2.3.3 RETURN SLUDGE

Return sludge volume is calculated by the following equation.

Sludge return ratio 50 %
Return sludge volume = 43,000 × 0.5 = 21,500 m^3/day
= 15 m^3/min.

2.3.4 GRAVITY SLUDGE THICKENERS

Gravity thickened sludge production volume is calculated by the following equation.

Solids inflow = 2.75 + 2.73 = 5.48 t/day
Primary sludge Excess sludge
Sludge inflow = 137.6 + 304 = 441 m^3/day
Thickened sludge solids = 5.48 × 0.8 = 4.39 t/day
Assume solids content to be 3.5 %
Thickened sludge volume = 4.39 × 100 / 3.5 = 125 m^3/day

2.3.5 ANAEROBIC SLUDGE DIGESTERS

Anaerobic digested sludge production volume is calculated by the following equation.

Input solids = 4.39 t/day
Input sludge volume = 125 m^3/day
Volatile solids content of sludge 70 %
Solids destruction rate 50 %
Digested sludge solids = 4.39 × (1 – 0.7 × 0.5) = 2.85 t/day
Assume solids concentration is 3.0 %
Digested sludge volume = 2.85 × 100 / 3.0 = 95 m^3/day

2.3.6 SLUDGE DEWATERING

Dewatered sludge production volume is calculated by the following equation.

Input solids = 2.85 t/day
Recovered solids (90%) = 2.85 × 0.9 = 2.57 t/day
Assuming solids concentration as 20.0 %
Sludge cake volume = 2.57 × 100 / 20.0 = 13 m^3/day

2.4 COMPONENT FACILITIES

2.4.1 DESIGN BASIS

Design wastewater inflow rate is determined as follows.

Average daily flow Qin = 37,000 m^3/d
(Maximum daily flow in winter season)
Maximum daily flow Qin max = 43,000 m^3/d

Design wastewater quality :
Influent wastewater quality to reactor tank is calculated as Follows.

BOD	101.5	mg/L
SS	96	mg/L
T-N	21.6	mg/L

(S-BOD is 69.02 mg/l) 68 %
(SBOD/BOD)

Design discharge wastewater quality :
Design effluent wastewater quality from final sedimentation tank (average quality)
Is determined as follows.

Removal efficiency

BOD	9	mg/L	91.1	%	92.5
SS	8	mg/L	91.7	%	88
T-N	10	mg/L	53.7	%	11.6

T-N condition of Treated water is NOT-N 8.3 mg/L Removal efficiency
K-N 1.7 (T-N) 60~70%
Design water temperature 10 °c

2.4.2 DESIGN CALCULATION

(1) Resircuration Ratio(R)

Recircuration ratio (R) is calculated by the following equation.

Influent concentration of T-N to reactor tank CTN·in = 21.6 mg/L
(effluent water quality from final sedimentation tank)

NOT-N concentration, Cnox·eff = 8.3 mg/L, Assuming that nitrogen ratio which concerned about nitrification in CTN·in is $\alpha = 0.7$, recircuration ratio R is

$$R = \alpha \times CTN\cdot in / CNOX\cdot eff - 1$$

$$R = 0.7 \times 21.6 / 8.3 - 1 = 1.82 - 1 = 0.82 \rightarrow 1$$

(2) MLSS Concentration

MLSS concentration is calculated by the following equation.

Assuming that MLSS concentration at reactor tank 3,000 mg/L (2,000~3,000MLSS) and return sludge concentration 9,000 mg/l, so that return sludge ratio R r is

$$9000\,R\,r = 3000 \times (1 + R\,r)$$

$$R\,r = (3{,}000) / (9{,}000 - 3{,}000) = 0.5$$

Recircuration flow Qc and return sludge flow Qr are respectively

$$R - R\,r = 1 - 0.5 = 0.5$$

$$Qr = Qin \times 0.5 = 18{,}500\ m^3/day$$

$$Qc = Qin \times 0.5 = 18{,}500\ m^3/day$$

(3) A -SRT

Retention time at aerobic tank is calculated by the following equation.

Assuming that complete nitrification, and to consider daily and seasonally change of water quantity and quality, A-SRT(d) is

$$\delta = 1.5 \text{ (Assuming)}$$

T = 10 °c (Assuming)

$\theta XA = \delta \times 20.6 \times \exp(-0.0627 \times T) - 0.627$

$= 1.5 \times 20.6 \times 0.534192 = 16.5$ day

(4) Aerobic Tank Capacity VA(m^3)

Aerobic tank capacity is calculated by the following equation.

$VA = (Q\,in \times \theta XA \times (a \times C_S\text{-}BOD\text{-}in + b \times SS\text{-}in)) / (1 + C \times \theta XA) \times X$

θXA = Aerobic solids retention time 16.5 day

a = Gross yield coefficient of dissolved BOD (0.5~0.6) 0.55 gMLSS/gS-BOD

Cs-BOD = Dissolved BOD concentration of influent flow 69.02 mg/L

b = Gross yield coefficient of SS (0.9~1.0) 0.95 gMLSS/gSS

c = Autolysis coefficient of sludge (0.025~0.035) 0.03 L / day

X = MLSS concentration 3,000 mg/L

VA = 37,000 × 16.51 × 129 / 4486 = 17,586 m^3

$A \times C_S\text{-}BOD\text{-}in \quad b \times SS\text{-}in = 0.55 \times 69.02 + 0.95 \times 96 = 129$

$(1 + c \times \theta XA) \times X = (1 + 0.03 \times 16.5) \times 3,000 = 4,486$

(5) Biological Reaction Tank Capacity V(m^3)

Biological reaction tank capacity is calculated by the following equation.

Assuming BOD-SS load(LBOD/x) is 0.06 kgBOD/kgMLSS/day (0.05~0.1)

$V = (BOD\text{-}in \times Qin) / (LBOD/x \times X)$

$= (101.5 \times 37,000) / (0.06 \times 3,000) = 20,864\ m^3$

(6) Anoxic Tank Capacity VDN m^3

Anoxic tank capacity VDN m3 is calculated by the following equation.

