Table 9.5.1 (3/4) PAYMENT ITEMS AND THE COSTS FOR PACKAGE-1

ID No.	BQ Item		Unit	Quantity	Unit Cost				Cost			
					PF/C	IF/C	L/C	Total	PF/C	IF/C	L/C	Total
JD-P1-Bq-137	K.	Furnishing and Installing Metalwork										
JD-P1-Bq-138	K.1	Miscellaneous Metalwork (Galvanized)	kg	7,000	10,070	0	10,740	20,810	70,490,000	0	75,180,000	145,670,000
JD-P1-Bq-139	K.2	Miscellaneous Metalwork (Painted)	kg	4,500	9,490	50	7,150	16,690	42,705,000	225,000	32,175,000	75,105,000
JD-P1-Bq-140	K.3	Miscellaneous Metalwork (Stainless Steel)	kg	500	31,770	0	9,560	41,330	15,885,000	0	4,780,000	20,665,000
JD-P1-Bq-141	K.4	Miscellaneous Metal Work in Underground Works :										
JD-P1-Bq-142	K.4.1	for Diversion Tunnel Plugs (Grout and Cooling Pipes)	L.S.	1	5,867,000	50,400	1,664,900	7,582,300	5,867,000	50,400	1,664,900	7,582,300
JD-P1-Bq-143	K.4.2	for Adit Concrete Filling (Grout Pipes)	L.S.	1	10,457,800	89,200	3,265,700	13,812,700	10,457,800	89,200	3,265,700	13,812,700
JD-P1-Bq-144	L.	Water Control Plant										
JD-P1-Bq-145	L.1	Furnishing and Installing Water Control Plant for Outlet Facilities :										
JD-P1-Bq-146	L.1.1	Bulkhead Gate; B 2.0 m x H 2.0 m including Gate Guide, Hoist, Air Vent, etc	L.S.	1	1,911,078,800	0	1,124,983,000	3,036,061,800	1,911,078,800	0	1,124,983,000	3,036,061,800
JD-P1-Bq-147	L.1.2	Emergency Water Outlet Gate; B 2.0 m x H 1.65 m including Gate Guide, Lifting Beam, Hoist, etc	L.S.	1	1,616,974,200	0	778,160,000	2,395,134,200	1,616,974,200	0	778,160,000	2,395,134,200
JD-P1-Bq-148	L.1.3	Trash Rack for Bulkhead Gate and Low Water Outlet Gate	L.S.	1	666,213,300	0	531,782,000	1,197,995,300	666,213,300	0	531,782,000	1,197,995,300
JD-P1-Bq-149	L.1.4	Outlet Pipe; 1400 mm dia., 650 mm dia. 250 mm including Transition Pipe, Reducer, Installation Stand, etc.	L.S.	1	8,386,460,300	0	3,993,334,000	12,379,794,300	8,386,460,300	0	3,993,334,000	12,379,794,300
JD-P1-Bq-150	L.1.5	Control and Guard Gates with Auxiliary Facilities; for 650 mm dia. Outlet Pipe	L.S.	1	2,362,460,900	0	541,919,000	2,904,379,900	2,362,460,900	0	541,919,000	2,904,379,900
JD-P1-Bq-151	L.1.6	Control and Guard Gates with Auxiliary Facilities; for 250mm dia. Outlet Pipe	L.S.	1	864,188,300	0	142,648,000	1,006,836,300	864,188,300	0	142,648,000	1,006,836,300
JD-P1-Bq-152	L.1.7	Overhead Traveling Crane (3 ton) and Operating Stand in Control and Guard Gates Operation Room	L.S.	1	186,680,100	0	55,113,000	241,793,100	186,680,100	0	55,113,000	241,793,100
JD-P1-Bq-153	L.1.8	Electrical Equipment for Control and Guard Gates including local control panels and ultrasonic flow meter	L.S.	1	191,934,500	0	18,754,000	210,688,500	191,934,500	0	18,754,000	210,688,500
JD-P1-Bq-154	L.2	Furnishing and Installing Water Control Plant for Hydropower Station :										
JD-P1-Bq-155	L.2.1	Outlet Pipe Comprising 1400 mm dia. Section, 1400 mm to 800mm reducer, and 800mm dia. section	L.S.	1	43,277,400	0	20,050,100	63,327,500	43,277,400	0	20,050,100	63,327,500
JD-P1-Bq-156	L.2.2	Tailrace Gate; B 2.15 m x H 2.075 m including Gate Guide, Hoist, etc	L.S.	1	9,372,500	137,800	10,998,000	20,508,300	9,372,500	137,800	10,998,000	20,508,300
JD-P1-Bq-157	L.2.3	Drainage Pipe Valve 150 mm dia.	L.S.	1	4,038,900	36,300	325,600	4,400,800	4,038,900	36,300	325,600	4,400,800
JD-P1-Bq-158	L.3	Furnishing and Installing Flap Gate 600 mm dia.	L.S.	1	2,504,100	34,100	1,731,500	4,269,700	2,504,100	34,100	1,731,500	4,269,700
JD-P1-Bq-159	L.4	Furnishing and Installing Closure Gate for Diversion Tunnel; B 6.2 m x H 5.8 m including Gate Guide, etc	L.S.	1	967,584,100	0	722,824,800	1,690,408,900	967,584,100	0	722,824,800	1,690,408,900
JD-P1-Bq-160	M.	Instrumentation of Structures										
JD-P1-Bq-161	M.1	Supplying and Installing Electrical Piezometer :										
JD-P1-Bq-162	M.1.1	in Embankment	No.	20	7,621,260	59,630	1,370,190	9,051,080	152,425,200	1,192,600	27,403,800	181,021,600
JD-P1-Bq-163	M.1.2	in Borehole	No.	4	7,688,380	60,150	1,382,250	9,130,780	30,753,520	240,600	5,529,000	36,523,120
JD-P1-Bq-164	M.2	Supplying and Installing Foundation Deformation Meter (including Drilling and Backfilling Drilled Hole)	No.	1	30,942,090	242,080	5,562,890	36,747,060	30,942,090	242,080	5,562,890	36,747,060
JD-P1-Bq-165	M.3	Supplying and Installing Electrical Tri-axial Joint Meters	No.	2	5,423,100	42,430	975,000	6,440,530	10,846,200	84,860	1,950,000	12,881,060
JD-P1-Bq-166	M.4	Supplying and Installing Probe Extensometer with Magnet/Reed Switch Transducer	No.	1	135,206,900	1,057,800	24,308,100	160,572,800	135,206,900	1,057,800	24,308,100	160,572,800
JD-P1-Bq-167		including Excavating Trench and Constructing Protective Surround										
JD-P1-Bq-168		including Readout Unit										
JD-P1-Bq-169	M.5	Supplying and Installing Strong Motion Accelerograph with Recorder	No.	2	170,198,600	1,331,550	30,599,000	202,129,150	340,397,200	2,663,100	61,198,000	404,258,300
JD-P1-Bq-170	M.6	Supplying and Installing Surface Movement Markers :										
JD-P1-Bq-171	M.6.1	on Upstream Surface of Embankment Dam	No.	6	190,490	110,660	305,590	606,740	1,142,940	663,960	1,833,540	3,640,440
JD-P1-Bq-172	M.6.2	on Downstream Surface of Embankment Dam	No.	9	96,790	95,270	185,670	377,730	871,110	857,430	1,671,030	3,399,570
JD-P1-Bq-173	M.6.3	on Dam Crest	No.	6	99,060	95,230	179,170	373,460	594,360	571,380	1,075,020	2,240,760
JD-P1-Bq-174	M.6.4	on Natural Ground	No.	4	99,060	95,230	179,170	373,460	396,240	380,920	716,680	1,493,840
JD-P1-Bq-175	M.6.5	Movement Marker Bench Mark	No.	3	2,718,900	36,300	306,200	3,061,400	8,156,700	108,900	918,600	9,184,200
JD-P1-Bq-176	M.6.6	Movement Marker Control Station	No.	2	44,181,700	589,900	4,974,700	49,746,300	88,363,400	1,179,800	9,949,400	99,492,600
JD-P1-Bq-177	M.7	Supplying and Installing Terminal Box for instruments in gallery	No.	3	18,058,533	0	2,274,400	20,332,933	54,175,600	0	6,823,200	60,998,800
JD-P1-Bq-178	M.8	Supplying and Installing Digital Readout Unit	No.	2	14,589,850	0	1,837,550	16,427,400	29,179,700	0	3,675,100	32,854,800
JD-P1-Bq-179	M.9	Supplying and Installing Stand Pipe Piezometer in Borehole	No.	7	20,114,680	0	2,533,360	22,648,040	140,802,760	0	17,733,520	158,536,280
JD-P1-Bq-180	M.10	Supplying and Installing Seepage Measuring Facilities	No.	2	46,301,300	0	5,831,450	52,132,750	92,602,600	0	11,662,900	104,265,500
JD-P1-Bq-181	N.	Generating Plant										
JD-P1-Bq-182	N.1	Furnishing and Installing Turbines and Auxiliaries :										
JD-P1-Bq-183	N.1.1	Hydraulic Turbine (Horizontal Francis; 1,630kW, H= 64.3m, Q= 3m^3/s)	Set	1	9,387,200,000	0	1,043,000,000	10,430,200,000	9,387,200,000	0	1,043,000,000	10,430,200,000
JD-P1-Bq-184	N.1.2	Governor (Electric governor Dn:30% Dp:60%)	Set	1								
JD-P1-Bq-185	N.1.3	Inlet Valve (Butterfly or Biplane Valve ϕ=0.8m)	Set	1								
JD-P1-Bq-186	N.1.4	Cooling Water System, if necessary	Set	1								
JD-P1-Bq-187	N.1.5	Drainage & Dewatering System.	Set	1								
JD-P1-Bq-188	N.1.6	Oil Storage & Transfer System, if necessary	Set	1								
JD-P1-Bq-189	N.1.7	Compressed Air Supply System, if necessary	Set	1								
JD-P1-Bq-190	N.1.8	Maintenance Tools Machine Shop Equipment	Lot	1								
JD-P1-Bq-191	N.1.9	Spare Parts	Lot	1								
JD-P1-Bq-192	N.1.10	Instruction of Emplyer's Personnel and Attendance of Employer at Shop Tests	Lot	1								
JD-P1-Bq-193	N.1.11	Flow Meter System	Set	1	513,400,000	0	90,600,000	604,000,000	513,400,000	0	90,600,000	604,000,000
JD-P1-Bq-194	N.2	Furnishing and Installing Generators and Excitation System :										
JD-P1-Bq-195	N.2.1	Generator (Horizontal 2MVA 750rpm 6.6kV pf:0.8)	Set	1	6,407,900,000	0	1,244,100,000	7,652,000,000	6,407,900,000	0	1,244,100,000	7,652,000,000
JD-P1-Bq-196	N.2.2	Excitation System (Brashless exciter & AVR two indoor cubicles)	Set	1								
JD-P1-Bq-197	N.2.3	Neutral Grounding Cubicle	Set	1								
JD-P1-Bq-198	N.2.4	Spare parts	Lot	1								
JD-P1-Bq-199	N.3	Furnishing and Installing Main Transformer (2000kVA 6.6/20kV)	set	1	525,400,000	0	54,400,000	579,800,000	525,400,000	0	54,400,000	579,800,000
JD-P1-Bq-200	N.4	Furnishing and Installing Outdoor Cubicle :										
JD-P1-Bq-201	N.4.1	20kV DS Cubicle (one outdoor cubicle 20 kV MOF, DS, LA, DS, CH)	Lot	1	374,400,000	0	241,600,000	616,000,000	374,400,000	0	241,600,000	616,000,000

