827.2
-602.0
-225.2
-551.8
-17.3
-415.6
-70.6
-28.4
-19.9
-1379.0
-28.4
-19.9
-1379.0
-28.4
-19.9
-1379.0
-28.5
-355.7
442.2
555.3
-33.5
-827.2
-551.8
-827.2
-551.8
-843.3
39%
97% | 40%
11,805
32.3
2023
-827.2
-602.0
-225.2
-783.3
-17.3
-17.3
-415.6
-70.6
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15,594
42.7
2024
-827.2
-602.0
-225.2
-17.3
-17.3
-115.6
-70.6
-53.0
-39.7
-1423.4
2024
615.7
494.8
38.3
-1423.4
-827.2
-596.2
-807.7
43%
50%
50% | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0
522.0
96.8
38.3
-33
-1437.5
-827.2
-610.3
-782.7
-827.2
-610.3
-783.4
480%
-183.6
-783.6 | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-70.6
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-70.7
-1452.8
2026
699.3
549.7
111.4
38.3
-1452.8
-827.2
-625.6
-753.4
48%
-753.4
112%
55% | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
-70.6
-99.0
-39.7
-39.7
-39.7
-1469.4
2027
742.5
578.0
126.2
38.3
-1469.4
-827.2
-642.2
-726.9
51%
-116%
58%
 | 29,499
80.8
-2028
-827.2
-602.0
-225.2
-643.4
-17.3
-415.6
-70.6
-70.6
-100.2
-39.7
-1470.6
-2028
764.8
585.0
141.5
38.3
-1470.6
-827.2
-643.4
-705.8
585.0
119%
59% | 29,856
81.8
2029
-827.2
-602.0
-225.2
-644.6
-70.6
-101.4
-39.7
-1471.8
2029
787.3
592.1
157.0
38.3
-1471.8
-827.2
-644.6
-684.5
533% | 80%
30,217
82.8
2030
-827.2
-602.0
-225.2
-445.6
-70.6
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-102.7
-39.7
-1473.1
2030
810.4
599.3
172.9
38.3
-1473.1
-827.2
-645.9
-665.7
555%
60% | 80%
31,549
86.4
-827.2
-602.0
-225.2
-650.4
-17.3
-415.6
-70.6
-70.6
-107.2
-39.7
-1477.6
-2031
859.1
625.7
195.2
-38.3
-1477.6
-827.2
-650.4
-618.5
-58%
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2032
869.1
633.2
197.6
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| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost Cost - O&M Cost - RMC (existing) - Project Cost (additional) - Project Cost (cost (cost (cost cost (cost cost))) DWSD (existing) - Project O&M cost (clectricity) Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Water Charge - Sanitation Charge - TAX Expenditure - CAPEX - Q&M Cost Balance Coverage Rate of Total Cost Coverage Rate of Water Supply Total Cost Coverage Rate of Water Supply O&M Cost | NPV
-7,948
-5,784
-2,164
-166
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-602.0
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-415.6
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-2019
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229.7
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31.9
-1276.3
-827.2
-449.1
-1014.7
20%
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24% | -827.2 -602.0 -225.2 -449.1 -17.3 -415.6 -16.2 -1276.3 2020 382.3 348.3 0.0 382.3 348.3 0.0 -1276.3 -827.2 -449.1 -894.0 30% 85% 36% | -827.2 -602.0 -225.2 -449.1 -17.3 -415.6 -16.2

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8,362
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-39.7
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2024
615.7
494.8
82.6
38.3
-1423.4
-827.2
-596.2
-807.7
43%
103%
50%
112% | 19,740
54.1
2025
-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0
522.0
96.8
38.3
-1437.5
-827.2
-610.3
-780.4
46%
108%
53% | 24,253
66.4
2026
-827.2
-602.0
-225.2
-625.6
-17.3
-115.6
-70.6
-82.4
-39.7
-1452.8
2026
699.3
549.7
111.4
38.3
-1452.8
-827.2
-625.6
-753.4
48%
112%
55%
123% | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
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-99.0
-39.7
-39.7
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126.2
38.3
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-39.7
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-102.7
-39.7
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38.3
-1473.1
-827.2
-645.9
-662.7
55%
125%
60% | 80%
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86.4
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-827.2
-602.0
-225.2
-652.4
-17.3
-415.6
-70.6
-107.2
-39.7
-1477.6
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625.7
195.2
38.3
-1477.6
-827.2
-650.4
-618.5
58%
132%
63%
140% | 80%
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87.5
-602.0
-225.2
-651.7
-17.3
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-39.7
-1478.9
-2032
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-633.2
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-488.5
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-415.6
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-112.5
-39.7
-1482.9
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-1482.9
-827.2
-655.7
-583.3
61%
137%
147%
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| Coverage Rater of Sewerage Service Treatment Water Amount (1000 m3/year) Treatment Water Amount (MLD) Expenditure Cost - Capital Investment Cost - Existing Capital Cost - Project Cost Cost - O&M Cost - RMC (existing) - Proposed Labor Cost (additional) - Project O&M cost (treatment) - Project O&M cost (electricity) Total Cost Balance of Revenue and Expenditure of Water Supply an Revenue - Sanitation Charge - TAX Expenditure - CAPEX - QAM Cost Balance Coverage Rate of Total Cost Coverage Rate of O&M Cost | NPV
-7,948
-5,784
-2,164
-166
-3,993
-414
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-349
-13,108
d Sanitation S
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442.2
555.3
-33.9
-827.2
-551.8
-827.2
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-843.3
39%
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11,805
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-53.0
-39.7
-1423.4
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615.7
494.8
38.3
-1423.4
-827.2
-596.2
-807.7
43%
50%
50%
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54.1
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-827.2
-602.0
-225.2
-610.3
-17.3
-415.6
-70.6
-67.1
-39.7
-1437.5
2025
657.0
522.0
96.8
38.3
-33
-1437.5
-827.2
-610.3
-782.7
-827.2
-610.3
-783.4
480%
-183.6
-783.6 | 24,253
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-827.2
-602.0
-225.2
-625.6
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-1452.8
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549.7
111.4
38.3
-1452.8
-827.2
-625.6
-753.4
48%
-753.4
112%
55% | 29,146
79.9
2027
-827.2
-602.0
-225.2
-642.2
-17.3
-415.6
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-99.0
-39.7
-39.7
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-1469.4
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126.2
38.3
-1469.4
-827.2
-642.2
-726.9
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-116%
58% | 29,499
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-2028
-827.2
-602.0
-225.2
-643.4
-17.3
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-39.7
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764.8
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-705.8
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-827.2
-602.0
-225.2
-644.6
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-101.4
-39.7
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157.0
38.3
-1471.8
-827.2
-644.6
-684.5
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-827.2
-602.0
-225.2
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-39.7
-1473.1
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172.9
38.3
-1473.1
-827.2
-645.9
-665.7
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-827.2
-602.0
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-39.7
-1477.6
-2031
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-38.3
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Appendix D1.2 PredictedRevenue and Expenditure of Water Supply and Sewerage Service (Middle Case) (unit: million Rs.)