$VDN = V - VA = 20,864 - 17,586 = 3,278\ m^3$

(7) Capacity Ratio of Anoxic Tank and Aerobic Tank

VDN : VA = 3,278 : 20,864 = 1 : 6.4

(8) Speed Constant of Denitrification KDN (mgN/ g MLSS/h)

Speed constant of denitrification KDN is calculated by the following equation.

$KDN = (LNOX.DN \times 10^3) / (24\ VDN \times X)$

Here

$COX.A = \alpha \times CTN\text{-}in \times 1 / (1 + R)$

$= (0.7 \times 21.6 \times 1) / (1 + 1) = 7.6$ mg/L

$LNOX.DN = CNOX.A \times (Qr + Qc) \times 10^{-3}$

$= 7.6 \times (18,500 + 18,500) \times 10^{-3} = 280$ kg/day

$KDN = (280 \times 10^3) / (24 \times 3,278 \times 3)$

$= 1.185$ (mgN/gMLSS/h) > 0.872 OK

Check of denitrification speed

Less than(y') is NO $y' = 6.2 \times 0.06 + 0.5 = 0.872$

More than (y') is OK

Calculate back $Vdn = \dfrac{280 \times 10^3}{24 \times 0.872 \times 3} = 4{,}455\ m^3$

$VD : VA = 1 : 3.95$

$V = 4{,}455 + 17{,}586 = 22{,}041\ m^3$

(9) Biological Reaction Tank Capacity and Retention Time

Biological reaction tank capacity and retention time is calculated by the following equation.

Retention time at biological reaction tank in winter season, t(h) is

$t = (24 \times 22{,}041) / 37{,}000 = 14.3\ h$

Retention time at aerobic tank in winter season, tA(h) is

$t = (24 \times 17{,}586) / 37{,}000 = 11.4\ h$

Retention time for daily maximum flow at biological reaction tank in winter season, t(h) is

$t = (24 \times 22{,}041) / 43{,}000 = 12.3\ h$

(10) Necessary Oxygen Demand ΣD (kg/d)

Necessary oxygen demands is calculated by considering of oxidation of carbonic organic matter, necessary oxygen for endogenous respiration and nitrification reaction of micro-organisms in activated sludge, and necessary oxygen for maintain a dissolved oxygen.

$OD = OD1 + OD2 + OD3 + OD4$

Here

OD	Necessary oxygen demands (kgO_2/day) (AOR)	
OD1	Necessary oxygen for oxidation of carbonic organic matter	(kgO_2/day)
OD2	Necessary oxygen for endogenous respiration	(kgO_2/day)
OD3	Necessary oxygen for nitrification reaction	(kgO_2/day)
OD4	Necessary oxygen for maintain a dissolved oxygen	(kgO_2/day)

OD1 = A(kgO_2/kgBOD) × [Removal BOD(kgBOD/day) − Denitrification volume (kgN/day) × K (kgBOD/kgN)]

Here A : Necessary oxygen for removal of BOD (0.5~0.7)

K : BOD consumption for denitrification (2.86)

OD2 = B(kgO_2/kgMLVSS·day) × VA(m^3) × MLVSS(kgMLVSS/m^3)

Here B : Oxygen consumption by endogenous respiration at MLSS unit (0.05~0.15)

VA : Reaction tank capacity at aerobic part

OD3 = C (kgO_2/kgN) × Nitrificated Kj-N volume(kgN/day)

Here C : Nitrificated oxygen at nitrification reaction (4.57)

Nitrificated Kj-N (Inflow Kj-N) − (Outflow Kj − N volume) − (Removal volume of Kj -N by excess sludge)

OD4 = Q × DO concentration of reaction tank

Here DO : Dissolved oxygen concentration at end point of aerobic tank 1.5mg/L

(Design flow = 37,000 m^3/day)

BODin = 101.5 mg/L, T-N = 21.6 mg/L

BODout = 9 mg/L, VA = 17,586 m^3

The results of calculation is shown in table below.

		unit		note	
Necessary oxygen demands for oxidation of BOD (OD1)	(1) Q	m^3/day	37,000		
	(2) BODin	mg/L	101.5		
	(3) BODout	mg/L	9		
	(4) {(2) – (3)}×(1)×10^{-3}	kg/day	3,423		
	(5) ΔDN (denitrification volume)	kg/day	280		
	(6) k × (5)	kg/day	800	k =	2.86
	OD1= A × {(4) – (6)}	kg/day	157	A =	0.06
Necessary oxygen demands for endogenous respiration (OD2)	(1) MLSS	mg/L	3,000		
	(2) VA	m^3	17,586		
	(3) (1) × (2) × 10^{-3}	kg/day	52,758		
	OD2 = B × (3)	kg/day	5,276	B =	0.1
Necessary oxygen demands for nitrification reaction (OD3)	(1) α (nitrification ratio)		0.7		
	(2) T-N·in	mg/L	21.6		
	(3) Q	m^3/day	37,000		
	OD3= 4.57×(1)×(2)×(3) ×10^{-3}	kg/day	2,557	C=	4.57
Necessary oxygen demands for maintain dissolved oxygen (OD4)	(1) DO concentration at reaction tank	mg/L	1.5		
	(2) Q	m^3/day	37,000		
	(3) Qr+Qc	m^3/day	55,500		1.5
	(4) {(2)+(3)}	m^3/day	92,500		
	OD4 = (1)×(4)×10^{-3}	kg/day	139		
Necessary oxygen (OD) demands	OD= OD1+OD2+OD3+OD4	kg/day	8,129		
			0.220 Q		

Design of air diffuser (Assuming that diffused air aeration、fine bubble、spiral flow)

EA = 7.5, ρ = 1.293

Qw = 0.233 (Assuming)

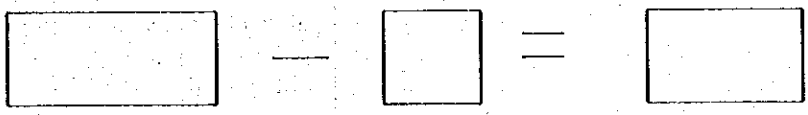
Supplied air (N m^3/day) =

(Necessary oxygen demands(kgO_2)) / EA(%) × 10^{-2} × ρ (Air/Nm^3) × Ow(kgO_2/kgAir)
= (0.220 × Q) / (7.5 × 0.01 × 1.293 × 0.233)
= 9.72 Q = 359,748 (N m^3/day) = 250 (Nm^3/min)

2.4.3 MEASURE FOR ADVANCED TREATMENT

Way of thinking

Changing from conventional activated sludge process to advanced treatment process (T-N,T-P removal).
Calculate a necessary treatment capacity of advanced treatment process and evaluate a capacity of conventional activated sludge process.
Extend a necessary ponds and equipment in the future.