Table 9.5.1 (4/4) PAYMENT ITEMS AND THE COSTS FOR PACKAGE-1

ID No.	BQ Item		Unit	Quantity	Unit Cost				Cost			
					FF/C	IF/C	L/C	Total	FF/C	IF/C	L/C	Total
JD-P1-Bq-202	N.4.2	20kV CB Cubicle (one outdoor cubicle 24kV CB, PT, CT, CH)	Set	1	1,026,700,000	0	302,000,000	1,328,700,000	1,026,700,000	0	302,000,000	1,328,700,000
JD-P1-Bq-203	N.4.3	6.6kV Cubicle (one outdoor cubicle 6.6 kV DS, PT, CT, CH)	Lot	1	241,600,000	0	60,400,000	302,000,000	241,600,000	0	60,400,000	302,000,000
JD-P1-Bq-204	N.5	Furnishing and Installing Indoor Cubicle :										
JD-P1-Bq-205	N.5.1	6.6kV CB cubicle (one indoor cubicle VCB 7.2kV 1kA, DS, PT, CT, Ar, CH)	Lot	1	422,800,000	0	60,400,000	483,200,000	422,800,000	0	60,400,000	483,200,000
JD-P1-Bq-206	N.5.2	Station Tr. Cubicle (one indoor cubicle St.Tr: 6.6/.4,.2 150kVA, PF, PT, CT)	Lot	1	241,600,000	0	60,400,000	302,000,000	241,600,000	0	60,400,000	302,000,000
JD-P1-Bq-207	N.5.3	DC Supply System (one indoor cubicle, Charger, Inverter, Battery, MCCB)	Lot	1	422,800,000	0	60,400,000	483,200,000	422,800,000	0	60,400,000	483,200,000
JD-P1-Bq-208	N.5.4	Switchgear for Krapyak s/s (one indoor cubicle, 24kV CB, PT, CT, CH)	Lot	1	1,026,700,000	0	302,000,000	1,328,700,000	1,026,700,000	0	302,000,000	1,328,700,000
JD-P1-Bq-209	N.6	Furnishing and Installing Control and Protection Equipment (six panels)	Lot	1	2,415,800,000	0	302,000,000	2,717,800,000	2,415,800,000	0	302,000,000	2,717,800,000
JD-P1-Bq-210	N.7	Furnishing and Installing Cables and Fittings :										
JD-P1-Bq-211	N.7.1	20kV Power Cables (CVT 3c 35m)	Lot	1	66,400,000	0	54,400,000	120,800,000	66,400,000	0	54,400,000	120,800,000
JD-P1-Bq-212	N.7.2	6.6kV Power Cables (CVT 3c 100m)	Lot	1	66,400,000	0	54,400,000	120,800,000	66,400,000	0	54,400,000	120,800,000
JD-P1-Bq-213	N.7.3	Low Voltage Cables (PVC-CVV, CVV-S)	Lot	1	72,500,000	0	60,400,000	132,900,000	72,500,000	0	60,400,000	132,900,000
JD-P1-Bq-214	N.8	Furnishing and Installing Ancillary Equipment :										
JD-P1-Bq-215	N.8.1	Telephone System (PABX 20telephone sets)	Lot	1	48,300,000	0	12,100,000	60,400,000	48,300,000	0	12,100,000	60,400,000
JD-P1-Bq-216	N.8.2	Lighting Auxiliary (Lighting fixture Distribution panels conduit wires)	Lot	1	96,600,000	0	24,200,000	120,800,000	96,600,000	0	24,200,000	120,800,000
JD-P1-Bq-217	N.9	Furnishing and installing Grounding System	Lot	1	60,400,000	0	60,400,000	120,800,000	60,400,000	0	60,400,000	120,800,000
JD-P1-Bq-218	N.10	Furnishing and Installing Overhead Travelling Crane (15ton, span= 9.5m, lift=20m, Hoist=1tonne)	Set	1	1,159,600,000	0	120,800,000	1,280,400,000	1,159,600,000	0	120,800,000	1,280,400,000
JD-P1-Bq-219	N.11	Furnishing and installing Transmission Lines :										
JD-P1-Bq-220	N.11.1	Steel Towers (20kV 1cct h=20m)	Set	2	217,441,250	0	362,371,550	579,812,800	434,882,500	0	724,743,100	1,159,625,600
JD-P1-Bq-221	N.11.2	Concrete Poles (20kV 1cct h=13m)	No.	280	2,840,425	0	4,180,325	7,020,750	795,319,000	0	1,170,491,000	1,965,810,000
JD-P1-Bq-222	N.11.3	Insulators and Fittings (Suspension : 254mm)	Lot	1	199,314,100	0	181,200,000	380,514,100	199,314,100	0	181,200,000	380,514,100
JD-P1-Bq-223	N.11.4	Power Conductors (AAAC 120 sq. 14km)	km	14	67,866,000	0	129,474,000	197,340,000	950,124,000	0	1,812,636,000	2,762,760,000
JD-P1-Bq-224	N.11.5	Telecommunication Lines (CCCP-AP-SS-0.65mm-20P)	km	14	27,292,500	0	42,282,500	69,575,000	382,095,000	0	591,955,000	974,050,000
JD-P1-Bq-225	O.	**Relocation of Power Transmission Line**										
JD-P1-Bq-226	O.1	Relocation of Power Transmission Line	L.S.	1	6,692,098,700	602,973,000	3,139,545,300	10,434,617,000	6,692,098,700	602,973,000	3,139,545,300	10,434,617,000
JD-P1-Bq-227	P.	**Miscellaneous Works**										
JD-P1-Bq-228	P.1	Bridge Bearings :										
JD-P1-Bq-229	P.1.1	for Spillway Bridge including Elastometric Bearing Pad (350 x 280 x 73) and Rubber Sheet (400 x 100 x 30)	No.	6	564,583	863,052	1,420,738	2,848,372	3,387,495	5,178,312	8,524,425	17,090,232
JD-P1-Bq-230	P.1.2	for Access Road Bridge including Elastometric Bearing Pad (350x 280x 59) and Rubber Sheet (400 x100x20)	No.	10	529,780	1,371,142	1,853,492	3,754,413	5,297,800	13,711,415	18,534,915	37,544,130
JD-P1-Bq-231	P.2	Bridge Expansion Joints :										
JD-P1-Bq-232	P.2.1	in Spillway Bridge	L.S.	1	120,600	7,100	123,800	251,500	120,600	7,100	123,800	251,500
JD-P1-Bq-233	P.2.2	in Access Road Bridge	L.S.	1	131,600	7,800	135,100	274,500	131,600	7,800	135,100	274,500
JD-P1-Bq-234	P.3	Permanent Electrical Installation :										
JD-P1-Bq-235	P.3.1	Gallery and General Lighting Installation	L.S.	1	272,614,000	0	124,228,000	396,842,000	272,614,000	0	124,228,000	396,842,000
JD-P1-Bq-236	P.3.2	Power Cables	L.S.	1	5,382,600	0	25,082,300	30,464,900	5,382,600	0	25,082,300	30,464,900
JD-P1-Bq-237	P.4	Supplying and Installing Submergible Drainage Pumps :										
JD-P1-Bq-238	P.4.1	Drainage for Gallery; 0.2 m^3/min with Automatic Pump Operation System	No.	2	37,692,400	1,328,700	6,818,600	45,839,700	75,384,800	2,657,400	13,637,200	91,679,400
JD-P1-Bq-239	P.4.2	Drainage for Hydropower Station; 0.5 m^3/min	No.	2	30,907,100	1,509,900	5,782,800	38,199,800	61,814,200	3,019,800	11,565,600	76,399,600
JD-P1-Bq-240	P.5	Reconstruction Wet Stone Masonry Steps to Goa Kreo	L.S.	1	1,740,600	236,800	5,207,200	7,184,600	1,740,600	236,800	5,207,200	7,184,600
JD-P1-Bq-241	P.6	Furnishing and Installing Trash Boom in Reservoir including Concrete Anchor	L.S.	1	437,500,300	1,500,000	56,247,300	495,247,600	437,500,300	1,500,000	56,247,300	495,247,600
JD-P1-Bq-242	P.7	Supplying and Installing Reservoir Water Level Sensor with Recorder	L.S.	1	211,022,100	1,566,900	27,728,400	240,317,400	211,022,100	1,566,900	27,728,400	240,317,400
JD-P1-Bq-243	P.8	Supplying and Installing Water Level Staff Gauge :										
JD-P1-Bq-244	P.8.1	for Reservoir Water Level installed on Inclined Intake Structure	No.	1	18,722,200	352,600	56,979,000	76,053,800	18,722,200	352,600	56,979,000	76,053,800
JD-P1-Bq-245	P.8.2	for Downstream River Water Level installed on Concrete Wall	No.	1	93,620	1,770	284,900	380,290	93,620	1,770	284,900	380,290
JD-P1-Bq-246	P.9	Provision of Maintenance Equipment :										
JD-P1-Bq-247	P.9.1	Patrol Boat with Trailer	No.	1	169,620,500	3,019,500	18,343,500	190,983,500	169,620,500	3,019,500	18,343,500	190,983,500
JD-P1-Bq-248	P.9.2	Patrol Vihicles (4-WD)	No.	2	393,225,000	7,000,000	42,525,000	442,750,000	786,450,000	14,000,000	85,050,000	885,500,000
JD-P1-Bq-249	P.9.3	Station Wagon	No.	2	146,055,000	2,600,000	15,795,000	164,450,000	292,110,000	5,200,000	31,590,000	328,900,000
JD-P1-Bq-250	P.9.4	Dump Truck (6 tonne)	No.	1	457,449,900	8,143,300	49,470,600	515,063,800	457,449,900	8,143,300	49,470,600	515,063,800
JD-P1-Bq-251	P.9.5	Grass Cutters	No.	3	33,985,900	605,000	3,675,400	38,266,300	101,957,700	1,815,000	11,026,200	114,798,900
JD-P1-Bq-252	Q.	**Building Works**										
JD-P1-Bq-253	Q.1	Hydro Power Station (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & Windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	337,109,400	132,794,200	1,125,069,300	1,594,972,900	337,109,400	132,794,200	1,125,069,300	1,594,972,900
JD-P1-Bq-254	Q.2	Garage (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	8,633,000	3,548,500	45,080,600	57,262,100	8,633,000	3,548,500	45,080,600	57,262,100
JD-P1-Bq-255	Q.3	Guard House (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	31,495,000	16,354,100	134,205,100	182,054,200	31,495,000	16,354,100	134,205,100	182,054,200
JD-P1-Bq-256	Q.4	External Works (including excavation, filling, grading, foundation, fence, drain cover, flag stone, retaining wall, tree planting, concrete block, plastering, concrete paving, tile, sanitary, electrical and painting works)	L.S.	1	18,074,700	8,156,100	87,526,100	113,756,900	18,074,700	8,156,100	87,526,100	113,756,900
									190,366,515,415	11,592,102,659	126,629,515,985	328,588,134,059

Table 9.5.2 (1/2) PAYMENT ITEMS AND THE COSTS FOR PACKAGE-2

Component : Construction of Jatibarang Multipurpose Dam

Package-2 : Operation and Maintenance Building and Goa Kreo Bridge

ID. No.	Item No.	BQ Item	Unit	Quantity	Unit Cost				Cost			
					PF/C	IF/C	L/C	Total Unit Cost	PF/C	IF/C	L/C	Total Cost
JD-P2-Bq-1	A	**General**										
JD-P2-Bq-2	A.1	**Mobilization and Demobilization**	L.S.	1	40,723,800	760,600	31,727,500	73,211,900	40,723,800	760,600	31,727,500	73,211,900
JD-P2-Bq-3	A.2	**Establishment**	L.S.	1	24,292,200	7,722,000	103,657,200	135,671,400	24,292,200	7,722,000	103,657,200	135,671,400
JD-P2-Bq-4	A.3	**Drawings**	L.S.	1	10,590,900	600,000	50,257,900	61,448,800	10,590,900	600,000	50,257,900	61,448,800
JD-P2-Bq-5	A.4	**Transport Facilities**										
JD-P2-Bq-6	A.4.1	Supply, operate and maintain new four-door four-wheel drive station jee	months	25	4,502,922	75,323	2,033,215	6,611,460	112,573,042	1,883,083	50,830,375	165,286,500
JD-P2-Bq-7	A.4.2	Supply, operate and maintain new station wagon	months	25	1,368,886	31,053	1,391,463	2,791,403	34,222,146	776,333	34,786,583	69,785,063
JD-P2-Bq-8	A.4.3	Supply, operate and maintain new motor cycle with capacity greater tha	months	25	335,802	25,613	955,325	1,316,740	8,395,042	640,333	23,883,125	32,918,500
JD-P2-Bq-9	B	**Dam Mangement Complex**										
JD-P2-Bq-10	B.1	**Buildings**										
JD-P2-Bq-11	B.1.1	Administration Building (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & Windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	216,239,200	74,916,700	906,148,200	1,197,304,100	216,239,200	74,916,700	906,148,200	1,197,304,100
JD-P2-Bq-12	B.1.2	Staff House 1 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	47,493,200	12,475,000	162,163,900	222,132,100	47,493,200	12,475,000	162,163,900	222,132,100
JD-P2-Bq-13	B.1.3	Staff House 2-1 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	24,946,800	7,624,300	97,737,800	130,308,900	24,946,800	7,624,300	97,737,800	130,308,900
JD-P2-Bq-14	B.1.4	Staff House 2-2 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	24,946,800	7,624,300	97,737,800	130,308,900	24,946,800	7,624,300	97,737,800	130,308,900
JD-P2-Bq-15	B.1.5	Staff House 2-3 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	24,946,800	7,624,300	97,737,800	130,308,900	24,946,800	7,624,300	97,737,800	130,308,900
JD-P2-Bq-16	B.1.6	Staff House 2-4 (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	24,946,800	7,624,300	97,737,800	130,308,900	24,946,800	7,624,300	97,737,800	130,308,900
JD-P2-Bq-17	B.1.7	Mushola (including excavation, filling, grading, foundation, reinforced concrete, roofing, concrete block, brick, plastering, door & windows, glazing, miscellaneous metal, interior finishing, tile, sanitary, electrical and painting works)	L.S.	1	29,248,500	10,630,600	120,312,400	160,191,500	29,248,500	10,630,600	120,312,400	160,191,500