Source: JICA Study Team

Revenue fof Water Charge Appel	ndix D1	.3 Pre	dicted	Reve	nue an	id Exp	bendit	ure of	Water	r Supj	ply and	d Sew	erage	Servic	e (Hig	gh Ca	se) (ur	nit: mill	ion Rs.	.)		
Revenue for Water Charge		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Population in RMC Service Area		1,197,910	1,297,578	1,313,279	1,329,169	1,345,252	1,361,530	1,378,004	1,394,678	1,411,554	1,428,634	1,445,920	1,463,416	1,481,123	1,499,045	1,517,183	1,535,541	1,603,224	1,622,623	1,642,257	1,662,128	1,682,240
Coverage Ratio		50%	50%	50%	53%	56%	59%	62%	65%	68%	71%	74%	77%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Consumption per capita (l/day)		135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0
Water Demand for Domestic Use (1000 m3/year)		29,514	31,969	32,356	34,712	37,121	39,583	42,099	44,670	47,297	49,981	52,723	55,525	58,386	59,092	59,807	60,531	63,199	63,964	64,738	65,521	66,314
Charged Water Consumption (excl. well area and slum																						
area)	45%	13,281	14,386	14,560	15,621	16,704	17,812	18,944	20,101	21,284	22,491	23,725	24,986	26,274	26,592	26,913	27,239	28,440	28,784	29,132	29,484	29,841
Tariff (Rs /m3)		6.0	6.0	10.5	10.5	10.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Biiled Charge (million Rs.)		79.7	86.3	152.9	164.0	175.4	267.2	284.2	301.5	319.3	337.4	355.9	374.8	394.1	398.9	403.7	408.6	426.6	431.8	437.0	442.3	447.6
Water Demand for Organizations (1000 m3/year)	4.0%	1,181	1,279	1,294	1,388	1,485	1,583	1,684	1,787	1,892	1,999	2,109	2,221	2,335	2,364	2,392	2,421	2,528	2,559	2,590	2,621	2,653
Tariff (Rs./m3)	4.070	1,101	10.0	17.5	1,500	1,405	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	2,370	25.0	2,055
Biiled Charge for Ortanizations (million Rs.)		11.8	12.8	22.6	24.3	26.0	39.6	42.1	44.7	47.3	50.0	52.7	55.5	58.4	59.1	59.8	60.5	63.2	64.0	64.8	65.5	66.3
Water Demand for Commercial/Industries (1000 m3/year)	16.0%	4,722	5,115	5,177	5,554	5,939	6,333	6,736	7,147	7,568	7,997	8,436	8,884	9,342	9,455	9,569	9,685	10,112	10,234	10,358	10,483	10,610
Tariff (Rs./m3)		15.0	15.0	26.3	26.3	26.3	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Biiled Charge for Commercial/Industries (million Rs.)		70.8	76.7	135.9	145.8	155.9	237.5	252.6	268.0	283.8	299.9	316.4	333.2	350.3	354.6	358.8	363.2	379.2	383.8	388.4	393.1	397.9
		1/2.2	155.0						(11.0	(50.4	(05.0	525.0		000.0	010 5		022.2	0.00.0	050 5	000.0	000.0	011.0
Total Billed Charge (million Rs.) Collection Rate		162.3	175.8	311.4	334.1	357.3	544.2 80%	578.9 85%	614.2 90%	<u>650.4</u> 90%	687.2 90%	725.0 90%	763.5 90%	802.8 90%	812.5 90%	822.3 90%	832.3 90%	869.0 90%	879.5 90%	890.2 90%	900.9 90%	911.8 90%
Total Collected Charge (million Rs.)		89.3	60% 105.5	202.4	233.9	268.0	435.4	492.0	552.8	585.3	618.5	652.5	687.1	722.5	731.3	740.1	749.1	782.1	791.6	801.1	90% 810.8	820.6
Total Collected Charge (minion Ks.)		09.5	105.5	202.4	233.9	200.0	435.4	492.0	334.0	303.3	010.5	052.5	007.1	144.5	/31.3	/40.1	/49.1	/02.1	791.0	001.1	010.0	020.0
Revenue of Sanitation Charge (in Zone2)	60%	of Water	Charge			1	52%	Population	n Rate of Z	one2 in w	hole Ranch	ni										
Coverage Rater of Sewerage Service	0070								26%	32%	38%	44%	50%	56%	62%	68%	74%	80%	80%	80%	80%	80%
Collected Sanitation Charge									69.0	85.9	103.3	121.0	139.2	157.8	176.8	196.3	216.2	244.0	247.0	250.0	253.0	256.0
<u> </u>																						
Revenue of TAX	(unit: million	Rs.)																				
		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Collection Rate		55%	60%	65%	70%	75%	80%	85%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Total																						
Billed Amount		42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5
Collected Amount		23.4	25.5	27.6	29.8	31.9	34.0	36.1	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3
Calculation of Sewerage Treatment Amount (in Zone2)																						
Carculation of Sewerage Treatment Amount (III Zone2)		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Domestic Consumption (1000 m3/year)		2015	2010	2017	2010	2017	2020	2021	23,228	24,594	25,990	27,416	28,873	30,361	30,728	31,100	31,476	32,864	33,261	33,664	34,071	34,483
Organizational Consumption (1000 m3/year)									929	984	1.040	1,097	1.155	1,214	1,229	1.244	1.259	1,315	1.330	1,347	1.363	1,379
Industrial Consumption (1000 m3/year)									3,717	3,935	4,158	4,387	4,620	4,858	4,916	4,976	5,036	5,258	5,322	5,386	5,451	5,517