Necessary treatment capacity of advanced treatment process	Treatment capacity of conventional activated sludge process	Extend or remodeling of treatment about shortage of capacity

Explanation of measures for advanced treatment

Here showing a treatment capacity of two processes in table below.

* Conventional activated sludge process
* Advanced treatment process(Recircuration process)

Explanation of Measures for Advanced Treatment

	unit	Necessary advanced capacity	Facility and equipment for advanced treatment	
			Conventional activated sludge process	Measures for shortage of capacity
・Primary sedimentation tank surface load	$m^3/m^2/day$	35	35	—
Facility shape			ϕ25m × 4 tanks	
・Reaction tank				
Retention time	hour	12.3	12.3	12.3
Distribution ratio of water	%		6.3/12.3×100= 51	100 – 51 = 49
			Making a wall in reaction tank, and divided an anoxic zone and aerobic zone	Build an extend tank for reaction tank
Facility shape			W5.5m × H5.5m × L49m × 8 tanks	W5.5m × H5.5m × L46m × 8 tanks
・Final sedimentation tank surface load	$m^3/m^2/day$	15	9.0	12.3
Facility shape			ϕ30m × 4 tanks	New ponds ϕ25m × 4 tanks
・Return sludge flow	%	Usually 50% (Sludge pump capacity 100%)	Same to the left	Same to the left (New pumps are Necessary)
・Recircuration flow of nitrificated water	%	50%	Provide a recircuration pumps at the outflow point of reaction tank(aerobic tank)	Same to the left
・Supplied air flow	m^3/min	250	229	203 Extend capacity
・Waste sludge volume (Inflow sludge solids of thickener) (exclude T-P removal)	t/day	5.48	8.04 (Sludge products from Conventional activated sludge process)	Not necessary a extend of capacity
(include T−P removal)		6.26		Not necessary a extend of capacity
・ T-P removal by addition of coagulant		New equipment is necessary	Same to the left	Same to the left

Waste sludge volume produced from T-P removal
Waste sludge production volume by addition of coagulant
Influent T-P concentration of reaction tank 4.14 mg/L
Additional concentration of aluminum sulfate CA(mg/L) is calculated by following

equation

CAL = Csp·in × m × AL / P

Here

Csp·in	Influent dissolved T-N concentration(mg/l)	4.14
P	Valence of phosphorus	31
AL	Valence of aluminum	27
m	Additional molality ratio	1 (assuming)

CAL = (4.14 × 27 × 1) / (31) = 3.6 mg/L

Assuming that waste sludge production volume by addition of coagulant is 5 times as additional aluminum volume.

Waste sludge production volume by addition of coagulant

= QD × 5 × CAL × 10^{-6}

= 43,000 × 5 × 3.6 × 10^{-6} = 0.78 t/day

Waste sludge production volume in case of removal of T-N and T-P simultaneously

= 5.48 + 0.78 = 6.26 t/day

APPENDIX-5CONSTRUCTION PLAN AND COST ESTIMATE

1. CONSTRUCTION PLAN

1.1 GENERAL

Construction works for the project includes earthwork, concrete work, pipe work, mechanical/electrical work, architectural work and miscellaneous work. These works, in general, will be executed by ordinary construction methods using construction equipment readily available in Tulcea. Major works are planned to be carried out with mechanical equipment for smooth and economical performance.

Construction site for the proposed facilities are located in the eastern part of Tulcea City. There would be no difficulty to transport materials and equipment because the area has adequately provided road networks. There is neither difficulty in obtaining water nor electricity for construction.

1.2 CONSTRUCTION METHOD

Major construction works are construction of WWTP, installation of wastewater pumps and installation of sewer pipes and manholes.

1.2.1 CONSTRUCTION OF WWTP

The major construction works of WWTP are construction of primary and final sedimentation tank, aeration tank, influent and discharge pumping station, sludge treatment facilities and administration building.

No special construction method will be applied for the construction of WWTP except placing of Pre-stressed concrete for sludge digester tank. Since there are many experiences to construct pre-stressed concrete structure by Romanian contractors, there would not be any difficulty to construct this kind of structures.

1.2.2 INSTALLATION OF WASTEWATER PUMPS

Wastewater pumps will be installed at the former stormwater pumping station, which is not used for the original purpose and their pumps have already be removed. The work is only installation of new wastewater pumps. Therefore no special construction works/methods would be required.

1.2.3 INSTALLATION OF SEWER PIPES

Open trench method would be adopted for installation of sewer pipes, because earth covering depth for sewer pipes are less than three meters.