Table 9.5.2 (2/2) PAYMENT ITEMS AND THE COSTS FOR PACKAGE-2

ID. No.	Item No.	BQ Item	Unit	Quantity	Unit Cost				Cost			
					PF/C	IF/C	L/C	Total Unit Cost	PF/C	IF/C	L/C	Total Cost
JD-P2-Bq-18	B.2	External Works (including excavation, filling, grading, foundation, fence, drain cover, flag stone, retaining wall, tree planting, concrete block, plastering, concrete paving, tile, sanitary, electrical and painting works)	L.S.	1	48,002,100	12,019,000	268,964,100	328,985,200	48,002,100	12,019,000	268,964,100	328,985,200
JD-P2-Bq-19	B.3	Power Supply Facilities (including PLN connection to all	L.S.	1	5,382,600	0	25,082,300	30,464,900	5,382,600	0	25,082,300	30,464,900
JD-P2-Bq-20	C	Construction of Approach Bridge to Goa Kreo										
JD-P2-Bq-21	C.1	Bridge and Approach Road										
JD-P2-Bq-22		(Superstructure)										
JD-P2-Bq-23	C.1.1	Concrete, Type B including Formwork, Scaffolding, and Falsework	m^3	104	794,760	46,160	1,249,600	2,090,520	82,655,040	4,800,640	129,958,400	217,414,080
JD-P2-Bq-24	C.1.2	Deformed Reinforcing Bars	kg	18,680	1,200	2,810	3,620	7,629	22,414,132	52,487,064	67,615,996	142,517,192
JD-P2-Bq-25	C.1.3	Asphaltic Concrete	tonne	25	60,331	19,470	117,591	197,392	1,508,275	486,750	2,939,775	4,934,800
JD-P2-Bq-26	C.1.4	Expansion Joint	m	11	39,700	58,500	182,950	281,150	436,700	643,500	2,012,450	3,092,650
JD-P2-Bq-27	C.1.5	Hand Rail	kg	500	2,081	1,051	5,065	8,197	1,040,500	525,500	2,532,500	4,098,500
JD-P2-Bq-28	C.1.6	Drain Pipe, PVC Pipe Dia. 100 mm	m	51	4,780	6,730	22,350	33,860	243,780	343,230	1,139,850	1,726,860
JD-P2-Bq-29	C.1.7	Elastomeric Bearing Pad (316 x 316 x 41)	No.	16	347,600	302,000	715,900	1,365,500	5,561,600	4,832,000	11,454,400	21,848,000
JD-P2-Bq-30		(Substructure and Approach Road)										
JD-P2-Bq-30.1	C.1.8	Clearing and Grubbing	m^2	10	3,850	90	3,030	6,970	38,500	900	30,300	69,700
JD-P2-Bq-31	C.1.9	Stripping of Topsoil	m^3	50	13,330	260	10,420	24,010	666,500	13,000	521,000	1,200,500
JD-P2-Bq-32	C.1.10	Excavation	m^3	1,130	14,480	270	12,860	27,610	16,362,400	305,100	14,531,800	31,199,300
JD-P2-Bq-33	C.1.11	Backfilling	m^3	967	9,480	120	7,800	17,400	9,167,160	116,040	7,542,600	16,825,800
JD-P2-Bq-34	C.1.12	Embankment	m^3	114	24,560	1,210	40,050	65,820	2,799,840	137,940	4,565,700	7,503,480
JD-P2-Bq-35	C.1.13	Concrete, Type C-1 including Scaffolding and Formwork	m^3	163	170,470	42,580	404,870	617,920	27,786,610	6,940,540	65,993,810	100,720,960
JD-P2-Bq-36	C.1.14	Deformed Reinforcing Bars	kg	12,170	1,200	2,810	3,620	7,629	14,602,783	34,195,266	44,051,749	92,849,798
JD-P2-Bq-37	C.1.15	Leveling Concrete, Type E	m^3	9	74,860	37,740	203,790	316,390	673,740	339,660	1,834,110	2,847,510
JD-P2-Bq-38	C.1.16	Wet Stone Masonry	m^3	150	38,790	28,800	207,300	274,890	5,818,500	4,320,000	31,095,000	41,233,500
JD-P2-Bq-39	C.1.17	Weep Hole, Dia. 50 mm	No.	70	2,654	909	14,990	18,552	185,769	63,636	1,049,266	1,298,671
JD-P2-Bq-40	C.1.18	Asphaltic Concrete	tonne	19	60,331	19,470	117,591	197,392	1,146,289	369,930	2,234,229	3,750,448
JD-P2-Bq-41	C.1.19	Gravel	m^3	35	5,830	1,360	34,090	41,280	204,050	47,600	1,193,150	1,444,800
JD-P2-Bq-42	C.2	Gate Relocation										
JD-P2-Bq-43	C.2.1	Demolition of Existing Gate	L.S.	1	1,450,900	15,800	4,418,000	5,884,700	1,450,900	15,800	4,418,000	5,884,700
JD-P2-Bq-44	C.2.2	Excavation	m^3	20	14,480	270	12,860	27,610	289,600	5,400	257,200	552,200
JD-P2-Bq-45	C.2.3	Concrete, Type C-1 including Formwork	m^3	7	110,420	42,390	252,940	405,750	772,940	296,730	1,770,580	2,840,250
JD-P2-Bq-46	C.2.4	Deformed Reinforcing Bars	kg	230	1,200	2,810	3,620	7,629	275,977	646,254	832,531	1,754,762
JD-P2-Bq-47	C.2.5	Wet Stone Masonry Reconstruction	m^3	10	38,790	28,800	207,300	274,890	387,900	288,000	2,073,000	2,748,900
JD-P2-Bq-48	C.2.6	Stone Block Reconstruction	m^3	30	278,170	0	134,800	412,970	8,345,100	0	4,044,000	12,389,100
JD-P2-Bq-49	C.3	Existing Building										
JD-P2-Bq-50	C.3.1	Demolition and Reconstruction of Guard House, Mushola, and Toilet	L.S.	1	40,706,200	14,354,600	168,385,300	223,446,100	40,706,200	14,354,600	168,385,300	223,446,100
								Total Cost	922,490,714	279,495,930	2,742,841,479	3,944,828,124

Table 9.5.3 ENGINEERING SERVICE COST

COST FOR ENGINEERING SERVICES ON CONSTRUCTION SUPERVISION
SUMMARY

I.	**FOREIGN CURRENCY IN YEN**		**¥458,803,714**
	1.1 Remuneration (Professional A)	¥427,630,286	
	1.2 Direct Cost	¥31,173,428	
II.	**LOCAL CURRENCY PORTION**		**Rp.5,662,546,000**
	3.1 Remuneration (Professional B)	Rp.2,413,530,000	
	3.2 Direct Cost	Rp.2,821,116,000	
	3.3 Equipment Cost	Rp.427,900,000	
III.	**TOTAL (I + II + III)**		**Rp.33,371,875,539**
	Foreign Currency in Yen	Rp.27,709,329,539	
	Local Currency in Rupiah	Rp.5,662,546,000	
		or equivalent to	**¥552,562,645**
IV.	**PYSICAL CONTINGENCY (10%)**		**Rp.3,337,187,554**
	Foreign Currency in Yen	Rp.2,770,932,954	¥45,880,371
	Local Currency in Rupiah	Rp.566,254,600	
		or equivalent to	**¥55,256,265**
V.	**PRICE CONTINGENCY (F/C 3%, L/C 8%)**		**Rp.1,412,711,923**
	Foreign Currency in Yen	Rp.914,407,875	¥15,140,523
	Local Currency in Rupiah	Rp.498,304,048	
		or equivalent to	**¥23,391,309**
VI.	**VAT (10% OF III + IV + V)**		**Rp.3,812,177,502**
VII.	**TOTAL (III + IV + V + VI)**		**Rp.41,933,952,517**
		or equivalent to	**¥694,331,240**

Note: Applied Conversion Rate as of July 31, 1999

Table 9.5.4 CALCULATION SHEET FOR COMPENSATION COST

Description	Unit	Quantities	Unit Cost			Total Cost			Remarks
			PF/C	IF/C	L/C	PF/C	IF/C	L/C	
Land Acquisition	m2	1,500,000	0	0	9,000	0	0	13,500,000,000	
Total			0	0	9,000	0	0	13,500,000,000	

Table 9.5.5 PRICE CONTINGENCY

	P/F	I/F	L/F	Total Cost
Construction Base Cost	26,604,025,121	1,540,710,599	50,127,589,019	78,272,324,738
Engineering Service Cost	914,407,875		498,304,048	1,412,711,923
Compensation Cost			3,612,842,957	3,612,842,957
Administration Cost			5,210,874,308	5,210,874,308
Total	27,518,432,996	1,540,710,599	59,449,610,331	88,508,753,926

Note : All costs are exclusive of Tax.

Table 9.5.6 DISBURSEMENT SCHEDULE

Work Name	Currency	2000	2001	2002	2003	2004	2005	Total
Package-1	Rupiah	0	55,879,189,400	86,628,610,591	137,631,892,156	202,195,013,201	0	482,334,705,348
	Converting into Yen	0	925,232,766	1,434,373,509	2,278,872,288	3,347,891,286	0	7,986,369,849
Package-2	Rupiah	0	0	1,225,446,496	4,095,545,004	808,744,605		6,129,736,105
	Converting into Yen	0	0	20,290,617	67,812,946	13,390,978	0	101,494,541
Administration Cost	Rupiah	0	4,407,588,567	5,082,466,112	8,199,107,935	11,744,019,047	0	29,433,181,661
	Converting into Yen	0	72,979,680	84,154,123	135,758,650	194,454,346	0	487,346,799
Engineering Service Cost	Rupiah	838,679,050	4,701,203,147	7,391,298,516	11,923,749,804	17,079,022,000	0	41,933,952,517
	Converting into Yen	13,886,625	77,841,272	122,383,156	197,430,280	282,789,907	0	694,331,240
Compensation Cost	Rupiah		18,462,842,957					18,462,842,957
	Converting into Yen	0	305,702,846	0	0	0	0	305,702,846
Total	Rupiah	838,679,050	83,450,824,071	100,327,821,715	161,850,294,898	231,826,798,853	0	578,294,418,588
	Converting into Yen	13,886,625	1,381,756,564	1,661,201,405	2,679,874,164	3,838,526,517	0	9,575,245,275

Note : All costs include price and physical contingencies and tax.

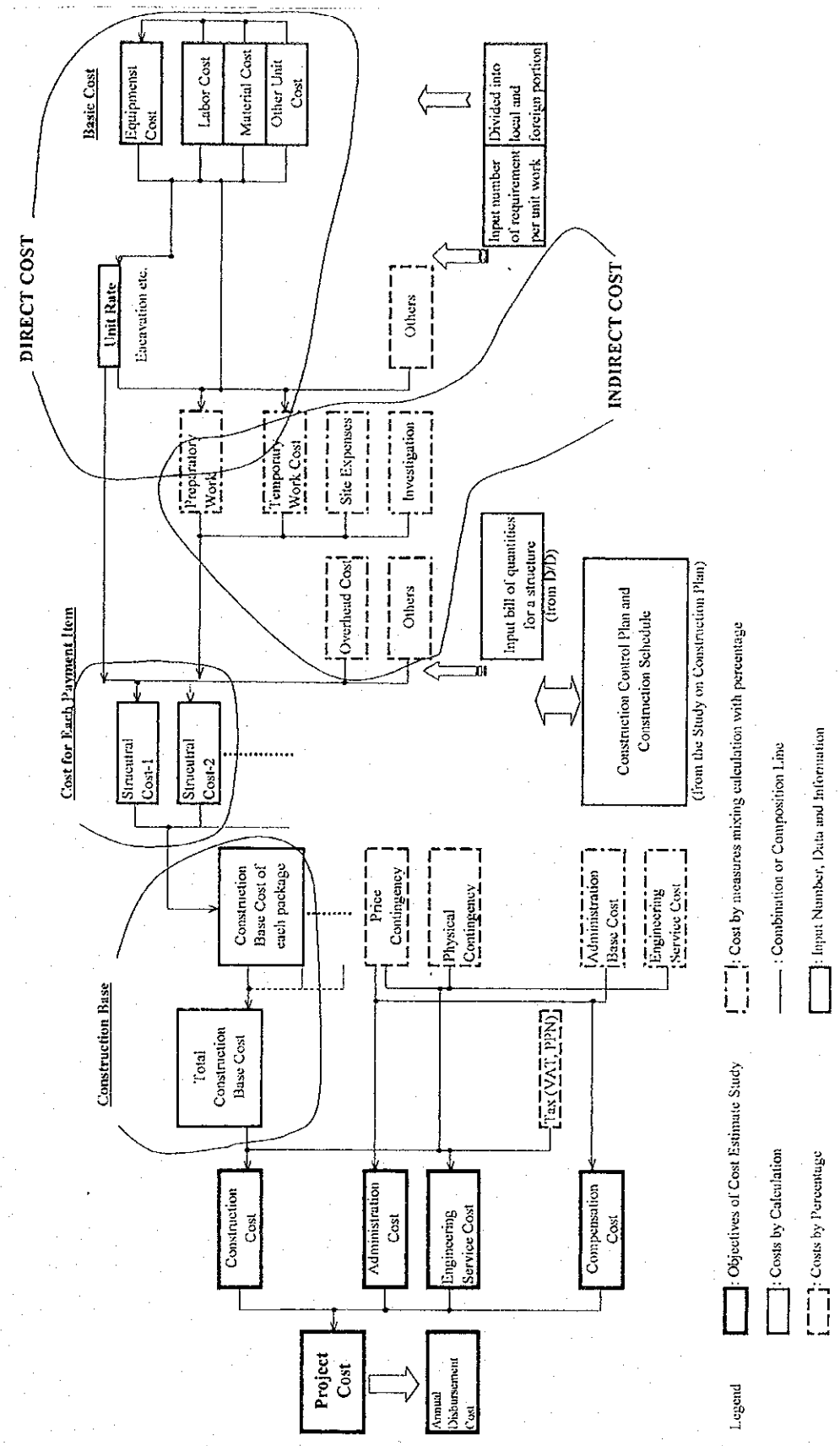
FIGURES

CHAPTER 9

COST ESTIMATE

LIST OF FIGURES

Chapter 9



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 9.2.1
JAPAN INTERNATIONAL COOPERATION AGENCY	FLOW CHART OF COST ESTIMATE