Total Consumption (1000 m3/year)									27,874	29,513	31,188	32,899	34,647	36,433	36,874	37,320	37,771	39,436	39,913	40,396	40,885	41,380
Coverage Rater of Sewerage Service									30%	40%	50%	60%	70%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Treatment Water Amount (1000 m3/year)									8,362	11,805	15,594	19,740	24,253	29,146	29,499	29,856	30,217	31,549	31,931	32,317	32,708	33,104
Treatment Water Amount (MLD)									22.9	32.3	42.7	54.1	66.4	79.9	80.8	81.8	82.8	86.4	87.5	88.5	89.6	90.7
T	00140	1.040																				
Expenditure	O&M Cost		million Rs			2010	2020	2021	2022	2022	2024	2025	2026	2027	2020	2020	2020	2021	2022	2022	2024	2025
Cont. Control II. and an a Cont.	NPV	2015 -827.2	2016 -827.2	2017	2018	2019	2020 -827.2	2021 -827.2	2022 -827.2	2023 -827.2	2024	2025 -827.2	2026	2027	2028	2029 -827.2	2030 -827.2	2031	2032	2033 -827.2	2034 -827.2	2035
Cost - Capital Investment Cost - Existing Capital Cost	- 7,948 -5,784	-602.0	-602.0	-827.2 -602.0	-827.2 -602.0	-827.2 -602.0	-602.0	-602.0	-602.0	-602.0	-827.2 -602.0	-602.0	-602.0	-827.2 -602.0	-827.2 -602.0	-602.0	-602.0	-827.2 -602.0	-602.0	-602.0	-602.0	-827.2 -602.0
- Project Cost	-3,784	-225.2	-225.2	-225.2	-225.2	-225.2	-002.0	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-225.2	-002.0	-225.2	-225.2	-225.2	-225.2	-002.0	-225.2	-225.2
Cost - O&M Cost	2,104	-449.1	-449.1	-449.1	-449.1	-449.1	-449.1	-449.1	-497.4	-528.9	-596.2	-610.3	-625.6	-642.2	-643.4	-644.6	-645.9	-650.4	-651.7	-653.0	-654.3	-655.7
- RMC (existing)	-166	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3
- DWSD (existing)	-3,993	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6	-415.6
- Proposed Labor Cost (additional)	-365	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-16.2	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6	-70.6
- Project O&M cost (treatment)	-796								-28.4	-40.1	-53.0	-67.1	-82.4	-99.0	-100.2	-101.4	-102.7	-107.2	-108.5	-109.8	-111.1	-112.5
- Project O&M cost (electricity)	-349								-19.9	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7	-39.7
Total Cost	-13,060	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1324.6	-1356.1	-1423.4	-1437.5	-1452.8	-1469.4	-1470.6	-1471.8	-1473.1	-1477.6	-1478.9	-1480.2	-1481.5	-1482.9
Balance of Revenue and Expenditure of Water Supply and	l Sanitation S		2016	2017	2010	2010	2020	2021	2022	2022	2024	2025	2026	2027	2020	2020	2020	2021	2022	2022	2024	2025
D	5.756	2015 112.7	2016 131.0	2017 230.0	2018 263.6	2019 299.8	2020 469.4	2021 528.2	2022 660.0	2023 709.5	2024 760.1	2025 811.7	2026 864.6	2027 918.6	2028 946.3	2029 974.7	2030 1,003.5	2031 1,064.3	2032 1,076.8	2033 1,089.4	2034 1,102.1	2035 1,114.9
Revenue - Water Charge	5,756 4,583	89.3	105.5	230.0	263.6	299.8	469.4	528.2 492.0	552.8	585.3	618.5	652.5	864.6 687.1	722.5	731.3	974.7 740.1	749.1	782.1	1,076.8 791.6	1,089.4 801.1	810.8	820.6
- Sanitation Charge	4,385	0.0	0.0	0.0	0.0	0.0	435.4	492.0	69.0	85.9	103.3	121.0	139.2	157.8	176.8	196.3	216.2	244.0	247.0	250.0	253.0	256.0
- TAX	322	23.4	25.5	27.6	29.8	31.9	34.0	36.1	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3
Expenditure	-13,060	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1276.3	-1324.6	-1356.1	-1423.4	-1437.5	-1452.8	-1469.4	-1470.6	-1471.8	-1473.1	-1477.6	-1478.9	-1480.2	-1481.5	-1482.9
- CAPEX	-7,948	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2	-827.2
- O&M Cost	-5,112	-449.1	-449.1	-449.1	-449.1	-449.1	-449.1	-449.1	-497.4	-528.9	-596.2	-610.3	-625.6	-642.2	-643.4	-644.6	-645.9	-650.4	-651.7	-653.0	-654.3	-655.7
Balance	-7,304	-1163.6	-1145.3	-1046.3	-1012.7	-976.5	-806.9	-748.1	-664.5	-646.6	-663.3	-625.7	-588.2	-550.8	-524.3	-497.2	-469.5	-413.2	-402.1	-390.8	-379.5	-368.0
Coverage Rate of Total Cost		9%	10%	18%	21%	23%	37%	41%	50%	52%	53%	56%	60%	63%	64%	66%	68%	72%	73%	74%	74%	75%
Coverage Rate of O&M Cost		25%	29%	51%	59%	67%	105%	118%	133%	134%	127%	133%	138%	143%	147%	151%	155%	164%	165%	167%	168%	170%
Coverage Rate of Water Supply Total Cost		10%	12%	21%	24%	28%	44%	50%	56%	59%	62%	65%	69%	72%	73%	74%	75%	78%	79%	80%	81%	82%
Coverage Rate of Water Supply O&M Cost		23%	27%	50%	57%	65%	104%	118%	132%	139%	138%	146%	153%	161%	163%	165%	167%	174%	176%	178%	180%	182%
Coverage Rate of Sewerage Total Cost		5%	5%	6%	6%	6%	7%	7%	30%	32%	31%	34%	37%	40%	44%	48%	53%	58%	59%	59%	60%	60%
Coverage Rate of Sewerage O&M Cost	l	75%	82%	89%	96%	103%	110%	117%	138%	110%	90%	94%	96%	98%	107%	117%	127%	139%	139%	140%	141%	141%
Source: JICA Study Team																						