1.3 CONSTRUCTION SCHEDULE

1.3.1 WORKING DAYS

Annual working days are estimated to be 225 days based on the following assumptions:

Winter season idle period:	3 month (from Dec.15 to Mar. 15)
Workable period:	275 days

Sundays in workable period:	9 month x 4 days = 36 days
National holidays in workable period:	1 day
Rainy days in workable period:	10 days (more than 10 mm/day, ave. last 5 years)
Total work suspension days in workable period:	47 days
Working days:	**275 days - 47 days = 228 days : 225 days**

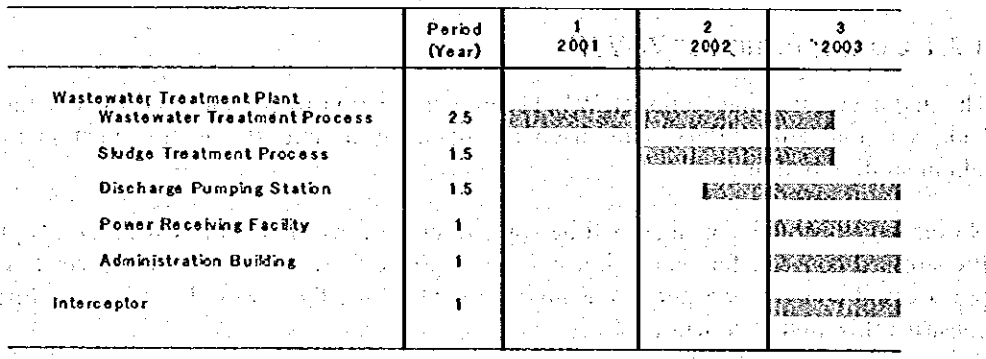
1.3.2 WORK TIME

All construction works will be done during day time in principle. The working time is eight (8) hours per day

1.3.3 REQUIRED CONSTRUCTION PERIOD AND SEQUENCE OF WORKS

Required construction periods are estimated based on the construction volume and the above mentioned working days and work time assumptions by each construction works/structures by ordinary scale of inputs. The sequence of works is decided as follows by relationship between construction period and provision of project efficiency. Construction plan for the Tulcea project is presented in the *Figure AII.5.1*.

Figure AII.5.1 Construction plan and sequence of works for the Tulcea project



2. COST ESTIMATE

2.1 BASIS OF COST ESTIMATE

The project cost consists of I) construction cost, II) equipment cost, III) engineering service cost, IV) government administration cost and V) physical contingency as shown in *Table AII.5.1*. The project cost is estimated under the following conditions.

- All base costs are expressed under the economic conditions that prevailed in June 1999.
- The exchange rates of currencies are US$1 = ROL15,756 = ¥122.
- Only equipment cost is classified into foreign and local currency portions and their rate is FC : LC = 70% : 30%, because all construction works are done by local products and equipment.
- Engineering service cost is including all services for detailed design, tendering assistance and construction supervision. The cost is assumed at 10% of the construction cost.
- Government administration cost is costs that should be prepared by government and/or executing agency (*e.g.* cost for personnel and organization for the project management, cost for commission for external loan, etc.). The cost is assumed at 2 % of the construction

cost.

- Physical contingency allowance is assumed to be 10% of the total of construction, equipment, engineering service and government administration cost.
- Price escalation is not counted.

Table AII.5.1 Structure of Project Cost

	Item	Remarks
I	Construction Cost	
II	Engineering Service Cost	10% of (I)
III	Government Administration Cost	2% of (I)
IV	Contingency	10% of (I+II+III)
V	Project Cost	I+II+III+IV

2.2 CONSTRUCTION COST

The construction cost consists of 1) mobilization and demobilization cost, 2) cost for preparatory works, 3) cost for main works, and 4) cost for miscellaneous works as shown in *Table AII.5.2.*

2.2.1 MOBILIZATION AND DEMOBILIZATION COST

Mobilization and demobilization cost is assumed at five (8) percent of the cost for main works.

2.2.2 PREPARATORY WORKS

Cost for preparatory works is assumed at five (5) percent of the cost for main works.

2.2.3 COST FOR MAIN WORKS

The direct cost for main works (cost for civil work, mechanical/electrical equipment cost, mechanical/electrical equipment installation cost, and construction cost for administration building) will be estimated based on the results of preliminary engineering design. Indirect costs such as site expenses and overhead and profit are estimated by percentage.

- The site expense is estimated to be ten (10) percent of the direct cost of main works.
- The overhead and profit are estimated to be ten (10) percent of the direct cost of main works.
- The cost for the miscellaneous works is estimated to be ten (10) percent of the cost for main works.

Table AII.5.2 Structure of Construction Cost

	Item	Remarks
I	Construction Cost	Total of I-1 to I-6
I-1	Mobilization and demobilization	5 % of I-3
I-2	Preparatory works	5 % of I-3
I-3	Direct Cost for Main works	Total of I-3-1 to I-3-4
I-3-1	Civil work	
I-3-2	Mechanical/electrical equipment	
I-3-3	Mechanical/electrical equipment installation	
I-3-4	Administration building	
I-4	Miscellaneous works	10 % of I-3
I-5	Site expenses	10 % of I-3
I-6	Overhead and profit	10 % of I-3

(1) Cost for Civil and Architectural Work

The cost for civil and architectural work is estimated by multiplying the quantity of works by unit construction costs. The unit construction costs are estimated by unit prices of labor, construction materials and equipment.

The unit prices of personnel, material and equipment operation are estimated based on prevailing market prices referring the data collected from MPWTP and other organizations concerned. The Unit prices that are used in the study, are shown in *Tables AII.5.3* to *AII.5.5*.

Table AII.5.3 Unit Costs of Personnel

	lei/month	lei/day
Engineer	3,500,000	140,000
Foreman	2,600,000	104,000
Skilled Labor	2,200,000	88,000
Common Labor	1,600,000	64,000
Technician	2,200,000	88,000
Equipment Operater	2,000,000	80,000
Driver	1,800,000	72,000
Administrator/Clark	3,000,000	120,000

Table AII.5.4 Unit Price of Material

Item		Unit	Price (Lei)
Sand		m3	100,000
Soil		m3	100,000
Crushed stone		m3	200,000
Asphalt		ton	800,000
tack coat		l	15,000
Reinforcing bar		ton	5,000,000
Wooden material		m3	700,000
Ready mix concrete	B50	m3	500,000
	B200		700,000
	B250		900,000
RC pipe	Dia200 mm	m	100,000
	Dia300 mm		150,000
	Dia400 mm		175,000
	Dia500 mm		215,000
	Dia600 mm		250,000
	Dia700 mm		350,000
	Dia800 mm		450,000
	Dia1000 mm		750,000
	Dia1500 mm		2,000,000
	Dia1650 mm		2,350,000
	Dia2000 mm		3,500,000
	Dia2200 mm		4,500,000
	Dia2800 mm		7,000,000
	Dia3400 mm		12,000,000
Steel Pipe	Dia400 mm		500,000