CHAPTER 10

ENVIRONMENTAL AND SOCIAL IMPACTS

CHAPTER 10 ENVIRONMENTAL AND SOCIAL IMPACTS

10.1 Environmental and Social Impact Analysis

10.1.1 Natural Environment

The study area covers 204 km^2 as a whole catchment area of Garang River, of which most of the part lie in the jurisdiction of Semarang City (Kotamadya), so the area has been already developed in terms of social infrastructure due to the predominant influence of urban environment. In other word, natural forest no longer exists in the study area to provide for wild animals' habitat or refuge. Regenerated woods can be seen instead after natural vegetation covers have been intensively eliminated by cutting trees and fires. Under present environment, there is no endangered species of fauna nor protected flora. This section, therefore, presents general characteristics of river environment as a result of study and analysis.

Water Quality

Water sampling was carried out on October 27, 1997. Sampling locations are the same as those selected in June, 1992 for the Feasibility Study. The total number of samples is 15, out of which 10 are from Garang River/West Floodway and 5 are from Semarang River (refer to Fig. 10.1.1). Water quality test was conducted in the laboratory of Diponegoro University for physical, chemical and microbiological analysis. The test results are given in Table 10.1.1. According to the Government regulation No.20 established in 1990, there are four(4) categories on Water Quality Standard as described below;

Standard A: Raw water which can be used for human consumption without treatment
Standard B: Raw water which needs to be properly treated for drinking
Standard C: Water to be used for fishery
Standard D: Water to be used for agriculture or industry

Knowing the fact that Garang River is the major water source for the citizen of Semarang City, Standard B can be applicable to the water of Garang River, since PDAM water intake facility is located upstream of Simongan Weir and nobody uses them as source of domestic water supply. Waters taken from KG7 to KG10, lower part from Simongan Weir, are saline because river water is mixed with tidal sea water.

Test results are considered to represent water quality of the rivers in dry, thereby sampling was carried out in drought-stricken period. According to the results, surface-water in the

upper reaches from Simongan Weir meets requirements of Standard B to some extent. However, it is absolutely necessary to make continuous efforts to improve water quality in line with Clean River Project (Proyek Kali Bersih: PROKASIH). Semarang River is playing double functions as a main urban drainage channel as well as sewerage canal, so that the water is so polluted due to mainly discharge of domestic waste into the river. The water pollution will certainly get worse year by year unless proper measures are taken at an early stage possible.

Further details on water quality are described as follows;

(1) Biodegradable Organics

BOD, an organic pollution indicator, shows 4.4 mg/*l* in the upper reaches from Simongan Weir and 5.1 mg/*l* in the lower reaches. In the meantime COD values are 14.8 mg/*l* and 25.6 mg/*l* respectively, showing a remarkable pollution increase between KG6 and KG7 on Garang River, which may be attributable to the inflow of large volume of domestic wastewater in the lower part from the Weir. With regard to DO, it is over the standard value of 6 mg/*l* in almost all upstream locations, except KG6 where water seems to be less polluted in terms of oxygen demand. It is rather inconsistent with BOD and COD in this regard, but the reason is not explainable. It should be noted that no oxygen is contained in the water of both KG9 and KG10. However, DO value may easily fluctuate in one single day in the tidal area which is stretching from the river mouth to KG7.

BOD, COD and DO at each sampling location are graphically shown in Fig.10.1.2. Based on the study conducted by JICA Study Team in June, 1992, water quality degradation can be observed as compared with new data of 1997 (refer to Fig.10.1.3). It shows remarkable changes in water quality causing Semarang, Asin and Baru rivers to the development of septic conditions. Meanwhile, water in the upstream portion of Garang River is slightly worsened in terms of BOD during the last five years, but it is still on acceptable level to be used for source of water supply.

According to sample analysis data from November 1993 to October 1997 provided by Regional Government Water Supply Enterprise (PDAM), water quality at intake location tends to be somewhat degraded in terms of BOD. On the contrary, DO concentration is gradually improved in recent years (refer to Fig.10.1.4). There is something contradictive because these two parameters have trade-off relations to each other. The reason remains unknown. Nevertheless, both of them still satisfy PDAM

standards describing as 6 mg/*l* for BOD and 3 mg/*l* for DO.

(2) Heavy Metals

Study includes analysis of such parameters as Cd, Zn, Pb, Cr and Cu. Garang River water is characteristically represented by high concentration of Cd in the lower part from Simongan Weir. Pb is, however, detected in both upper and lower reaches. Content of these toxic substances are mainly attributed to the wastewater discharge from industrial area. Pollution source may be identified as dry cell, paint or paint using factories. Generally heavy metal concentration tends to be higher in lower reaches, so that special attention needs to be paid to the fact that Pb concentration is more than five times as high as standard value of 0.1 mg/*l* at KG6 where PDAM water intake is located nearby.

The test results show that there seems to be no significant presence of Zn, Cr and Cu. It is, however, important to keep watch on water quality because heavy metal concentration may vary from time to time and depending on regional economy. According to PDAM weekly-based record for 1996, Cd has been constantly detected as a result of analysis of intake water and its value is frequently over the standard.

(3) Nutrients

Nitrogen and phosphorus are essential nutrients for the growth of undesirable aquatic environment which may result in water quality deterioration and eutrophication. Algal activity can be controlled by such nutrients concentration as dissolved inorganic phosphorus (orthophosphate: PO_4-P) and ammonia nitrogen (NH_4-N) or nitrate nitrogen (NO_3-N). These are mainly contained in domestic wastewater discharge.

Although there is no specific requirements for PO_4-P under Water Quality Standard, it represents high concentration (4.7 mg/*l*) at KG5 where dense residential areas are extended on both sides of Garang River. Nitrogen concentration is slightly high in the form of NO_2-N, at locations of KG7 and KG8 on West Floodway.

(4) Coliform

There is no location to satisfy standards as a result of sample analysis. Total coliform, expressed in number of cells in 100 ml of water, is fully dominated by fecal coliform in the upper reaches of Garang River which is currently being used for the source of water supply to the city. The test results show obviously high values, if compared to

the standards, showing 10,000 cells for total coliform and 2,000 cells for fecal coliform. For example, at KG5 and KG6 near the PDAM water intake, coliform organisms are exceeding $24x10^4$ and $24x10^6$ respectively.

Even at the location KG1 in proposed reservoir area, the situation remains undesirable because bacteriological parameters still represent more than the standard value. The bacteria of total coliform group is, for instance, nearly 5 times higher than the allowable limit. This value is, however, equivalent to 23 times more than the standard in terms of fecal coliform group. Echericia coli, which is common organism found in human feces, has been identified as predominant pathogenic bacteria. It should be noted that there are 12 villages with nearly 30,000 people living around and upstream of the future reservoir site.

Aquatic Biota

For further consideration of river environment, following biological study needs to be carried out to be aware of present aquatic ecosystem.

(1) Plankton

Biological characteristics of the water body can be shown by the abundance and diversity of plankton as shown in Table 10.1.2. Constituents of fitoplankton are identified as Chlorophyta, Chrysophyta, Cyanophyta, Euglenophyta and Bacillariophyta. In general, the water body in low flow period may provide micro-flora or algae with preferable life conditions. Algae are important microorganism with respect to water quality because they will form a symbiotic relationship with bacteria. In this sense the population (total individu/*l*) seems to be high as a result of laboratory analysis. It is probably explained in such a way that sampling was carried out in mid-dry season. Zooplankton, primary consumer of fitoplankton, consists of such genus as Ciliophora, Rhizopoda, Rotatoria and so on.

In judging aquatic environment, diversity index (H') can be applied. This is calculated based upon total individu and species by Shannon-Weaver method. According to Lee et al. criteria, 1978, the significance of diversity index can be divided into following 4 categories;

H'> 2.00	: lightly polluted ~ not polluted
H': 1.51~2.00	: moderately ~ lightly polluted
H': 1.00~1.50	: heavily ~ moderately polluted

H'< 1.00 : heavily polluted

Water in the proposed reservoir area is considered to be desirable quality for aquatic life as it shows high diversity index of 2.58, supported by high evenness index which is nearly 1. Attention should be paid to the appearance of Chrysophyta which may cause water bloom when multiplied in the reservoir water. In the upstream portion of Garang River, water quality is still satisfactory level in terms of presence of algal species. In the downstream portion, however, it is significantly worsened due to the organic pollution. The analysis test shows that total individu is jumped up to tens of thousands and diversity index falls to 0.88~1.31. Representative algal species found in this portion are known as organic pollution indicators such as Oscillatoria, Diatome, Cyclotella, Chlorococcum and Batrydiopsys.

(2) Benthos

Benthos is considered to represent general characteristics of stream-bottom ecosystem. The abundance and diversity of benthos are given in Table 10.1.3 as a result of analysis test. The presence of total number of individu of Tubifex sp, genus Oligochaeta is remarkable in the location KG6. This species is usually predominant in organically polluted bottom deposits. However, it is noted that many other groups and species of aquatic life can also be found in the same location, so that KG6 is supposed to be an unique site providing more desirable ecosystem compared with others in terms of habitat suitability. In the meantime, in the downstream of Simongan Weir, the stream bottom is likely unsuitable for aquatic habitat, though a small number of Bilvalvia and Crustacea are found in KG10.

(3) Nekton

The study was carried out by hearing of local people and some biologists of Diponegoro University in order to identify fish species living in the river. The report in this section is, therefore, not based on the observation, and total individu of each species remain unknow as a result. Habitat suitability varies depending on water quality and river structure. Fish species found in the upstream of Simongan Weir are obviously different from those in the downstream. General characteristics of aquatic habitat for fishes are summarized as follows;

(a) The river channel is split up into two water areas with different ecosystems by the Weir, freshwater in upstream section and brackishwater in downstream section, which inhibits fishes from anadroming.

(b) Banks are not lined with concrete, and bottom sediment consists of mainly sand and gravel in the upper portion and sand and mud in the lower portion.

(c) There are remarkable changes in river discharge between flood period and drought period. It should be considered that flow rate is extremely low in dry season as water hardly overflows the Weir.

(d) Aquatic plants can be found in some locations upstream which may have a function to provide fishes with spawning places.

(e) River water quality is deteriorated due to the discharge of domestic, commercial and industrial waste.

(f) The river will play a different role as sand quarry site in the upper reaches of Garang River when water level is low. However, this activity definitely leads to a significant impact on aquatic habitat as well as fish-spawning areas.

Under such river environment, following fishes can be listed as identifiable species in both upstream and downstream of the river;

Upstream (Freshwater)		Downstream (Brackishwater)	
(Local Name)	(Scientific Name)	(Local Name)	(Scientific Name)
Kutuk	Ophiocephallus striatus	Lundu	Mystus sp.
Lele	Clanas batrachus	Kutuk	Ophiocephallus striatus
Bader	Puntius sp.	Bloso	-
Wader	Rasbora sp.	Mujaer	Tillapia mossambica
Cethul	Poecilia reticulata		

At KG9 and KG10 located near river mouth where water is more polluted, only two species such as Lundu and Kutuk can be found at high tide. Lundu could be observed in sea water and brackishwater even under undesirable conditions in terms of water quality, whereas Kutuk has its own habitat in both freshwater and brackishwater.

(4) Aquatic Plant

Study was conducted on February 5 and 6, 1998, in mid-wet season, and thereby the rain causes the river to high water. For the growth of plants, an adequate environment is needed to satisfy basic conditions such as light, water and vegetative soil. In addition, it should be stressed that these plants are vulnerable to flooding. As a result of the study, several species of aquatic plants were identified along the river

downstream of Simongan Weir. However, some of these plants could be observed in upper basin, too during dry season. Following five(5) species grown at some locations not affected by the flow can be found in the field observation.