Appendix D1.3 Predicted Revenue and Expenditure of Water Supply and Sewerage Service (High Case) (unit: million Rs.)

Coverage Rate of Sewerage O&M Cost Source: JICA Study Team

APPENDIX D1

Trend of Cost and Benefit under Case1 (WTP)

Appendix D1.4 Cost and Benefit Flow of Economic Analysis (unit: million Rs.)

I rend of Cost and Benefit und	er Casel	$(\mathbf{W}\mathbf{IP})$																																							
Benefit Calculation	NPV	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054
Population in Zone2		660,966	679,292	687,51	1 695,830	704,250	712,771	721,396	730,125	738,959	747,901	756,950	766,109	775,379	784,761	794,257	803,867	813,355	823,197	833,157	843,238	853,442	863,768	874,220	884,798	895,504	906,340	917,306	928,406	939,639	951,009	962,516	974,163	985,950	997,880	1,009,954	1,022,175	1,034,543	1,047,061	1,059,731	1,072,553
Coverage Ratio of Sewerage Service		0%	0%	0	1% 0%	6 0%	0%	0%	26%	32%	38%	44%	50%	56%	62%	68%	74%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Willingness to Pay per H.H. (Rs /year)		451.2	451.2	451.	.2 451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2	451.2
Willingness to Pay per Person (Rs/year)		91.7	91.7	91.	.7 91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7	91.7
1) Benefit of Improvement in Livelihood by																																							1	1	
Willingness to Pay (million Rs)	436								17.4	21.7	26.1	30.5	35.1	39.8	44.6	49.5	54.5	59.7	60.4	61.1	61.9	62.6	63.4	64.1	64.9	65.7	66.5	67.3	68.1	68.9	69.8	70.6	71.5	72.3	73.2	74.1	75.0	75.9	76.8	77.7	78.7
Loss of Treatment Cost (Rs./person)		940	940	94	10 940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940	940
Coverage Ratio of Sewerage Service		0%	0%	0	1% 09	6 0%	0%	0%	26%	32%	38%	44%	50%	56%	62%	68%	74%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
2) Benefit of Reduction in Medical Cost																																							1	1	
(million Rs)	4,474								178.4	222.3	267.2	313.1	360.1	408.2	457.4	507.7	559.2	611.6	619.0	626.5	634.1	641.8	649.6	657.4	665.4	673.4	681.6	689.8	698.2	706.6	715.2	723.8	732.6	741.4	750.4	759.5	768.7	778.0	787.4	796.9	806.6
Increase in Productivity (Rs./person)		574	574	57	74 574	4 574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574	574
Coverage Ratio of Sewerage Service		0%	0%	0	1% 09	6 0%	0%	0%	26%	32%	38%	44%	50%	56%	62%	68%	74%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
3) Benefit of Production Increase (million Rs)	2,732								109.0	135.7	163.1	191.2	219.9	249.2	279.3	310.0	341.5	373.5	378.0	382.6	387.2	391.9	396.6	401.4	406.3	411.2	416.2	421.2	426.3	431.5	436.7	442.0	447.3	452.7	458.2	463.8	469.4	475.1	480.8	486.6	492.5
Cost Calculation	NPV	2015	2016	5 20	17 201	8 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	3 2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	7 2048	3 2049	2050	2051	2052	2053	2054
Cost - Capital Investment Cost	-5,864	-240.3	-349.5	-143	.4 -2,380.8	8 -2,374.9	-2,381.4	-2,409.9																			Rep	acement	-292.3										Residu	al Value	2,599.4
Cost - O&M Cost	-822	-7.3	-7.3	-7.	.3 -7.3	3 -7.3	-7.3	-7.3	-75.2	-103.6	-115.2	-127.9	-141.7	-156.6	-157.7	-158.8	-159.9	-164.0	-165.1	-166.3	-167.5	-168.7	-169.9	-171.2	-172.4	-173.7	-175.0	-176.3	-177.6	-178.9	-180.3	-181.7	-183.0	-184.4	-185.8	-187.3	-188.7	-190.2	-191.7	-193.2	-194.7
Total Cost	-7,707	-247.6	-356.8	-150.	.7 -2,388.1	-2,382.2	-2,388.7	-2,417.2	-75.2	-103.6	-115.2	-127.9	-141.7	-156.6	-157.7	-158.8	-159.9	-164.0	-165.1	-166.3	-167.5	-168.7	-169.9	-171.2	-172.4	-173.7	-175.0	-176.3	-469.9	-178.9	-180.3	-181.7	-183.0	-184.4	-185.8	-187.3	-188.7	-190.2	-191.7	-193.2	2,404.7
1) Benefit of Improvement in Livelihood by																																							1	1	
Willingness to Pay (million Rs)	436								17.4	21.7	26.1	30.5	35.1	39.8	44.6	49.5	54.5	59.7	60.4	61.1	61.9	62.6	63.4	64.1	64.9	65.7	66.5	67.3	68.1	68.9	69.8	70.6	71.5	72.3	73.2	74.1	75.0	75.9	76.8	77.7	78.7
2) Benefit of Reduction in Medical Cost																																							1	1	
(million Rs)	4,474								178.4	222.3	267.2	313.1	360.1	408.2	457.4	507.7	559.2	611.6	619.0	626.5	634.1	641.8	649.6	657.4	665.4	673.4	681.6	689.8	698.2	706.6	715.2	723.8	732.6	741.4	750.4	759.5	768.7	778.0	787.4	796.9	806.6
																																							1	1	
3) Benefit of Production Increase (million Rs)	2,732								109.0	135.7	163.1	191.2	219.9	249.2	279.3	310.0	341.5	373.5	378.0	382.6	387.2	391.9	396.6	401.4	406.3	411.2	416.2	421.2	426.3	431.5	436.7	442.0	447.3	452.7	458.2	463.8	469.4	475.1	480.8	486.6	492.5
Total Benefit	4,314	0.0	0.0	0.	.0 0.0	0.0	0.0	0.0	304.8	379.7	456.3	534.8	615.1					1,044.8																							
Balance	-3,393	-247.6	-356.8	-150	.7 -2,388.1	-2,382.2	-2,388.7	-2,417.2	229.6	276.1	341.1	406.9	473.4	540.6	623.6	708.4	795.3	880.8	892.3	903.9	915.7	927.6	939.7	951.8	964.2	976.6	989.2	1,002.0	722.7	1,028.1	1,041.3	1,054.7	1,068.4	1,082.1	1,096.0	1,110.0	1,124.3	1,138.7	1,153.3	1,168.1	3,782.5
Sensitivity Analysis	NPV	2015	2016	5 20	17 201	8 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	3 2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	5 2046	2047	7 2048	, 2049	2050	2051	2052	2053	2054
Cost +10%	-8,478	-272.4	-392.5	-165	.8 -2,626.9	9 -2,620.5	-2,627.6	-2,658.9	-82.7	-114.0	-126.7	-140.7	-155.9	-172.3	-173.5	-174.7	-175.9	-180.4	-181.6	-182.9	-184.3	-185.6	-186.9	-188.3	-189.6	-191.1	-192.5	-193.9	-516.8	-196.8	-198.3	-199.9	-201.3	-202.8	-204.4	-206.0	-207.6	-209.2	-210.9	-212.5	2,645.2
Benefit -10%	3,883	0.0	0.0	0.	.0 0.0	0.0	0.0	0.0	274.3	341.7	410.7	481.3	553.6	627.5	703.1	780.5	859.7	940.3	951.7	963.2	974.9	986.7	998.6	1,010.7	1,022.9	1,035.3	1,047.8	1,060.5	1,073.3	1,086.3	1,099.5	1,112.8	1,126.2	1,139.9	1,153.7	1,167.6	1,181.7	1,196.0	1,210.5	1,225.2	1,240.0
Balance (B: Benefit -10%)	-3,825	-247.6	-356.8	-150	.7 -2,388.1	-2,382.2	-2,388.7	-2,417.2	199.1	238.1	295.5	353.4	411.9		545.4	621.7	699.8	776.3	786.6	796.9	807.4	818.0	828.7	839.5	850.5	861.6	872.8	884.2	603.5	907.4	919.2	931.1	943.2	955.5	967.9	980.3	993.0	1,005.8	1,018.8	1,032.0	3,644.7
Balance (C: Cost +10%)	-4,164	-272.4	-392.5	-165	.8 -2,626.9	9 -2,620.5	-2,627.6	-2,658.9	222.1	265.7	329.6	394.1	459.2	525.0	607.8	692.6	779.3	864.4	875.8	887.3	898.9	910.7	922.7	934.7	946.9	959.3	971.7	984.4	675.8	1,010.2	1,023.3	1,036.5	1,050.1	1,063.7	1,077.5	1,091.3	1,105.5	1,119.7	1,134.1	1,148.8	4,023.0
Balance (D: Benefit -10%, Cost +10%)	-4,595	-272.4	-392.5	-165	.8 -2,626.9	-2,620.5	-2,627.6	-2,658.9	191.6	227.8	284.0	340.6	397.7	455.2	529.7	605.8	683.8	759.9	770.1	780.3	790.6	801.1	811.7	822.4	833.3	844.2	855.3	866.6	556.5	889.5	901.1	912.9	924.9	937.0	949.3	961.6	974.2	986.8	9999.6	1,012.6	3,885.2
	D 14 67							Case B:	Benefit -	Case C	: Cost	D: Benef	fit -10% ,	1																											
	Result of Ser	isitivity An	alysis			Case A:	Base Case	10	%	+10	%	Cost	+10%																												
	IRR					5.	6%	4.9	9%	5.0	1%	4.3	3%	1																											