Table AII.5.5 Unit Price of Equipment Operation

Item		Price (Lei/day)
Dunp Truck	10t	800,000
Truck		800,000
Concrete Transporter		1,200,000
Concrete Pumping Car		1,200,000
Bulldozer	11t	1,200,000
Backhoe	0.6m3	1,000,000
Crawler Crane	20t	1,800,000
Truck Crane	20t	1,800,000
Pile Dirving Machine		2,500,000
Tire Roller		800,000
Vibration Roller		400,000
Compactor		200,000

(2) Cost for Mechanical/Electrical Equipment and Installation

Since there are no published standard market price list for mechanical/electrical equipment for wastewater treatment, the cost for mechanical/electrical equipment will be obtained from manufacturer that have experience in Romania and/or neighboring countries based on the specifications resulting from preliminary engineering design.

The appropriate cost decided based on the obtained quotation would be used for the mechanical/electrical equipment cost for the project.

(3) Direct Cost for Main Works

The direct cost for main works are estimated for WWTP and interceptor separately as shown in *Table AII.5.6* and *AII.5.7*

2.3 PROJECT COST

Estimated total project cost is about ROL 321,054 million, and its breakdown is shown in *Table AII.5.8*. Of the total project cost, ROL 107,265 million or 33% is foreign currency portion, and remaining ROL 213,789 million or 67% is local currency portion.

Table AII.5.8 Project Cost (Tulcea Project)

Item		Cost (million Lei)	FC (million Lei)	LC (million Lei)
I	**Construction Cost**	**260,596**	**94,235**	**166,361**
	Mobilization and Demobilization	9,307	0	9,307
	Preparatory Works	9,307	0	9,307
	Main Works	186,140	94,235	91,905
	Wastewater Treatment Plant	181,372	93,238	88,135
	Wastewater Treatment Process	92,805	46,392	46,413
	Sludge Treatment Process	62,486	35,045	27,441
	Discharge Pumping Station	20,015	11,426	8,589
	Power Receiving Facility	2,565	0	2,565
	Administration Building	3,502	375	3,127
	Interceptor	4,768	998	3,770
	Miscellaneous Works	18,614	0	18,614
	Site Expenses	18,614	0	18,614
	Overhead and Profit	18,614	0	18,614
II	**Engineering Service Cost**	**26,060**	**13,030**	**13,030**
III	**Government Administration Cost**	**5,212**	**0**	**5,212**
IV	**Contingency**	**29,187**	**0**	**29,187**
V	**Project Cost**	**321,054**	**107,265**	**213,789**

(unit: million lei)

2.4 OPERATION AND MAINTENANCE (O/M) COST

Major portions of O/M cost of the WWTP are electric power charge for the equipment and cost for personnel. The O/M cost for the Tulcea project is estimated at ROL 3,820 million as

following *Table AII.5.9.*

Table AII.5.9 Operation and Maintenance Cost for Tulcea Project

Item	unit	unit price	Q'ty	Total
Personnel	lei/month/person (average)	2,000,000	40	960
Electricity	lei/kwh	500	449	1,938
Chemical	lei/kg	5,000	342,000	171
Excess Sludge Disposal	m^3	20,000	7,000	140
Repairing	0.5% of Mechanical cost		52,660	263
olhters	10% of above			347
Total				3,820

(unit: million lei)

3 IMPLEMENTATION SCHEDULE

3.1 IMPLEMENTATION SCHEDULE

The project will be completed within four (4) years from 2000. Pre-construction stage of one (1) year is assumed for the detailed design period and tender process followed by three (3) years' construction works.

Proposed implementation schedule is presented in *Figure AII.5.2.*

Figure AII.5.2 Implementation Schedule (Tulcea Project)

	Period Year	1 2000	2 2001	3 2002	4 2003
Detailed Design	1				
Construction					
Wastewater Treatment Plant					
Wastewater Treatment Process	2.5				
Sludge Treatment Process	1.5				
Discharge Pumping Station	1.5				
Power Receiving Facility	1				
Administration Building	1				
Interceptor	1				

3.2 DISBURSEMENT SCHEDULE

Proposed annual cost disbursement schedule of the Tulcea project for entire project life is shown in *Table AII.5.10.*

Table AII.5.6 Direct Construction Cost of WWTP (Tulcea)