Local Name	Scientific Name	Location
Kangkung	Ipomoea aquatica	KG7,8,9 and CS1,2,3,4,5
Krema	Jussieua repens	KG7
Kremah	Alternanthera sessilis	KG7,8,9,10 and CS1,2,3,4,5
Eceng gondok	Eichhornia crassipes	KG7,8,9,10 and CS3
Wlingi	Cyperus sp	KG10

Common characteristics of the above aquatic plants may be described as they grow on rich organic soil and resist brackish water, except Eceng gondok which is known as a floating plant. On the other hand, there are only three species that can be seen on urban river sides.

Sediment Analysis

Sediment samples were taken from five(5) selected locations on Garang River and also from five locations along urban rivers to examine heavy metals concentration. The analysis results are shown in Table 10.1.4. Heavy metals found in bottom sediment are likely to be deposits after soluble metals have been absorbed by soil particles and subsequently settled. They also tend to be more concentrated in the sediment of organic compounds. Therefore, heavy metals concentration will become higher in the lower basin where water quality is degraded by receiving waste discharge. In consequence, it can be understood that metal content values at KG6 are generally much higher as compared with those of other locations, because the flow is once blocked by the Weir and so sediment is accumulated thereby.

In Indonesia, there is no specific standard for heavy metals concentration for sediment, so that Japanese standard for industrial wastes for marine disposal as shown below may be applicable to the environmental assessment in this regard.

Parameter	Allowable Limit (mg/kg)
Cu	70
Cr	25 *
Cd	5
Zn	450
Pb	50

* Value is expressed for hexavalent chromium

According to the above standard, heavy metal content at each sampling location on Garang River is still in allowable limit. However, attention should be paid to the urban rivers as high values of Cu, Zn, Pb are detected at CS1(Asin), CS4(Semarang) and CS5(Baru). High concentration of these hazardous substances are probably found at every location in Asin and Baru rivers and between Gajah Mada street and a railway bridge along Semarang River (refer to Fig.10.1.5).

Small soil particles gradually settle as they absorb dissolved organic and inorganic compounds in the water. This may lead to the increase of heavy metal content in bottom deposit. Comparison of heavy metal concentration between water and sediment can be referred to Fig.10.1.6. It shows extremely high values for the sediment compared to the water. For example, Cu content of Garang River sediment is 2,500~6,300 times much higher than that of water, while Cr content is 330~740 times. The same comparison is made for Cd, Zn and Pb, and these are figured out at 22~380, 12,000~28,000 and 39~320 times respectively.

10.1.2 Social Environment

Basic Consideration

Social environment involves numerous factors not associated with the physical, chemical and biological concerns. It should be more descriptive of human relationships and interactions and, therefore, include in-depth information on social and economic activities in project-affected areas. In discussing these issues, all available information need to be assembled and compiled in an effort to predict significant impacts for the potential changes resulting from project implementation. Considering project components and characteristics, basic approach to social environmental study should be made to take following factors into account, and study output will facilitate subsequent works to analyze social impacts.

(1) Population characteristics in project area, including number of direct and indirect project-affected households.

(2) Employment and unemployment patterns, including occupational distribution and location and manpower availability.

(3) Land use patterns, ownership and covering areas.

(4) Housing characteristics, including types of housing occupancy levels, age and present condition of housing.

(5) Land values based on Tax Object Selling Value (Nilai Jual Objek Pajak : NJOP).

(6) Evaluation of house, agricultural products and other assets values.

(7) Health and social services, including water supply, wastewater discharge system, solid waste collection and disposal, and utilities.

(8) Tourism and recreational opportunities, including monument preservation.

(9) Community's attitudes and public awareness of the project.

Project-affected Area

It is rather sensitive question to determine project-affected area because issues to be discussed here will be related to the land acquisition. Jatibarang Multipurpose Dam Construction Project will affect vast area of farm land and woods in and around proposed reservoir site, and it also requires quarry site as a supply source of construction materials. Further information is given as follows:

(1) Dam and Reservoir Area

The total required area for the construction of dam and reservoir is estimated at about 150 ha of land which is presently used for paddy, upland, small plantation, woods and so on, and no people are living there. In consequence, no house evacuation is required. According to the tax-related block map issued by Tax Office, there might be 340 land owners involved in the project. They live in four(4) different villages (Kelurahan) such as Kedungpane and Jatibarang on the left bank and Kandri and Jatirejo on the right bank.

In the proposed reservoir area, a city park called "Goa Kreo" is situated with a symbolic cave as Moslem's holy place. The park is managed by Tourism Agency (Dinas Pariwisata) under Municipality and expected to earn Rp. 14 million of annual revenue from about 34,000 visitors. People enjoy spending time in weekend in this recreation site. The park environment makes suitable habitat for monkeys, too. It is reported that the number of heads reaches about 200 and they are taken care of by the Agency. This park, however, will become isolated when the reservoir is filled up with water.

Power transmission line crossing the reservoir area should also be removed allowing the project free from obstruction. In this connection, at least two towers soaring in submerged area have to be relocated. State Electricity Company PT Perusahaan Listrik Negara (PLN) will take charge of elaborating relocation plan.

(2) Quarry Site

Proposed quarry site is located at about 25 km south of the dam site lying near the village of Krajan Wringin Putih which belongs to a newly established sub-district, called Bergas under Semarang regency. The 2 km-access road is now provided to reach quarry site from the artery road connecting to Yogyakarta, but it looks obviously unsuitable for heavy vehicles to transport quarry materials as the road is so narrow passing through the village.

As groundwater is only an available water source in this area, each family owns a well of 10~15m deep in his compound. An area required for the project will cover about 200m x 300m. It forms hillock area covered with woods and is supposed to be owned by several private persons. Quarry operation is currently underway by manual laborers at nearby site.

Public Awareness of the Project

With regard to dam and reservoir area, resettlement problem does not occur due to its land use pattern.. It is confirmed that whole required area is covered with only farm land and unutilized land. Under such circumstances, land acquisition will be conducted on cash-based compensation which is supposed to be the most realistic option. Practically various reactions can be predicted in this stage if farmers realize the significance of losing their property as their lives are firmly tied up with the land. Tough negotiations are expected to reach agreement with every single farmer.

Land acquisition shall be performed in accordance with legal procedure stipulated in the Presidential Decree No.55, 1993. It requires to set up a Land Acquisition Committee under the direction of Governor and Mayor. The Committee comprises various responsible agencies to deal with practical works in their respective field in terms of land acquisition, and then inventory survey is to be conducted to estimate compensation cost on land, house, plants and other assets related to the land. The land price is determined based on real or actual value referring to NJOP. The selling price of plant is decided by the Agency specialized in the field of agriculture.

Dam Reservoir Area

Study was conducted by means of questionnaire to provide basic materials for the prediction of social impacts and its assessment. In this stage it is still difficult to define the border of area in relation to land acquisition, so that samples were carefully chosen from families

representing socio-economic environment of the project-affected locations. Details of the study outcome for each area are described as follows:

(1) General Information

Total number of affected households are supposed to be about 340, but samples were assembled from 120 representative families from three(3) villages, of which distribution was based on such a proportion as 20 (Jatirejo), 60 (Kandri) and 40 (Kedungpane).

An average family is composed of 5 ~ 6 members and is principally engaged in agriculture as the data shows that 93 respondents dedicate themselves to the farming. 70 % of those have land ownership (Hak Milik: HM) and the rest of 30 % are landless. Since villages are located outside of the dam reservoir area, houses are not subject for the discussion of land acquisition and evacuation. However, referring to habitability or housing environment, following characteristics should be mentioned; (i) almost all respondents are regarded as owners of their house, (ii) 77 families or 64 % of respondents live in small-sized house of less than 100 m^2, (iii) this number increases to 111 or 93 % for the house of less than 200 m^2, (iv) there are 4 owners living in the house of more than 500 m^2 and (v) 79 families or 66 % of answerers feel satisfied with present housing conditions.

(2) Farm Economy

In discussing agricultural income, 88 % of responding farmers answered that their monthly-based earning is less than Rp.200,000. Apart from the agriculture, those who have different income source are confirmed to be 85 families, from which 74 are determined as low income group as their earning is inferior to Rp.200,000/month. Under these conditions some of low income households are having financial support from their family or relatives.

Minimum life is hardly guaranteed for small-scaled farmers, many of them are, therefore, engaged in side business to support their farm economy. Despite of such efforts, total monthly income does not reach Rp.300,000 for the 94 households which accounts for about 78 % of all respondents. Meanwhile, it can be noted that several people earn more than Rp.500,000 a month (refer to Fig.10.1.7).

With regard to expenditure, 94 % of inquired families spend not more than Rp.300,000 a mouth and the majority of people are charged between Rp.100,000 and

Rp.200,000 for monthly living expenses. For further details it shows that nearly 87 % of respondents spend less than Rp.150,000 on food, and 73 % of those spend under Rp.25,000 on education and 81 % of the same pay under Rp.10,000 on electricity and medical care, respectively.

(3) Land Use and Production

The survey results revealed present land status that 117 farmers have right of ownership for their farm land, and about 33 % of respondents possess irrigated land. Total land area of the 120 respondents is estimated at 48 ha which is currently used for paddy field, upland field, plantation and others. Further details are given in the tables below.

LAND STATUS

(Unit: Number of households)

Classification	Village			Total	%
	Jatirejo	Kandri	Ked.pane		
Right of Ownership	18	60	39	117	97.5
Rental	2	0	0	2	1.7
Mortgage	0	0	1	1	0.8
Total	20	60	40	120	100.0

FARMING SYSTEM

(Unit: Number of households)

System	Village			Total	%
	Jatirejo	Kandri	Ked.pane		
Irrigation	1	37	2	40	33.3
Rain-fed	19	23	38	80	66.7
Total	20	60	40	120	100.0

LAND USE

Classification	Total Area (ha)	%
Paddy Field	26.1	54.1
Upland Field	14.6	30.2
Plantation	1.7	3.6
Others	5.8	12.1
Total	48.2	100.0

There are 70 owners of paddy field but most of them are small-scaled farmers engaged in rice production in less than one(1) hectare of land. This can be further proved by the fact that 76 % of those are petty farmers having less than 0.5 ha of paddy field. The situation is more or less the same to the land other than paddy field in terms of land size. Animal husbandry is not developed in this region due to the limited land size. Only 9 families keep goats for business and are supposed to earn Rp.500,000 to Rp.1,000,000 annually.

In Kedungpane almost all farmers are depending on rain-fed agriculture so that

harvesting period is only once a year. In Kandri and Jatirejo, on the other hand, double cropping can be expected for the land with irrigation system. Spot delivery price, or farm gate price of products in 1998, was up from the previous year due to recent inflation over the country. For example, yield and farm gate price of main products are given below:

YIELD AND FARM GATE PRICE

Major Crops	Yield	Farm Gate Price
Paddy	4.0~ 4.5 ton/ha	Rp.500,000~ 700,000/ton
Cassava	10.0~15.0 ton/ha	Rp.120,000~ 200,000/ton
Corn	3.0~ 3.5 ton/ha	Rp.600,000~1,000,000/ton
Durian	60 nos/tree	Rp.100,000~ 300,000/tree
Rambutan	100 kg/tree	Rp. 75,000~ 150,000/tree
Jackfruit	20~25 nos/tree	Rp. 50,000~ 100,000/tree

(4) Tax Object Selling Value (NJOP)

Land price is decided on the basis of tax-related selling value, namely NJOP, which is applicable to the land acquisition for development project. In determining NJOP real or actual value of land is taken into consideration. According to the experience of DGWRD, the Ministry of Public Works, land owners with proper certificate (Hak Milik) are entitled to receive 100 % of the land value, and those without certificate or unofficial certificate so called letter "D" would receive 90 %. Meanwhile, users of state-owned land with certificate of "right of use" would also be paid 100 % and without certificate 90 %. However, if the period of right is limited to 10 years or less, only 70 % of the value would be paid.

LAND PRICE ON NJOP

Village	No.of Blocks	Area (ha)	NJOP(Rp./m2)	Total ($Rp.10^6$)
Jatibarang	1	2.8	10,000	281
Jatirejo	84	28.5	5,000	1,428
Kandri	108	40.8	5,000~14,000	2,843
Kedungpane	156	80.5	10,000~14,000	8,747
Total	349	152.6		13,299

Total required area is estimated at about 150 ha of land and consists of nearly 350 blocks determined by Tax Office. Survey result shows that almost all lands are privately owned. As of February 1998, four prices can be applied to the project area such as Rp.5,000/m^2, Rp.7,500/m^2, Rp.10,000/m^2 and Rp.14,000/m^2. Thus, total NJOP will amounts to approximately $Rp.13,300x10^6$ as shown in the table above. However, NJOP will vary depending on country's economic situations.