Coso A. Poso Coso	Case B: Benefit -	Case C: Cost	D: Benefit -10%,
Case A: Dase Case	10%	+10%	Cost +10%
5.6%	4.9%	5.0%	4.3%
-3,393	-3,825	-4,164	-4,595
0.56	0.50	0.51	0.46
	5.6% -3,393	Case A: Base Case 10% 5.6% 4.9% -3,393 -3,825	Case A: Base Case 10% +10% 5.6% 4.9% 5.0% -3,393 -3,825 -4,164

Trend of Cost and Benefit under Case2 (ATP)

| a Case2 | (AIF) | | | | | | | | | |
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 | 2045 | 2046 | 2047 | 2048 | 2049
 | 2050 | 2051 | 2052 | 2053 | 2054 |
| | 660,966 | 679,292 | 687,511 | 695,830 | 704,25 | 0 712,771 | 721,396 | 730,125 | 738,959 | 747,901 | 756,950
 | 766,109 | 775,379 | 784,761 | 794,257

 | 803,867 | 813,355 | 823,197 | 833,157
 | 843,238 | 853,442

 | 863,768 | 874,220 | 884,798
 | 895,504
 | 906,340
 | 917,306
 | 928,406 | 939,639 | 951,009
 | 962,516 | 974,163 | 985,950 | 997,880 | 1,009,954
 | 1,022,175 | 1,034,543 1 | ,047,061 1 | 1,059,731 | 1,072,553 |
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 | 544.6 | 551.2

 | 557.9 | 564.6 | 571.4
 | 578.4
 | 585.4
 | 592.4
 | 599.6 | 606.9 | 614.2
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 | -141.7 | -156.6 | -157.7 | -158.8

 | -159.9 | -164.0 | -165.1 | -166.3
 | -167.5 | -168.7

 | -169.9 | -171.2 | -172.4
 | -173.7
 | -175.0
 | -176.3
 | -177.6 | -178.9 | -180.3
 | -181.7 | -183.0 | -184.4 | -185.8 | -187.3
 | -188.7 | -190.2 | -191.7 | -193.2 | -194.7 |
| -7,742 | -247.6 | -356.8 | -150.7 | -2388.1 | -2382. | 2 -2388.7 | -2417.2 | -75.2 | -103.6 | -115.2 | -127.9
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 | -159.9 | -164.0 | -165.1 | -166.3
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| 4,268 | | | | | | | | 178.4 | 222.3 | 267.2 | 313.1
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 | 634.1 | 641.8

 | 649.6 | 657.4 | 665.4
 | 673.4
 | 681.6
 | 689.8
 | 698.2 | 706.6 | 715.2
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 | 396.6 | 401.4 | 406.3
 | 411.2
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 | 469.4 | 475.1 | 480.8 | 486.6 | 492.5 |
| 5,949 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 440.7 | 548.9 | 659.7 | 773.1
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| -1,793 | -247.6 | -356.8 | -150.7 | -2,388.1 | -2,382. | 2 -2,388.7 | -2,417.2 | 365.5 | 445.3 | 544.5 | 645.2
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 | 1,221.0 | 1,346.4 | 1,363.6 | 1,380.9
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 | 1,605.7 | 1,626.1 | 1,646.5 | 1,667.3 | 1,688.2
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| -8,516 | -272.4 | -392.5 | -165.8 | -2,626.9 | -2,620. | 5 -2,627.6 | -2,658.9 | -82.7 | -114.0 | -126.7 | -140.7
 | -155.9 | -172.3 | -173.5 | -174.7

 | -175.9 | -180.4 | -181.6 | -182.9
 | -184.3 | -185.6

 | -186.9 | -188.3 | -189.6
 | -191.1
 | -192.5
 | -193.9
 | -516.8 | -196.8 | -198.3
 | -199.9 | -201.3 | -202.8 | -204.4 | -206.0
 | -207.6 | -209.2 | -210.9 | -212.5 | 2,645.2 |
| 5,354 | 0.0 | 0.0 | 0.0 | 0.0 | 0. | 0.0 | 0.0 | 396.6 | 494.0 | 593.7 | 695.8
 | 800.3 | 907.1 | 1,016.5 | 1,128.3