Item		Unit	Quantity	Unit Price (Lei)	Amount (million Lei)	FC (million Lei)	LC (million Lei)
1 Wastewater Treatment Process							
1-1 Preliminary Treatment Process							
(1) Civil Work							
1) Earth Work							
Excavation		m3	4,889	5,000	24	0	24
Backfill		m3	683	22,000	15	0	15
Removal of Soil		m3	4,206	28,000	118	0	118
2) RC Concrete							
RC Concrete I	Floorborad	m3	941	1,543,000	1,452	0	1,452
RC Concrete II	Wall	m3	504	1,771,000	893	0	893
3) Pile Work (ave.L=10m, incl. driving work)		pcs	144	4,810,000	693	0	693
(2) Mechanical							
1) Equipment		ls	1	12,658,400,000	12,658	8,861	3,798
2) Installaiton		%	15		1,899	0	1,899
(4) Electorical		ls	1	61,528,200	62	0	62
1-2 Secondary Treatment Process							
(1) Civil Work							
1) Earth Work							
Excavation		m3	50,351	5,000	252	0	252
Backfill		m3	16,976	22,000	373	0	373
Removal of Soil		m3	27,375	28,000	767	0	767
2) RC Concrete							
RC Concrete I	Floorborad	m3	3,004	1,543,000	4,635	0	4,635
RC Concrete II	Wall	m3	2,899	1,771,000	5,134	0	5,134
3) Pile Work (ave.L=10m, incl. driving work)		pcs	10	4,810,000	48	0	48
(2) Architectural Work		m2	234	4,000,000	936	0	936
(3) Mechanical							
1) Equipment		ls	1	51,180,000,000	51,180	35,826	15,354
2) Installaiton		%	15		7,677	0	7,677
(4) Electorical		ls	1	304,328,400	304	0	304
1-3 Final Treatment Process							
(1) Civil Work							
1) Earth Work							
Excavation		m3	6,526	5,000	33	0	33
Backfill		m3	3,235	22,000	71	0	71
Removal of Soil		m3	1,130	28,000	32	0	32
2) RC Concrete							
RC Concrete I	Floorborad	m3	95	1,543,000	147	0	147
RC Concrete II	Wall	m3	134	1,771,000	237	0	237
(2) Architectural Work		m2	90	4,000,000	360	0	360
(3) Mechanical							
1) Equipment		ls	1	2,436,000,000	2,436	1,705	731
2) Installaiton		%	15		365	0	365
(4) Electorical		ls	1	4,474,800	4	0	4
2 Sludge Treatment Process							
2-1 Civil Work							
1) Earth Work							
Excavation		m3	13,195	5,000	66	0	66
Backfill		m3	9,985	22,000	220	0	220
Removal of Soil		m3	3,210	28,000	90	0	90
2) RC Concrete							
RC Concrete I	Floorborad	m3	476	1,543,000	734	0	734
RC Concrete II	Wall	m3	112	1,771,000	198	0	198
3) PC Concrete	Sludge digestion tank	m3	592	3,010,700	1,782	0	1,782
4) Pile Work (ave.L=10m, incl. driving work)		pcs	22	4,810,000	106	0	106
2-2 Architectural Work		m2	240	4,000,000	960	0	960
2-3 Mechanical							
1) Equipment		ls	1	50,064,000,000	50,064	35,045	15,019
2) Installaiton		%	15		7,510	0	7,510
2-4 Electorical		ls	1	755,647,200	756	0	756
3 Discharge Pumping Station							
3-1 Civil Work							
1) Earth Work							
Excavation		m3	1,079	5,000	5	0	5
Backfill		m3	781	22,000	17	0	17
Embankment		m3	298	22,000	7	0	7
2) RC Concrete							
RC Concrete I	Floorborad	m3	34	1,543,000	52	0	52

Table AII.5.6 Direct Construction Cost of WWTP (Tulcea)

Item	Unit	Quantity	Unit Price (Lei)	Amount (million Lei)	FC (million Lei)	LC (million Lei)
RC Concrete II Wall	m3	201	1,771,000	356	0	356
3) Pile Work (ave.L=10m, incl. driving work)	pcs	18	4,810,000	87	0	87
3-2 Architectural Work	m2	116	4,000,000	464	0	464
3-3 Mechanical						
1) Equipment	ls	1	16,322,400,000	16,322	11,426	4,897
2) Installaiton	%	15		2,448	0	2,448
3-4 Electorical	ls	1	174,808	0	0	0
3-5 Discharge Sewer dia 800 mm, EC=4m	m	150	1,703,000	255	0	255
4 Power Receiving Facility	ls	1	2,565,334,200	2,565	0	2,565
5 Administration Building						
5-1 Architectural Work						
1) Architectural Work	m2	600	4,000,000	2,400	0	2,400
2) Pile Work (ave.L=10m, incl. driving work)	pcs	25	4,810,000	120	0	120
5-2 Labo. and Office Equipment						
1) Labo. and Office Equipment	ls	1	750,000,000	750	375	375
2) Installaiton	%	0		0	0	0
5-3 Electorical	ls	1	231,600,000	232	0	232
TOTAL				**181,372**	**93,238**	**88,135**
				140,438		

Table AII.5.7 Direct Construction Cost of Interceptor (Tulcea)

Item		Unit	Quantity	Unit Price (Lei)	Amount (million Lei)	FC (million Lei)	LC (million Lei)
1 Pipe, Manhole and CSO							
1-1 Installation of interceptor pipe (RC pipe)							
1) RC pipe 200 mm	earth coverage 1 to 3 m	m	20	805,000	16.1	0	16
2) RC pipe 200 mm (replace)	earth coverage 1 to 3 m	m	10	1,207,500	12.1	0	12
3) RC pipe 400 mm	earth coverage 1 to 3 m	m	193	989,000	190.9	0	191
4) RC pipe 600 mm	earth coverage 1 to 3 m	m	12	1,225,000	14.7	0	15
5) RC pipe 600 mm (replace)	earth coverage 1 to 3 m	m	75	1,837,500	137.8	0	138
6) RC pipe 1000 mm	earth coverage 1 to 3 m	m	600	2,087,000	1,252.2	0	1,252
1-2 Installation of interceptor pipe (Steel pipe, pressured)							
1) Steel pipe 400 mm	earth coverage 1 to 2 m	m	285	1,398,000	398.4	0	398
1-3 Installation of Manhole and receiving tank							
1) Manhole dia 500		place	1	6,211,000	6.2	0	6
2) Manhole dia 600		place	1	6,873,000	6.9	0	7
3) Receiving Tank		place	1	22,416,000	22.4	0	22
1-4 Installation of Valve							
1) Installation of Valve	dia 1000 mm	place	5	200,000,000	1,000.0	0	1,000
2 Pumping Station							
2-1 Installation of wastewater pump							
1) Pump	Q=0.15m/s, H=30m	pcs	3	475,000,000	1,425.0	998	428
2) Installation		%	20		285.0	0	285
Total					4,767.7	997.5	3,770.2
					3,692		