(5) Water Use and Sanitation

Practically groundwater is the main water source in this rural area, so half-respondents have shallow well in their houseyard. However, shallow wells tend to reduce yields or to be dried up in dry season due to the fall of groundwater levels. In consequence, more people depend upon river water or PDAM water supply service which deliver the water to the house with water tank upon the request. Table below shows the breakdown of present water sources and beneficiaries.

WATER SOURCE

(Unit: Number of households)

Classification	Cooking		Washing and Bathing	
	Wet Season	Dry Season	Wet Season	Dry Season
Shallow Well	60	52	60	53
Deep Well	20	19	23	20
Spring	13	12	13	17
Public Hydrant	8	7	6	5
Water Supply (PDAM)	8	16	3	6
Water Seller	2	3	3	3
Rain Water	0	0	0	0
River Water	9	11	12	16
Total	120	120	120	120

With regard to sanitary facility, 90 % of people have family-owned latrine, regardless of whether septic tank is installed or not, and the remaining 10 % utilize river or nearby stream. Some privies are simply set up near the stream allowing sanitary wastes to discharge into the water. As no garbage collecting service is available in this area, many people dig the hole and throw the refuse into it, and some of them burn it afterward.

The most common sickness in this region is respiratory tract infectious disease followed by skin disease, dengue fever and diarrhea.

(6) Public Understanding and Perception

The survey result shows that 103 residents (86 %) are informed of the project and those who expressed positive attitude reached 74 accounting for nearly 62 %, while negative answer were only several (refer to Fig.10.1.8). However, the rest of people remain undecided, which means final decision may be made depending on the Government reaction. These people amount to 41, a fairly large number in a sense of time and energy to be spent for future land acquisition process. The main reason for agreement is people's willingness to participate in the development project and to cooperate with the Government. For disagreement it is caused by relentlessness or

disadvantage for the community. Cash compensation is expected by 84 % of all inquired people, then followed by alternative land (11 %).

10.2 Environmental and Social Impact Assessment

Environmental impact study has been conducted in accordance with terms of reference of Environmental Impact Statement, so called KA-ANDAL, which was approved by the Central Committee on Environment (KOMPUS) in October 1997. The study includes data collection, sample analysis, questionnaire and interview survey on present natural and social environment. The output of such a study is to be effectively used for the identification and evaluation of the potential impacts of proposed projects, and then management techniques and mitigation measures are discussed simultaneously as a basic approach to establish Environmental Management Plan (RKL). Likewise, Environmental Monitoring Plan (RPL) should also be required to formulate a comprehensive follow-up plan.

10.2.1 Present Environmental Condition

It is extremely important to consider main causes of present environmental problems prior to assessing the potential impacts of proposed projects. This idea is based on the concept that key factors of current environmental issues are concerned with the project and, therefore, should be considered as subjects of discussion for impact assessment. Under present environment, there is no endangered species of fauna nor protected flora.

Basic Concept for Comprehensive Environmental Management

Economic activities may give significant impacts on water resources environment. In fact, recent urbanization and industrialization have caused river water pollution due to mainly domestic and industrial wastewater discharges. On the other hand, land subsidence is occurring in coastal plain as a result of over pumping of groundwater by commercial and industrial sectors. Ground water exploitation should be restricted strictly and enactment of regulation to change water sources of commercial and industrial water from ground water to river surface water is quite necessary.

Under these circumstances, administrative measures should also be taken to strictly control resources extraction activities in a given river basin. There seems to be relevant regulations, standards and policies in both central and local governments to restrict development activities, but the question is how effectively these can be enforced. Although legal control on water or

land use have to be consistent with public interests, it sometimes leads to the clash of interests between institutions or agencies concerned.

If adverse effects are predicted by the project implementation, every possible measure needs to be taken to mitigate impacts on natural and social environment. Furthermore, the following should be taken into account in association with the project and as part of comprehensive approach to the environmental management.

(1) Groundwater level will be restored and stabilized in an effort to reduce the consumption of groundwater reserves and also to develop river surface water resources. Land subsidence will no longer occur as a consequence, and if so, it may ease the situation to improve urban drainage system.

(2) Water quality will be improved if natural purification system of the river is recovered due to the control of wastewater discharge as well as sand quarry operation. This may substantially help reduce water treatment cost and ensure that clean water can be supplied to the residents.

(3) Erosion control is expected by conducting soil conservation practices together with land development control for the purpose of reducing river water turbidity. As a result it can also play an important role in reducing sediment load at the water intake location.

Special Issues and Concerns

As noted above, the present bottle neck problems need to be considered for environmental impact assessment. Resources extraction such as groundwater abstraction, surface-water development and sand quarry activities are main concerns in this regard. Relevant regulations or progress of these activities are described below for reference.

(1) Groundwater Development

The regulation on groundwater development is established under the Ministry of Mining and Energy No.02.P/101/M.PE/1994 and the detailed implementation of the said regulation is described in SK Dirjen No.005.K/10/DDJG/1995. In this regard provincial regulation PERDA No.5/1985 should also be respected in Central Java.

The groundwater exploitation is subject to the permission issued by Dinas Pertambangan (Mining Agency) in the Provincial Government, which is valid for

three (3) years. There are two kinds of permission, one for the boring or drilling and the other one for the groundwater abstraction. The owner of the well is requested to submit monthly-based abstraction report to the Mining Agency. If some discrepancies or doubtful information are found in the report, the Mining Agency may dispatch inspectors to the site to check the consumption record of groundwater resources. Should the report is totally false in its statement of abstraction volume, the Mining Agency will issue a warning letter to the owner. If the owner still disregard the warning, sanction will be imposed by closing the well. But practically imposing sanction is hardly implemented. In fact, it is quite difficult to measure or check the volume of groundwater abstraction as the well is generally privately owned and particularly, deep wells are installed in industrial companies.

Furthermore, following restrictions are imposed on the construction of wells in terms of groundwater development:

- The maximum number of wells is four (4) in an area of 10 ha of land with a distance of not less than 110 m between the wells, and
- If more wells are required, one monitoring well needs to be installed in the area.

(2) Sand Quarry Activities

Quarry activities in the river are controlled under the decree No.458/KPTS/1986 of the Ministry of Public Works for the mining of Category (Golongan) "C" materials, which includes sand, gravel, boulder and sandy gravel. The letter of permit for the quarry operation is issued by the different authorities under the following conditions:

- If daily production is more than 100 m^3 and/or mechanical operation is applied, the permit will be issued by the Governor or Head of provincial level (Tk.I), and
- If the production is less than 100 m^3 and/or its operation is dependent on manual laborers, the permit will be issued by the Mayor or Head of Regency.

The decree No.176/KPTS/A/1987 issued by the Directorate General of Water Resources Development provides guidance for the implementation of the above ministerial decree. It is stipulated that the quarry activities should be avoided in such locations as river degradation area, concave side of flood plain of meandering portion and other restricted areas around river structures. Particularly, it is strictly prohibited

to take river bed materials in the area of 500 m upstream and 1,000 m downstream from the river structures.

Companies wishing to deal with quarry business is required to conduct environmental study and then its report should be submitted to the Central Committee for Environmental Impact Assessment (KOMPUS) for approval. The permit for quarry activities is subject to the approval by the KOMPUS. The effective period of the permit is five (5) years.

The provincial decree (Peraturan Daerah: PERDA) is also applicable to the quarry activities in rivers. In Central Java, the regulation No.6/1994 was established on May 16, 1994 and the area of exploitation is defined as follows:

- Maximum exploitable area is 10 ha. in one location for a person.
- Maximum exploitable area is 50 ha. in one location for a company.
- In case of 50 ha of area mentioned above, five (5) companies can be involved if permit is issued to each of them.

The operation permit is valid for 30 years with a possible extension of 10 years, and the extension is allowed twice in this regard.

The guidelines for the above provincial decree is established under the Governor's Decision No.188.3/01/1996 providing detailed descriptions with regard to the procedure for obtaining mining permit.

(3) River Surface Water Resources Development

Besides the proposed Jatibarang Dam which is expected to supply 2.00 m^3/s of water, Kedung Ombo reservoir is another promising surface-water resources to be developed in this region. JRATUNSELUNA Project Office is undertaking the construction of raw water transmission channel from Klambu to Kudu located northeast of Semarang City. The project is envisaged to convey 2.25 m^3/s of water to a new treatment plant at Kudu. The total length of the proposed conduction line is estimated at 40.5 km, of which so far 39.5 km was completed and the rest of 1.0 km is still under construction. It is scheduled to be completed by May 1999. This remaining portion was taken over to SSUDP from the JRATUNSELUNA Project Office in June 1998, and it will be, therefore, financed by the World Bank. The new treatment plant at Kudu will have

the capacity of 1.25 m^3/s and is expected to have an additional capacity of 1.00 m^3/s in the future, but so far there is no detailed schedule for the future plan due to the financial difficulties. In consequence, it remains undecided for the use of 1.00 m^3/s of water. Although this new water resource is to be used for drinking water, it will contribute to the reduction of groundwater consumption and would even be more helpful if many commercial and industrial companies could use it as an alternative source of water.

10.2.2 Predicted Impacts and Impact Sources

The prediction of impacts of project activities can be approached from three stages: (1) pre-construction, (2) construction, and (3) post-construction. For addressing environmental impacts, quantification approach can be considered to measure impact level. It can also be used to determine impact significance and required mitigation measures, so that it is desirable to quantify as many impacts as possible. However, in many cases quantification is impossible and qualitative impact prediction is practiced instead.

Predicted impacts are likely to be the key subjects to discuss environmental management plan. To provide a basis for such a discussion, impact sources should be identified in each stage of the project regardless of whether the effect is beneficial or detrimental. These are the causes of environmental changes resulting from the project implementation and should be, therefore, properly controlled and managed.

Man-induced environmental changes can be anticipated from the experience of similar projects undertaken in the last few decades, so predicted impacts and impact sources are considered as follows.

Pre-construction Stage

Problems to be considered in this preparatory stage are associated with the land. A large-scaled land acquisition is unavoidable for the dam project. The area required for the proposed dam and reservoir is estimated at 197 ha and 410 families are involved in this regard. Most of them are engaged in agriculture cultivating rice or growing cash crop trees. However, no one lives in the required land, and therefore, no resettlement/relocation plan for the people needs to be taken into account. Cash-based negotiation is supposed to be the best option to make up for the lost of their land. Failure in negotiation with the owners may cause a serious social problem and will affect construction schedule as a result.

Speculation and illegal use of land are troublesome problems. With regard to the land speculation, the focus of attention is given to the left bank of the dam site as the land ownership has been changed already in many parcels, so the speculation is likely to have started in this area. Significant impacts and impact sources commonly predicted in pre-construction stage are as follows:

Predicted Impacts		Impact Sources
- Social unrest	:	Unsuccessful negotiation or insufficient compensation relative to the land acquisition
- Illegal land use	:	Squatter's entry into the land prepared for the project
- Land ownership	:	Private property transaction by speculators

Construction Stage

It must be noted that the project site is located in the urban area and population-concentrated region. Even the proposed dam site is not distant from the urban center so that tens of thousands people may be affected by the project directly and indirectly. Minimization of nuisance conditions to the private citizens will be pre-requisite for the management of social environment. It involves such items as noise, air pollution, traffic disturbance, road damage and so on. In addition, the project-induced changes in urban environment is another important factor for addressing potential impacts. Water quality, dredged sludge and aquatic biology are main concerns in this connection.

Impact sources for the public nuisance can be identified as the operation and mobilization of heavy equipment or machinery. These may result in disruption in daily living and movement patterns for the people. On the other hand, those affecting urban environment are related to earth-moving works or concrete works undertaken in and along the rivers. During the construction period, the construction works will affect routine functions of public facilities such as water intake for domestic water supply and even ferry boat service. The summary of impacts and impact sources are presented in the following:

Predicted Impacts		Impact Sources
- Noise	:	Operation and mobilization of construction equipment and machinery.
- Air pollution	:	Operation of equipment and transportation of materials.

- Traffic disturbance	:	Mobilization of equipment and materials.
- Sedimentation	:	Dike embankment, soil excavation, dredging and other earth works relating to the project.
- River water quality	:	Earth works, concrete works, discard of construction waste materials and wastewater discharge from the camp.
- Road damage	:	Mobilization of equipment and transportation of materials.
-Aquatic biota	:	Earth works, concrete works, discard of construction waste discharge and wastewater discharge from the camp.
- Dredged material	:	Dredging river bed to increase flow capacity.
- Water intake facilities	:	Dredging works and reconstruction of Simongan Weir and its appurtenant facilities.
- Railway bridge	:	Raising a railway bridge to cope with design high water level.
- Ferry boat service	:	Dredging works and dike embankment works in West Floodway / Garang River.
- Sand quarry operation	:	Dredging works in Garang River

Post-construction Stage

Land issue remains to be an important factor for assessing impact after the dam construction because new landscape is created due to the impounded water and Goa Kreo park, and people draw more attention to such a scenically attractive area because of its recreational value. The land use pattern around reservoir area may change accordingly. It implies that the land might be illegally used unless proper management is practiced. Another important factor is water quality of reservoir as it hinges on land clearing before impounding. This matter can be considered in association with fish farming activities in dam reservoir in terms of water pollution control.