 | 1,242.8 | 1,359.4 | 1,375.8 | 1,392.5
 | 1,409.3 | 1,426.4

 | 1,443.6 | 1,461.1 | 1,478.8
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 | 1,533.1
 | 1,551.7 | 1,570.5 | 1
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 | 1,708.4 | 1,729.1 | 1,750.0 | | 1,792.6 |
| -2,388 | -247.6 | -356.8 | -150.7 | -2,388.1 | -2,382. | 2 -2,388.7 | -2,417.2 | 321.4 | 390.4 | 478.5 | 567.9
 | 658.6 | 750.5 | 858.8 | 969.5

 | 1,082.9 | 1,195.4 | 1,210.7 | 1,226.2
 | 1,241.8 | 1,257.7

 | 1,273.7 | 1,289.9 | 1,306.4
 | 1,323.0
 | 1,339.8
 | 1,356.8
 | 1,081.8 | 1,391.6 | 1,409.2
 | 1,427.0 | 1,445.2 | 1,463.5 | 1,482.0 | 1,500.7
 | 1,519.7 | 1,538.9 | 1,558.3 | 1,578.0 | 4,197.3 |
| -2,567 | -272.4 | -392.5 | -165.8 | -2,626.9 | -2,620. | 5 -2,627.6 | -2,658.9 | 357.9 | 435.0 | 533.0 | 632.4
 | 733.3 | 835.7 | 956.0 | 1,079.0

 | 1,205.0 | 1,330.0 | 1,347.1 | 1,364.3
 | 1,381.7 | 1,399.3

 | 1,417.2 | 1,435.1 | 1,453.5
 | 1,471.9
 | 1,490.6
 | 1,509.5
 | 1,207.3 | 1,548.2 | 1,567.7
 | 1,587.6 | 1,607.8 | 1,628.1 | 1,648.7 | 1,669.5
 | 1,690.6 | 1,712.0 | 1,733.6 | 1,755.4 | 4,637.0 |
| -3,162 | -272.4 | -392.5 | -165.8 | -2,626.9 | -2,620. | 5 -2,627.6 | -2,658.9 | 313.9 | 380.1 | 467.0 | 555.1
 | 644.4 | 734.9 | 843.0 | 953.7

 | 1,066.9 | 1,179.0 | 1,194.2 | 1,209.6
 | 1,225.1 | 1,240.8

 | 1,256.8 | 1,272.8 | 1,289.2
 | 1,305.6
 | 1,322.3
 | 1,339.2
 | 1,034.8 | 1,373.7 | 1,391.1
 | 1,408.8 | 1,426.9 | 1,445.0 | 1,463.4 | 1,481.9
 | 1,500.8 | 1,519.8 | 1,539.1 | 1,558.6 | 4,437.8 |
| | NPV
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Result of Sensitivity Analysis	Case A: Base Case	Case B: Benefit - 10%	Case C: Cost +10%	D: Benefit -10% , Cost +10%
IRR	8.3%	7.5%	7.6%	6.8%
NPV (D.R.=10%) (unit:million Rs.)	-1,793	-2,388	-2,567	-3,162
B/C	0.77	0.69	0.70	0.63

Source: JICA Study Team

Appendix E1

CHAPTER E1 LAND ACQUISITION RELATED LAW

Appendix E1.1 The National Rehabilitation and Resettlement Policy, 2007 Chapter - II (Extracted from Chapter-II of NRRP-2007)

2.¹ Objectives of the National Rehabilitation and Resettlement Policy

2.1 The objectives of the National Rehabilitation and Resettlement Policy are as follows:

(a) to minimize displacement and to promote, as far as possible, non-displacing or least-displacing alternatives;

(b) to ensure adequate rehabilitation package and expeditious implementation of the rehabilitation process with the active participation of the affected families;

(c) to ensure that special care is taken for protecting the rights of the weaker sections of society, especially members of the Scheduled Castes and Scheduled Tribes, and to create .obligations on the State for their treatment with concern and sensitivity;

(d) to provide a better standard of living, making concerted efforts for providing sustainable income to the affected families;

(e) to integrate rehabilitation concerns into the development planning and implementation process; and

(f) where displacement is on account of land acquisition, to facilitate harmonious relationship between the requiring body and affected families through mutual cooperation.

Appendix E1.2 The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 Chapter II

(Extracted from Chapter II of New Land Acquisition Act-2013, Section 4 to 9)

Determination of social impact and public purpose

A.-PLELIMINARY INVESTIGATION FOR DETERMINATION OF SOCIAL IMPACT AND PUBLIC PURPOSE

 $4.^{2}$

(1) Whenever the appropriate Government intends to acquire land for a public purpose, it shall consult the concerned Panchayat, Municipality or Corporation, as the case may be, at

¹ Section No. through whole NRRP-7

² Section No. through whole New Land Acquisition Act-2013

village level or ward level, in the affected area and carry out a Social Impact Assessment study in consultation with them, in such manner and from such date as may be specified by such Government by notification.

(2) The notification issued by the appropriate Government for commencement of consultation and of the Social Impact Assessment study under sub-section of (1) shall be made available in the local language to the Panchayat, Municipality or Municipal Corporation, as the case may be, and in the office of the District Collector, the Sub-Divisional Magistrate and the Tehsil, and shall be published in the affected areas, in such manners as may be prescribed, and uploaded on the website of the appropriate Government.

Provided that the appropriate Government shall ensure that adequate representation has been given to the representatives of Panchayat, Gram Sabha, Municipality or Municipal Corporation, as the case may be, at the stage of carrying out the Social Impact Assessment study.

Provided further that the appropriate Government shall ensure the completion of the Social Impact Assessment study within a period of six months from the date of its commencement.

(3) The Social Impact Assessment study report referred to in sub-section (1) shall be made available to the public in the manner prescribed under section 6.

(4) The Social Impact Assessment study referred to in sub-section (1) shall, among other matters, include the following, namely:-

(a) assessment as to whether the proposed acquisition serves public purpose;

(b) estimation of affected families and the number of families among them likely to be displaced;

(*c*) extent of lands, public and private, houses, settlements and other common properties likely to be affected by the proposed acquisition;

(*d*) whether the extent of land proposed for acquisition is the absolute bare-minimum extent needed for the project;

(e) whether land acquisition at an alternate place has been considered and found not feasible;

(*f*) study of social impact of the project, and the nature and cost of addressing them and the impact of these cost on the overall costs of the project vis- \hat{a} -vis the benefits the project;

Provided that Environmental Impact Assessment study, if any, shall be carried out simultaneously and shall not be contingent upon the completion of the Social Impact Assessment study;

(5) While undertaking a Social Impact Assessment study under sub-section (1), the

appropriate Government shall, amongst other things, take into consideration the impact that the project is likely to have on various components such as livelihood of affected families, public and community properties, assets and infrastructure particularly roads, public transport, drainage, sanitation, source of drinking water, source of water for cattle, community ponds, grazing land, plantations, public utilities such as post offices, fair price shops, food strage godowns,, electricity supply, health care facilities, school and educational or training facilities, anganwadis, children parks, places of workshop, land for traditional tribal institutions and burial and cremation ground.