Table AII.5.10 Disbursement Schedule of Tulcea Project

		Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Detailed Design	Total	13,030	13,030																													
	FC	6,515	6,515																													
	LC	6,515	6,515																													
Construction		260,596	0	42,242	103,453	114,901																										
Mobilization and Demobilization		9,307		4,653		4,653																										
Wastewater Treatment Plant Construction																																
Wastewater Treatment Process	Total	92,865		27,843	37,122	27,839																										
	FC	46,392		9,278	18,557	18,557																										
	LC	46,413		18,565	18,565	9,283																										
Sludge Treatment Process	Total	62,486		0	29,976	32,510																										
	FC	35,045		0	11,682	23,363																										
	LC	27,441		0	18,294	9,147																										
Discharge Pumping Station	Total	20,015		0	9,534	10,480																										
	FC	11,426		0	3,809	7,617																										
	LC	8,589		0	5,726	2,863																										
Power Receiving Facility	Total	2,565		0	0	2,565																										
	FC	0		0	0	0																										
	LC	2,565		0	0	2,565																										
Administration Building	Total	3,502		0	0	3,502																										
	FC	375		0	0	375																										
	LC	3,127		0	0	3,127																										
Interceptor Construction	Total	4,766		0	0	4,766																										
	FC	996		0	0	996																										
	LC	3,770		0	0	3,770																										
Other Costs	Total	65,149		9,745	26,821	28,583																										
	FC	0		0	0	0																										
	LC	65,149		9,745	26,821	28,583																										
Construction Supervision	Total	13,030		4,343	4,343	4,343																										
	FC	6,515		2,172	2,172	2,172																										
	LC	6,515		2,172	2,172	2,172																										
Government Administration		5,212		845	2,069	2,298																										
Contingency		29,187	1,303	4,743	10,987	12,154																										
O/M Cost	Total	374,316					3,666	3,666	3,666	3,666	3,666	3,666	3,666	96,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	96,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	96,666	3,666	3,666
	FC	279,000												93,000								93,000								93,000		
	LC	95,316					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Total Disbursement		695,370	14,333	52,173	120,852	133,696	3,666	3,666	3,666	3,666	3,666	3,666	3,666	96,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	96,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	96,666	3,666	3,666
FC		386,265	6,515	11,450	36,219	53,081	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0
LC		309,105	7,818	40,723	84,633	80,615	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666

APPENDIX-6 FINANCIAL AND ECONOMIC ANALYSIS

1 FINANCIAL ANALYSIS

1.1 MAJOR PRECONDITIONS AND ASSUMPTIONS

Following preconditions and assumptions were applied in the financial plan.

- The financial plan deals with only the cost and the revenue accrued by the project.
- Currency unit is ROL and the value of ROL is expressed as the June 1999 prices.
- Projection period is 30 years since the start of project implementation.
- Target year is 2010. From 2010 on the values of variables related to revenues and O & M cost are assumed to keep the 2010 level.
- Implementation period is 4 years from 2000 to 2003.
- 38 % of profit before tax is levied as a corporate tax.

Depreciation period is assumed as follows.

Depreciation Period

Item	Mechanical equipment	Civil works and sewer pipes
Depreciation period	8 years	40 years

1.2 TERMS AND CONDITIONS OF EXTERNAL FINANCIAL SOURCES

Conditions of possible external financial sources are assumed as shown in the table below.

Assumed Financing Terms for Possible External Financial Sources

Financial Organs	Financing Ratio (%)	Loan/Grant	Interest Rate (%)	Repayment Period (Years)	Grace Period (Years)
JBIC	70	Loan	2.7	30	10
EBRD	70	Loan	6.5	15	3
ISPA	75	Grant	-	-	-

It should be noted that they are nothing other than an example or assumption. In the case of EBRD, financing ratio depends on the circumstances and interest rate fluctuates in parallel with LIBOR (London Inter-bank Offered Rate).

1.3 BACKGROUND DATA FOR FINANCIAL PLAN

1.3.1 SERVED POPULATION

Based on the planning basis for WWTP facility plan, the numbers of served population and served household were estimated as follows.

Number of Served Population and Household

Year	2004	2005	2006	2007	2008	2009	2010	from 2011
Served population	71,000	71,333	71,667	72,000	72,333	72,667	73,000	73,000
Served household	22,188	22,292	22,396	22,500	22,604	22,708	22,813	22,813

1.3.2 QUANTITY OF WASTEWATER

Based on the planning basis for WWTP facility plan, the estimated quantities of domestic and non-domestic wastewater are as follows.

Quantity of Domestic and Non-domestic Wastewater

(Unit : 1,000 m^3/year)

Year	2004	2005	2006	2007	2008	2009	2010	from 2011
Domestic	5,682	5,895	6,111	6,328	6,547	6,767	6,990	6,990
Non-domestic	4,711	4,832	4,953	5,075	5,198	5,322	5,446	5,446

The coefficient *b*, the ratio of non-domestic sewerage charge to domestic one, was estimated 2.20 based on the values in 1998 and 1999.

1.3.3 HOUSEHOLD INCOME

The average monthly household income was estimated at ROL 2,088,267 in 1999 based on the result of the people's awareness survey conducted in this study. It was assumed to grow 3 % per year until 2010, and to remain the level of 2010 whereafter. The annual household income was calculated by multiplying the monthly value with 12.

The estimated average annual household income is as follows.

Average Annual Household Income

(Unit : 1,000 ROL/year)

Year	2004	2005	2006	2007	2008	2009	2010	from 2011
Annual Household Income	29,050	29,922	30,820	31,744	32,697	33,677	34,688	34,688

1.3.4 COLLECTION RATE

The charge collection rate was assumed to linearly increase from 81.4 % in 1999 to 95% in 2010, then remain 95% ever since.

The collection rate of sewerage charge was estimated as follows.

Sewerage Charge Collection Rate

Year	2004	2005	2006	2007	2008	2009	2010	from 2011
Collection Rate	87.6 %	88.8 %	90.1 %	91.3 %	92.5 %	93.8 %	95.0 %	95.0 %

1.4 FINANCIAL STATEMENTS FOR PROPOSED FINANCIAL PLANS

The financial statements for the proposed financial plans are shown in *Tables AII.6.1 to AII.6.4*. The structure of applied financial statements is as follows.