The magnitude of the predicted impact mentioned below are summarized in the succeeding sub-section.

Predicted Impacts	Impact Sources
- Illegal land use in reservoir surrounding areas :	Land acquisition and added recreational value due to the impounded water

- Water quality	: Reconstruction of Simongan Weir
- Flow of Garang River	: Construction of Simongan Weir and river improvement
- Land slide :	Fluctuation of water level in reservoir
- Goa Kreo park :	Change in recreational value as tourism attraction place due to the dam construction
- Land use pattern	: Increase in development potentiality due to the project
- Fish farming :	Construction of dam reservoir
- Replanting of roadside trees	: Trees temporarily transplanted during the embankment works along the west floodway
- Water intake facilities	: Reconstruction of Simongan Weir
- River morphology	: River dredging work and channel improvement
- Land subsidence	: Groundwater abstraction for commercial and industrial use
- River mouth morphology	: Change of sediment transport by the use of pump drainage system

10.2.3 Environmental Management Plan

Based on the significant impacts predicted in the previous section, environmental management plan needs to be prepared with a view to prevent, control, mitigate and compensate adverse effects or environmentally undesirable impacts resulting from the project implementation. It can be expected to provide conceptual approach for assessing impact significance and describing managing approach, location and responsible agency or institution.

Assessment of Impact Significance

For determining the significance of anticipated impacts, mitigation level can be systematically categorized according to the characteristics of negative impacts in order to consider appropriate mitigation measures within reasonable environmental and economic constraints. In this concept, mitigation includes (1) avoiding the impact altogether by not taking certain actions; (2) minimizing the impact by limiting the degree or magnitude of the action; (3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating the impact over time by preservation and maintenance operations; and (5) compensation for the impact by replacing or providing substitute resources or

environment. Based upon the above discussion, impact significance for the Project can be assessed as follows:

About construction of Jatibarang Multipurpose Dam, Negative impacts listed in "avoidance" are considered insignificant and the rest of them are all regarded as significant but "mitigable". Undesirable effects on river water quality and aquatic biota can be minimized by taking effective measures during the construction stage, but it does not mean that present aquatic environment will be improved thereby. Impacts on land use and reservoir water quality are likely to be quite significant in a sense of resources use, so impact mitigation should be considered from a broad perspective, and it could be mitigable only when the project is implemented in support of the public as well as relative agencies. The summary can be referred to the following:

Mitigation Category	Negative Impacts
Avoidance :	Flow of Garang river, Goa Kreo park (tourism attraction)
Minimization :	Noise, Air pollution, Traffic disturbance, River water quality, Sedimentation, Aquatic biota, Land use pattern
Rectification :	Road damage,
Reduction or elimination :	Land ownership by speculation, Illegal land use, Reservoir water quality, Land slide, Fish farming
Compensation :	Social unrest caused by land acquisition

Mitigation Measures

This section addresses a variety of considerations associated with impact mitigation measures. Relevant measures should be identified and then incorporated in project construction and operational characteristics so as to minimize undesirable effects on natural and social environment. Mitigation measures or impact managing approaches need to be developed for specific projects and should be applied actively to decrease the magnitude of significant impacts. It is also necessary to specify the location for taking mitigation measures, but in fact the determination of project influential area is not so easy. It will be dependent upon the particular project type and location. Mitigation measures can be referred to the following.

(1) Pre-Construction Stage

- Land ownership : Restrictions of private property transaction is required to control land speculation around the dam and reservoir areas.

- Social unrest : Respecting Presidential decree No.55/1993, tough negotiation is expected to reach agreement with project-affected families on land acquisition. Reasonable assets evaluation should be considered for the compensation.

- Roadside trees : Trees are to be transplanted temporarily in flood plain during the dike embankment works. Proper care needs to be taken under the guidance of specialist in this field.

- Illegal land use : Acquired land should be fenced up to protect the proposed site of Asin retarding pond from being intruded by squatters.

(2) Construction Stage

- Noise : Control of speed of construction vehicles and equipment is absolutely necessary to keep the noise level below 60 dBA. Working hours should be limited to daytime.

- Air pollution : Particularly dust control is required in this regard. Access road needs to be watered from time to time and materials should be covered with sheet. Air quality standard KEP decree No.02/MENLH/I/1988 is applicable in this regard.

- Traffic disturbance : Schedule adjustment may be necessary for equipment mobilization, and traffic control is required at the project site with construction sign board.

- Sedimentation : Installation of sand settling pond or protection fence may be required in an effort to keep soil suspended level at 100 to 250 mg/l in river water. Dredging work should be carried out from the downstream portion.

- Road damage : Regular check and inspection is required for the maintenance of village road as well as access road, and damaged portion is to be repaired if necessary.

- Water quality : Every effort needs to be made for the protection against spilt soil and concrete into the river. Protection fence may be necessary at the downstream direction. Government regulation No.20/1990 is applicable to the water quality.

- Aquatic biota : Base camp sanitary conditions must be well managed against river water pollution. Sediment control should also be taken into account for aquatic environment.

- Water intake facilities : For Garang river improvement, temporary cofferdam is to be constructed to maintain water level for the intake. During dredging work, protection fence should be set around PDAM intake facility.

- Sand quarry operation : Restrictions need to be imposed on sand quarry activities at the downstream section from Tugu Suharto.

- Railway bridge : Bridges over west floodway and Asin river are to be reconstructed due to the rise of river banks.

- Ferry boat service : Schedule control is required during the dredging work in both Garang river and west floodway.

- Dredged material : Use of water-proof sheet is required for the transportation of dredged material from Asin, Semarang and Baru rivers. It should be treated with cement to protect against leachate and disposed in designated land reclamation site.

(3) Post-Construction Stage

- Reservoir water quality : Complete land clearance is expected before impounding, and domestic waste discharge into the reservoir should be strictly controlled.

- Land slide : Slope stabilization or protection may be required for reservoir surrounding areas to mitigate land slide due to the fluctuation of water level.

- Land use pattern : Future land use plan should be reviewed in collaboration with other agencies concerned. EIA must be conducted for any project in upper river basin to assess impacts on dam reservoir and its surrounding areas.

- Fish farming : Restrictions need to be imposed on any fish farming activities in reservoir in terms of water pollution control.

- River water quality : Occasional flush out may be necessary at Simongan weir to improve water quality of floodway. Control of domestic waste discharge should also be considered as a long-term measure.

- Water intake facilities : Water level can be adjusted by the gate operation in order to facilitate existing water intake facilities.

- River morphology : Sand quarry operations should be prohibited in the downstream portion from Tugu Suharto in order to maintain stable river bed. River mouth morphological survey may be required to figure out environmental changes on estuary due to the pump drainage system.

- Land subsidence : Monitoring on land elevation needs to be conducted periodically for the proposed urban area. In this connection, the base station for BM must be carefully selected in the stable site.

In discussing over a wide range of environmental issues, all available data and information have been assembled and compiled to address selected aspects for planning environmental management. Table 10.2.1 summarizes fundamental parameters in matrix with regard to environmental management plan for respective projects.

10.2.4 Environmental Monitoring Plan

Environmental monitoring could be used to determine the effectiveness of each mitigation measure as discussed in the previous section. It provides information to review predicted impacts or effects for proper risk management and uncertainties and also to modify activity or develop mitigation measures in case of unpredictable harmful effects on the environment.

Project office should take the initiative in establishing monitoring system including determination of monitoring location, frequency and duration and be engaged in regular site inspection, field measurement, sample analysis and so on. Based on these fundamental activities, the level of project impacts could be assessed in real terms. The matrix of environmental monitoring plan is presented in Table 10.2.2.

Monitoring Items and Locations

Basically, monitoring items remain the same as those selected for management plan. They are associated with predicted impacts in terms of land issues, public nuisance, resource quality deterioration, facilities' functional damage and risk management. These are important factors to keep careful watch on environmental changes. The monitoring location must be selected taking topographic accessibility and geographic desirability into account and should be at the most environmentally vulnerable area. Monitoring items and locations are further described for each proposed project.

About construction of Jatibarang Multipurpose Dam, Land issues will be the sole subject to be considered in pre-construction stage. The progress of land acquisition may be evaluated by means of field inspection and interview with land owners. Monitoring is to be conducted in all project-affected villages such as Jatibarang, Jatirejo, Kandri and Kedungpane.

In construction stage, Attention needs to be paid to such public nuisance conditions as noise, air pollution and traffic disturbance in the above mentioned villages. On the other hand, water quality, aquatic biota and sedimentation will be targeted at the monitoring of resource quality deterioration. In this case it is desirable to determine the suitable monitoring locations on Kreo river. Road damage should also be inspected periodically as it is considered to be

facility's functional damage. This can be monitored on village roads or access roads to the project site.

In post-construction stage, monitoring includes a wide range of items. Particularly, reservoir water quality, land slide and land use pattern will be the key points in the monitoring work relating to the water pollution control. In addition, monitoring needs to be conducted for illegal land use around the reservoir and fish farming activities. Likewise, Goa Kreo park is to be monitored in order to assess impacts on its tourism attraction. Number of tourists will be used as an impact indicator. Furthermore, flow of Garang River should also be considered as a follow-up item in association with water quality.

Monitoring Frequency and Duration

In principle, monitoring should be undertaken by the project office in coordination with other agencies concerned. However, the project office assumes responsibility for the operation and maintenance of facilities for a few years after the completion of construction works, then the facilities are to be handed over to the local government or the municipality. Thus, the local government will take over all responsibilities for the project ever since. Under these circumstances, agencies or institutions responsible for monitoring in post-construction stage are still uncertain. Monitoring frequency and duration are determined according to the project characteristics, monitoring items and impact significance. These are summarized as follows:

(1) Pre-Construction Stage

(a) Land issues and social unrest

Monthly-based monitoring for as long as problems exist.

(b) Roadside trees along the West Floodway

Weekly-based monitoring for transplanted trees until embankment work is completed.

(2) Construction Stage

(a) Noise and air pollution

Monthly basis for the dam project and twice a month for the river improvement project as well as the urban drainage system improvement project.

(b) Water quality, sedimentation, road damage and aquatic biota

Monthly-based monitoring during the construction period.

(c) Traffic disturbance, sand quarry operation and dredged material

Weekly-based monitoring during the construction period.

(d) Water intake facilities, railway bridge and ferry boat service

Daily-based monitoring during the construction period.

(3) Post-Construction Stage

(a) Illegal land use

Bi-monthly (twice a month) basis for minimum two(2) years.

(b) Water quality (reservoir and river), fish farming and sediment disposal site

Monthly-based monitoring without limit of duration unless otherwise specified.

(c) Land slide and Goa Kreo park

Monthly-based monitoring for minimum two(2) years.

(d) Land use pattern, land subsidence and river morphology

Every six(6) months without limit of duration unless otherwise specified.

(e) Flood mitigation

Every rainy season without limit of duration.

(f) Water intake facilities

Daily-based monitoring without limit of duration.

10.3 River Basin Management

10.3.1 Basic Issues and Problems

The Garang river basin comprises part of Semarang City in the north and two other regencies, Kendal and Semarang in the south. As population of the capital city of Central Java Province increases by nearly 2.1 % annually, urban area is expanding toward the south. This trend can be seen in the upper basin of Garang River, particularly in Gunungpati and Mijen sub-districts

where the phenomenon is proved by annual population growth rate which indicate 3.7 % and 2.9 % respectively.

Under these circumstances, urban environment has not been discussed to cope with development schemes. In fact it has been always left behind urban development issues. As a result the city is now facing many problems as by-products of development. In dealing with these adverse effects, it is important to realize that urban environmental issues are closely concerned with water-related matters. From this point of view scrupulous attention shall be paid to the whole Garang river basin, and all available information have to be collected in an effort to study existing problems therein in terms of river basin management. In this regard, major problems and issues to be further discussed are abstracted as follows:

(1) Land subsidence is occurring in the northern part of the city due to the over-development of groundwater from the coastal plain aquifer. The number of deep tubewells in Semarang City was 300 in 1989 but this number was increased to 700 in 1997. Such uncontrolled development of groundwater resource has caused quality deterioration resulting from brackish water intrusion. Regulation for Water Pollution Control PP20, 1990 covers only surface-water and is not applicable to the groundwater.

(2) Since there is no sewerage system nor treatment plant for the domestic wastes in Semarang City, discharge of such wastewater may result in a great contribution to the total organic load and microbiological concentration in the river water.

(3) Wastewater discharge from manufacturing plants is uncontrollable, regardless of whether they are equipped with treatment plant or not. Industrial wastes in general contain heavy metals or hazardous substances to the human health. According to the information of Environmental Bureau in the Provincial Government, there are 89 industrial plants in Semarang City. Among those companies 18 are located upstream of PDAM water intake.