(6) The appropriate Government shall require the authority conducting the Social Impact Assessment study to prepare a Social Impact Management Plan, listing the ameliorative measures required to be undertaken for addressing the impact for a specific component referred to in sub-section (5), and such measures shall not be less than what is provided under a scheme or program, in operation in that area, of the Central Government or, as the case may be, the State Government, in operation in the affected area.

5.

Whenever a Social Impact Assessment is required to be prepared under section 4, the appropriate Government shall ensure that a public hearing is held at the affected area, after giving adequate publicity about the date, time and venue for the public hearing, to ascertain the views of the affected families to be recorded and include in the Social Assessment Report.

6.

(1) The appropriate Government shall ensure that the Social Impact Assessment study report and the Social Impact Management Plan referred to in sub-section (6) of section 4 are prepared and made available in the local language to the Panchayat, Municipality or Municipal Corporation, as the case may be, and the offices of the District Collectors, the Sub-Divisional Magistrate and the Tehsil, and shall be published in the affected areas, in such manner as may be prescribed, and uploaded on the website of the appropriate Government.

(2) Whenever Environmental Impact Assessment is carried out, a copy of the Social Impact Assessment report shall be made available to the Impact Assessment Agency authorized by the central Government to carry out environmental impact assessment:

Provided that, in respect of irrigation projects where the process of Environmental Impact Assessment is required under the provisions of any other law for the time being in force, the provisions of this Act relating to Social Impact Assessment shall not apply.

B.- APPRAISAL OF SOCIAL IMPACT ASSESSMENT REPORT BY AN EXPERT GROUP

7.

(1) The appropriate Government shall ensure that the Social Impact Assessment report is evaluated by an independent multi-disciplinary Expert Group, as may be consisted by it,

(2) The Expert Group constituted under sub-section (1) shall include the following, namely:-

(a) two non-official social scientists;

(*b*) two representatives of Panchayat, Gram Sabha, Municipality or Municipal Corporation, as the case may be;

(c) two experts on rehabilitation; and

(d) a technical expert in the subject relating the project.

(3) The appropriate Government may nominate a person from amongst the members of the Expert Group as the Chairperson of the Group.

(4) If the Expert Group constituted under sub-section (1), is of the opinion that, -

(a) the project does not serve any public purpose; or

(b) the social costs and adverse social impacts of the project outweigh the potential benefits,

It shall make a recommendation within two months from the date of its constitution to the effect that the project shall be abandoned forthwith and no further steps to acquire the land will be initiated in respect of the same.

Provided that the grounds for such recommendation shall be recorded in writing by the Expert Group giving the detail and reasons for such decision:

Provided further that where the appropriate Government, in spite of such recommendations, proceeds with the acquisition, then, it shall ensure that its reasons for doing so are recorded in writing.

(5) If the Expert Group constituted under sub-section (1), is of the opinion that, -

(a) the project will serve any public purpose; and

(b) the potential benefits outweigh the social costs and adverse social impacts,

It shall make special recommendations within two months from the date of it constitution whether the extent of land proposed to be acquired is the absolute bare-minimum extent needed for the project and whether there are no other less displacing options available:

Provided that the grounds for such recommendation shall be recorded in writing by the Expert Group giving the detail and reasons for such decision.

(6) The recommendations of the Expert Group referred to in sub-section (4) and (5) shall be made available in the local language to the Panchayat, Municipality or Municipal Corporation, as the case may be, and the offices of the District Collectors, the Sub-Divisional

Magistrate and the Tehsil, and shall be published in the affected areas, in such manner as may be prescribed, and uploaded on the website of the appropriate Government.

8.

(1) The appropriate Government shall ensure that –

(*a*) there is a legitimate and *bona fide* public purpose for the proposed acquisition which necessitates the acquisition of land identified;

(*b*) the potential benefits and the public purpose referred to in clause (*a*) shall outweigh the social costs and adverse social impact as determined by the Social Impact Assessment that has been carried out;

(c) only the minimum area of land required for the project is proposed to be acquired;

(d) there is no unutilized land which has been previously acquired in the area;

(*e*) the land, if any, acquired earlier and remained unutilized, is used for such public purpose and make recommendations in respect thereof.

(2) The appropriate Government shall examine the report of the Collector, if any, and the report of the Expert Group on the Social Impact Assessment study and after considering all the reports, recommend such area for acquisition which would ensure minimum displacement of people, minimum disturbance to the infrastructure, ecology and minimum adverse impact on the individuals affected.

(3) The decision of the appropriate Government shall be made available in the local language to the Panchayat, Municipality or Municipal Corporation, as the case may be, and the offices of the District Collector, the Sub-Divisional Magistrate and the Tehsil, and shall be published in the affected areas, in such manner as may be prescribed, and uploaded on the website of the appropriate Government.

Provided that where land is sought to be acquired for the purposes as specified in sub-section (2) of section 2, the appropriate Government shall also ascertain as to whether the prior consent of the affected families as required under the provision of sub-section (2) of section 2, has been obtained in the manner as may be prescribed.

9.

Where land is proposed to be acquired invoking the urgency provisions under section 40, the appropriate Government may exempt undertaking of the Social Impact Assessment study.