(4) Solid waste is currently disposed in city's sole landfill site, located at 8.5 km upstream of PDAM water intake, managed by the Municipal Cleaning Agency (Dinas Kebersihan Kotamadya). The volume of refuse properly collected and disposed of is estimated at 1,130 m^3 a day, including not only domestic wastes but also commercial, industrial and even medical wastes as well, so that it is also being used as a hazardous waste disposal site. Although the location is a little way from Kreo River, no

protection measure is taken against leachate and runoff from the landfill site. This situation may result in serious water pollution unless appropriate measure is taken.

(5) Housing complexes are constructed or going to be developed in the upper river basin to cope with rapidly expanding urban population. Housing development is one of the major concerns with impact assessment in terms of river basin management and control. It is, as a matter of course, dependent upon the particular project size and location, but its activity involves topsoil removing which may result in soil erosion and massive flood discharge. A new satellite town is planned to be constructed in sub-district Mijen upstream of the proposed dam site. The project requires 1,220 ha of land, of which about 50 % is to be used for housing area where more than 5,000 families can be accommodated. However, the project is behind the schedule due to the financial difficulties.

(6) As natural vegetation cover has been ripped off by the land development, soil erosion arises over an extensive area of the river basin and as a result the river carries washload downstream. It occurs at intermittent intervals that are related mostly to the rainfall intensity. Soil erosion is the major source of turbidity in surface-water and sedimentation as well. Nevertheless, it is difficult or impossible to determine the exact point of erosion.

(7) The Municipality officially authorizes 17 small local companies to do sand quarry operation business on Garang and Kreo rivers. Quarry area allocated to each of them ranges from 500 m^2 to 2,000 m^2 but its daily production is not clear. According to the Tax Office, the last year's revenue from the quarry company was Rp.400,000, calculated on the basis of Rp.500/ton. The annual production, therefore, amounts to 800 tons, which is rather skeptical and unreliable figure to show the real situation. The production volume may be reported underestimated. Nearly 70 workers are engaged in this job. They simply scoop the sand with bucket in the river bed and store it up on the banks. The broker comes to the site once in a while to buy the materials. Spot delivery price is Rp.20,000/m^3 for sand, whereas Rp.15,000/m^3 for cobble. However, an excessive quarry operation in the river bed will cause adverse effects to both river structures and aquatic environment.

(8) PDAM is currently taking about 1m^3/sec of water from Garang River and pumping it up to its own treatment plant. Sludge deposits, by-products of water treatment, is discharged back to the river at some 50 m downstream from the intake. This system may result in increased sediment load in the lower basin.

(9) Apart from the administrative initiatives for public services, it is absolutely necessary to enhance public awareness and consciousness of the importance of river environment. This can be a basic policy for overall river basin management, but in fact, many people tend to consider the river or open channel as a waste disposal site.

10.3.2 Key Idea and Countermeasures

Problems described above are correlated to each other and may be arisen from the large-scaled human intervention for the last few decades. Basically, countermeasures should be taken in such a way that land management techniques and conservation practices are undertaken in rural areas, whereas structural and hydrological control are conducted in urban areas.

Long term and short term approaches can be considered for effectively and economically viable measures, and strategically the management practice can be split into two types such as structural and nonstructural measures. Setting target years for 2003 for short term and 2008 for long term, measures and practices for the River Basin Management are described as follows:

Short Term Program

Short term program involves various schemes to support and accomplish on-going study and activities. It is important to consider that structural measures would not be achieved successfully without proper coordination and harmony with nonstructral measures. For example, solid waste collection and disposal system needs to be improved with a new sanitary landfill site and equipment, but at the same time strict control system is required to protect disposal place from entering hazardous wastes. In this sense penalty law should be established.

Soil conservation scheme should be enhanced as part of environmental campaign emphasizing the need to promote reforestation and soil erosion control. These activities have to be performed in the upper basin associated with control of land and housing development. Installation of septic tanks should also be accelerated in line with PROKASIH. Regarding hydrogeological balance between groundwater abstraction and land subsidence, in-depth information is absolutely necessary in order to provide analytical output and key ideas for future action program.

Strategic Approaches and Measures

	Short Term	Long Term
Structural Measures	- Installation of septic tanks - Construction of new sanitary land-fill site - Procurement of garbage collection equipment - Reforestation by rapidly growing vegetation - Soil erosion control by runoff collection basin - Improvement of PDAM sediment discharge system	- Surface-water resources development - Installation of public sewerage system and treatment plant - Installation or improvement of treat-ment plants for industrial wastes - Reforestation and vegetation coverage in developed land - Construction of check dams (Sabo Dam)
Nonstructural Measures	- Interinstitutional coordination and collaboration - Strengthening of solid waste control and management system - Enforcement of monitoring system for both river water quality and industrial waste discharge - Establishment of penalty law for waste disposal - Monitoring of land subsidence and groundwater level - Study on hydrological balance to determine optimum groundwater abstraction - Revision of regulation for Water Pollution Control PP20/1990 to include groundwater - Strict control and management for groundwater development - Control of land/housing develop-ment in the upper basin	- Enhancement of public awareness of environment - Improvement of raw water quality to clear the standards to full satisfaction - Upraising of garbage collection rate to 90 % - Establishment of law or regulation for "polluter's pay principle" - Government subsidy system for private companies or persons - Prohibition of quarry operation in the river

Long Term program

As ultimate structural measures, surface-water resources development and the installation of public sewerage system and industrial wastes treatment plants are highlighted in long term program. The implementation of these projects will require pre-conditions such as huge investment and public consensus. In this respect, new law or regulation should be established to impose tax for beneficiaries of sewerage system so that revenue can be used for the operation and maintenance of facility. It is suggested that the Government provides industries with financial assistance or subsidy for the installation of wastes treatment plant. On the other hand, the regulation must be applicable to those who are identified as polluters. They are liable to pay for penalty based on "Polluter's Pay Principle". Strategic approaches and measures are summarized in the table above.

10.3.3 On-going Countermeasures and Practice

(1) Groundwater Monitoring and Control

Environmental Impact Assessment Board (BAPEDAL) under the Ministry of Environment is undertaking groundwater monitoring and control project as part of the national environmental program with a technical assistance from the British Government, so called BAPEDAL-ODA Program. Semarang City was selected as a pilot project since it had been ranked in the highest priority. This project started in April, 1996 and is scheduled to be completed in March, 1998. In this connection the Mining Agency of the Central Java Provincial Government is playing a role as project coordinator and Directorate General of Geology in Bandung is also involved in relative investigations for the project.

The project includes technical assistance and suggestive approach to the institutional strengthening for the groundwater management and control, focusing on coastal aquifer and Ungaran aquifer which are considered to be the major groundwater reserves in Semarang City (refer to Fig.10.3.1). In this pilot project, 28 observation wells were installed in mainly coastal area with the view of monitoring groundwater abstraction and quality.

It indicates that the fall of groundwater levels occur in coastal areas as a result of over-development of groundwater reservoir and land is subsiding subsequently. It also mention that the groundwater table has lowered by 10 m in an extensive area and even by 20 m in eastern section of Semarang City. Consequently, it is warning that land subsidence of 5 m may occur resulting from 20 m down in groundwater levels. This may induce quality degradation due to the brackish water intrusion.

Current groundwater abstraction in Semarang City is still not clear enough. According to the study report on Groundwater Conservation in Semarang City and Surrounding Areas conducted in 1993 by the Sub-directorate of Hydrogeology in Bandung, daily abstraction was estimated at 100,800 m^3 in the area covering whole Semarang Municipality and Semarang Regency.

Knowing actual critical conditions of land subsidence and pollution risk over coastal areas, it is planned to relocate present industrial zone into Tugu and Genuk Regencies in order to reduce groundwater consumption. It is also necessary to enhance surface-water resources development in line with restriction and control of groundwater

abstraction. This is rather long-term plan but basic concept is to determine optimum use of groundwater resources taking account of hydrogeological balance.

(2) Surface-water Resources Development

Apart from proposed Jatibarang dam construction, Kedung Ombo reservoir located about 50 km southeast of Semarang City is nearly completed aiming at supplying domestic water as well as irrigation water. The development of this surface-water resource has been long expected for the benefit of Semarang citizen. PDAM, city water supply enterprise, plans to benefit from the water transfer from Klambu to Kudu located at northeast edge of Semarang City. The development potential for domestic water supply is 2.25 m^3/s.

The above raw water transmission project is undertaken by JRATUNSELUNA Project Office. The first phase will be completed in March 1998 to conduct 1.00 m^3/s of municipal water, and the second phase is due to end by October of the same year for 2.5 m^3/s. PDAM water supply project is designed to take 1.25 m^3/s of water from Kudu for the first phase and 1.00 m^3/s for the second phase. However, the first phase work is behind the schedule due to mainly financial difficulties. It is still on-going process in the hope that all works be achieved by the end of 1999. The first phase is financed by IBRD and the second phase, on the other hand, will be implemented under BOT system.

(3) Soil Conservation

Soil conservation in the upper basin of Garang River is undertaken by two different institutions, National Development Planning Board (BAPPEDA) and Forestry Office of each Regency concerned. Practical works and activities are described as follows;

(a) BAPPEDA

The study on agro-climatology and land characteristics in the Garang river basin is now being conducted as part of watershed management under BAPPEDA in collaboration with Soil Research Center of Bogor, Food Plant Protection Agency (BPTP) and Center for International Cooperation in Agricultural Research for Development (CIRAD) in France. The study began with the collection of basic information on soil and hydrology in the upper basin. Apart from the installation of four(4) automatic rainfall recorders, three(3) water level gauging stations were newly established in March 1997 on

Garang, Sikopek and Kripik rivers.

The study includes establishment of farming system and cropping pattern to be introduced in the deforested areas in terms of erosion control and soil conservation, and bench terrace is enhanced to the local farmers with the aim of selecting suitable cover crops under the technical guidance of the above assisting agencies. Such soil conservation by crop management is currently carried out in three pilot farms such as Pagrsari (3 ha), Gunungpati (4 ha) and Gonoharjo (3 ha), where the land is used for intensive cultivation of such crops as water melon, corn, onion, groundnuts, ginger, green pepper and so on.

Knowing the fact that the climate and soil conditions are key elements for farming, crops are carefully selected taking account of productivity as well as effectiveness for soil protection. Small storage reservoir is also seen for a pilot farm where cash crop trees are planted with some intercrops.

So far study results are practically not obtainable as the recording time is too short to analyze the data. Consequently, it can be hardly explained in quantitative way on how much effect the crops may give on soil protection and erosion control.

(b) Semarang Regency

The area of about 80 km^2 in the uppermost basin of Garang River is fallen in the jurisdiction of Semarang Regency and managed by the Forestry Office of Ungaran since its establishment of 1994. This Office is engaged in the practical field work management in relation to soil conservation and water recharging, and its strategic operation consists of two major activities such as reforestation enhancement and structural approach.

According to the last 3 years record, reforestation has been achieved for about 170 ha of sloped land in mainly sub-district of Ungaran. Although the Office is desirous of planting 400,000 trees a year, this number is far beyond the reality because in real case it reaches only 10 % of the above at the maximum efforts due to the budget constraint.

There are 4 nursery gardens totaling to 4.25 ha, in which seedlings are grown for free distribution to the local farmers and even to other sub-districts lying in the same river basin. The Office currently sends 6 personnel to Mijen,

Gunungpati and Ngaliyan sub-districts under Municipality to provide extension services as there is no specific agency in Municipal administration to deal with soil conservation. Plants to be distributed are fast growing species such as sengon (Albizzia falcata), mlinjo (Gnetum gnemon), banana, grass and so on.

Structural measures are also taken as part of operation program. This includes construction of check dams (sabo dam), recharge wells and storage reservoirs and rehabilitation of terrace-shaped land. Well construction seems to be the most frequent case with the aim of obtaining significant effects such as protection of surface runoff and groundwater recharging.

(c) Kendal Regency

Uppermost basin of Kreo River is under the administration of Kendal Regency. It covers about 26 km^2 consisting of two sub-districts, Limbangan and Boja. Forestry Office in Kendal owns 4 ha of nursery garden in 7 different sites in the Regency and is in charge of forest management. There are 18 forest extensionist, of which 2 are assigned for Limbangan and 3 are for Boja.

Operation work started in 1994/95 with reforestation of 25 ha of land in Limbangan in collaboration of local farmers. Since then the operation has continued to cover 25 ha every year, except fiscal year 1997/98 due to the budget cut. So far 75 ha of reforestation and 25 ha of terrace rehabilitation were achieved in the said two sub-districts.

With regard to structural measures, the Office has undertaken the construction of 45 recharge wells together with 42 small storage reservoirs. Unit cost of construction is reported to be Rp. 750,000 for the well and Rp. 1,500,000 for the reservoir.

(4) Solid Waste Management

Study is being conducted under SSUDP to select a new sanitary landfill site, and the report will be completed in July 1998. So far six (6) alternative cases are proposed to the Municipality. Final decision will be made after due consideration between local authorities concerned and an early implementation is expected to set up final disposal area because existing site will be no longer used in 2003. This project shall include management system to control both quality and quantity of refuse so that any industrial and medical wastes are not allowed to be brought in.