Appendix E2

CHAPTER E2 CATEGORIZATION OF PROJECT/ACTIVITIES BY EIA NOTIFICATION-2006

Appendix E2.1 List of Projects or Activities Requiring Prior Environmental Clearance (39 types of projects/activities in 8 sector)

	Project or Activity	Category with	threshold limit	Conditions if any
		А	В	
1. Mi	ning, extraction of natural resources	and power generation (for a specified	production capacity)	
(a)	Mining of minerals	≥ 50 ha. of mining lease area Asbestos mining irrespective of mining area	50ha \geq 5 ha .of mining lease area.	General Condition shall apply Note Mineral prospecting (not involving drilling) are exempted provided the concession areas have got previous clearance for physical survey
(b)	Offshore and onshore oil and gas exploration, development & production	All projects		Note Exploration Surveys (not involving drilling) are exempted provided the concession areas have got previous clearance for physical survey
(c)	River Valley projects	$(i) \ge 50$ MW hydroelectric power generation;	(i) < 50 MW ≥ 25 MW hydroelectric power generation;	General Condition shall apply
		$(ii) \ge 10,000$ ha. of culturable command area	(ii) < 10,000 ha. of culturable command area	
(d)	Thermal Power Plants	≥ 500 MW (coal/lignite/naphta & gas based);	< 500 MW (coal/lignite/naptha & gas based);	General Condition shall apply
		≥ 50 MW (Pet coke diesel and all other fuels -)	<50 MW ≥ 5MW (Pet coke ,diesel and all other fuels)	
(e)	Nuclear power projects and processing of nuclear fuel	All projects	-	-
2. Prin	nary Processing		•	•
(a)	Coal washeries	≥ 1 million ton/annum throughput of coal	<1 million ton/annum throughput of coal	General Condition shall apply (If located within mining area the proposal shall be appraised together with the mining proposal)
(b)	Mineral beneficiation	≥ 0.1million ton/annum mineral throughput	< 0.1million ton/annum mineral throughput	General Condition shall apply (Mining proposal with Mineral beneficiation shall be appraised together for grant of clearance)
3. Mat	erials Production			
(a)	Metallurgical industries (ferrous & non ferrous)	a)Primary metallurgical industry All projects b) Sponge iron manufacturing		
		≥ 200TPD c)Secondary metallurgical processing industry All toxic and heavy metal producing units	Sponge iron manufacturing <200TPD Secondary metallurgical processing industry	General Condition shall apply for Sponge iron manufacturing
		≥ 20,000 tonnes /annum	i.)All toxic andheavymetal producing units <20,000 tonnes /annum ii.)All other non -toxic secondary metallurgical processing industries >5000 tonnes/annum	
(b)	Cement plants	≥ 1.0 million tonnes/annum production capacity	<1.0 million tonnes/annum production capacity. All Stand alone grinding units	General Condition shall apply
4. Mat	erials Processing			
	Petroleum refining industry	All projects		1

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(b)	Coke oven plants	≥2,50,000 tonnes/annum	<2,50,000 & ≥25.000 tonnes/annum	-
(c)	Asbestos milling and asbestos based products	All projects		-
(d)	Chlor-alkali industry	≥300 TPD production capacityor a unit located out side the notified industrial area/ estate	<300 TPD production capacityand located within a notified industrial area/ estate	Specific Condition shall apply No new Mercury Cell based plants will be permitted and existing units converting to membrane cell technology are exempted from this Notification
(e)	Soda ash Industry	All projects	-	-
(f)	Leather/skin/hide processing industry	New projects outside the industrial area or expansion of existing units out side the industrial area	All new or expansion of projects located within a notified industrial area/ estate	Specific condition shall apply
5. Mai	nufacturing/Fabrication			
(a)	Chemical fertilizers	All projects	-	-
(b)	Pesticides industry and pesticide specific intermediates (excluding formulations)	All units producing technical grade pesticides	-	-
(c)	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	All projects	-	-
(d)	Manmade fibres manufacturing	Rayon	Others	General Condition shall apply
(e)	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	Located out side the notified industrial area/ estate	Located in a notified industrial area/ estate	Specific Condition shall apply
(f)	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	Located out side the notified industrial area/ estate	Located in a notified industrial area/ estate	Specific Condition shall apply
(g)	Distilleries	(i)All Molasses based distilleries (ii) All Cane juice/ non-molasses based distilleries <30 KLD	All Cane juice/non-molasses based distilleries -<30 KLD	General Condition shall apply
(h)	Integrated paint industry	-	All projects	General Condition shall apply
(i)	Pulp & paper industry excluding manufacturing of paper from waste paper and manufacture of paper from ready pulp with out bleaching	Pulp manufacturing and Pulp& Paper manufacturing industry	Paper manufacturing industry without pulp manufacturing	General Condition shall apply
(j)	Sugar Industry	-	\geq 5000 tcd cane crushing capacity	General Condition shall apply
(k)	Induction/arc furnaces/cupola furnaces 5TPH or more	-	All projects	General Condition shall apply
6. Serv	vice Sectors			
(a)	Oil & gas transportation pipe line (crude and refinery/ petrochemical products), passing through national parks /sanctuaries/coral reefs /ecologically sensitive areas including LNG Terminal	All projects		
(b)	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)	-	All projects	General Condition shall apply
7. Phy	sical Infrastructure including Enviro	nmental Services	1	1
(a)	Air ports	All projects	-	-
(b)	All ship breaking yards including ship breaking units	All projects	-	-

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(c)	Industrial estates/ parks/ complexes/ areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes.	If at least one industry in the proposed industrial estate falls under the Category A, entire industrial area shall be treated as Category A, irrespective of the area. Industrial estates with area greater than 500 ha. and housing at least one Category B industry.	-Industrial estates housing at least one Category B industry and area <500 ha. Industrial estates of area> 500 ha. and not housing any industry belonging to Category A or B.	Special condition shall apply Note: Industrial Estate of area below 500 ha. and not housing any industry of category A or B does not require clearance.
(d)	Common hazardous waste treatment, storage and disposal facilities (TSDFs)	All integrated facilities having incineration &landfill or incineration alone	All facilities having land fill only	General Condition shall apply
(e)	Ports, Harbours	≥ 5 million TPA of cargo handling capacity (excluding fishing harbours)	< 5 million TPA of cargo handling capacity and/or ports/ harbours ³ 10,000 TPA of fish handling capacity	General Condition shall apply
(f)	Highways	 i) New National High ways; and ii) Expansion of National High ways greater than 30 KM, involving additional right of way greater than 20m involving land acquisition and passing through more than one State. 	i) New State High ways; and ii) Expansion of National / State Highways greater than 30 km involving additional right of way greater than 20m involving land acquisition.	General Condition shall apply
(g)	Aerial ropeways		All projects	General Condition shall apply
(h)	Common Effluent Treatment Plants (CETPs)		All projects	General Condition shall apply
(i)	Common Municipal Solid Waste Management Facility (CMSWMF)		All projects	General Condition shall apply
8. Bui	Iding /Construction projects/Area De	evelopment projects and Townships		
(a)	Building and Construction projects		≥20000 sq.mtrs and <1,50,000 sq.mtrs. of built-up area#	#(built up area for covered construction; in the case of facilities open to the sky, it will be the activity area)
(b)	Townships and Area Development projects.		Covering an area \geq 50 ha and or built up area \geq 1,50,000 sq .mtrs ++	⁺⁺ All projects under Item 8(b) shall be appraised as Category B1

Source: JICA Study Team