Structure of Applied Financial Statements

S.C. ACET S.A. account	
Revenue	A
Operation and maintenance cost	B
Lease fee	C
Profit before tax	D = A – B – C
Corporate tax	E = D × 0.38
Profit after tax	F = D – E
Working capital	G = F
Cumulative working capital	H = Σ G
City's sewerage service account	
Revenue from lease fee	I = C
Depreciation	J
Payment of interest	K
Profit	L = I – J – K
Loan	M
Subsidy from general budget	N
Depreciation	O = I
Sources	P = L+M+N+O
Investment cost	Q
Payment of principal	R
Applications	S = Q + R
Working capital	T = P – S
Cumulative working capital	U = Σ T
City's general account	
City general revenue	V
Corporate tax from S.C. ACET S.A.	W = E
Revenue from lease fee	X = I
Total current revenue	Y = V + W + X
Subsidy	Z = N
Subsidy ratio	AA = Z/Y
Repayment ratio	AB = (K + R)/Y

It is noted that leveled allocation of lease fee was applied for EBRD cases, taking into consideration of quite intense repayment schedule for relative short period under EBRD conditions.

2 ECONOMIC ANALYSIS

Based on the economic benefit of the project estimated by the people's awareness survey conducted in this study and the project cost, an economic analysis was conducted.

Applied preconditions and assumptions are as follows:

- Currency unit is ROL and the value of ROL is a constant one expressed at the June 1999 prices.
- Project Life: 30 years since the start of project implementation.
- Target Year: 2010. From 2010 on the values of O & M cost variables are assumed to keep the 2010 level.

- Implementation Period: 4 years 2000 to 2003.
- OCC (Opportunity Cost of Capital): 10%.
- Conversion factor: 98.4% to capital cost (initial and replacement cost) taking account of customs duty for foreign components.

The cost benefit stream of the project, which calculates the EIRR (Economic Internal Rate of Return), NPV (Net Present Value), and B/C (Ratio of Benefit to Cost), is shown in *Table AII.6.5*.

Obtained EIRR, NPV, and B/C are as below:

NPV (ROL 1,000,000)	B/C	EIRR (%)
9,523	1.03	12.5

Results of the sensitivity analysis are as shown below:

Conditions	EIRR (%)	NPV (million Lei)	B/C
Cost: +20%	NA	- 57,906	0.86
Cost: +10%, Benefits: -10%	NA	- 58,859	0.84
Benefits: -20%	NA	- 59,811	0.82

Table AII.6.1 Financial Statements of Tulcea Financial Plan (Case IB3)

1. Financial Statements of S.C. ACET S.A. (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (A)					25,827	26,904	28,025	29,200	30,429	31,715	33,053	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623
Operation and maintenance (B)					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Leveled lease fee (C)					14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089
Lease fee calculation base					9,885	10,146	23,076	23,076	23,076	23,076	23,076	23,076	23,076	23,076	23,076	23,076	23,076	22,353	10,630	13,367	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439
Profit before tax (D = A−B−C)					8,072	9,149	10,270	11,445	12,674	13,960	15,298	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868
Corporate tax (E = 0,38 * D)					3,067	3,477	3,903	4,349	4,816	5,305	5,813	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650
Profit after tax (F = D − E)					5,004	5,673	6,368	7,096	7,858	8,655	9,485	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218
Working capital (G = F)					5,067	6,544	10,447	14,796	19,612	24,917	30,730	36,390	42,029	47,679	53,329	58,979	64,628	70,278	75,928	81,578	87,227	92,877	98,527	104,177	109,826	115,476	121,126	126,776	132,425	138,075
Cumulative W.C. (H = Σ G)					5,004	10,677	17,045	24,141	31,998	40,653	50,138	59,356	68,574	77,792	87,010	96,228	105,446	114,664	123,882	133,100	142,318	151,536	160,754	169,972	179,190	188,408	197,626	206,844	216,062	225,280

2. Tulcea City Sewerage Account (million ROL)

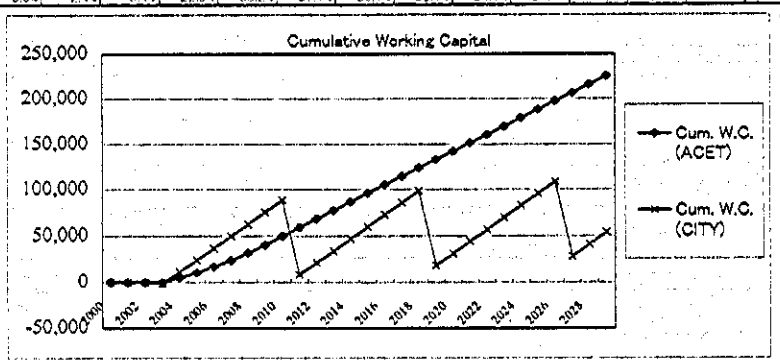
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue from lease fee (I = C)	0	0	0	0	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089
Depreciation (J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Payment of interest (K)	0	0	0	788	3,610	10,039	16,777	15,705	14,563	13,347	12,052	10,672	9,203	7,638	5,972	4,198	2,404	846	0	0	0	0	0	0	0	0	0	0	0	0
Profit (L = I−J−K)	0	0	0	−788	−2,399	−8,828	−15,566	−14,494	−13,352	−12,136	−10,841	−9,461	−7,992	−6,428	−4,761	−2,987	−1,193	365	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211
Loan (M)	10,033	36,521	84,596	93,587	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsidy from city/state budget (N)	4,300	15,652	36,256	40,109	5,682	18,207	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	30,577	25,170	12,645	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211
Depreciation (O = I)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Sources (P = L+M+N+O)	14,333	52,173	120,852	132,908	16,161	22,257	29,375	30,447	31,589	32,805	34,100	35,480	36,949	38,514	40,180	40,469	36,855	25,889	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Investment cost (Q)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Payment of principal (R)	0	0	0	698	3,283	9,379	16,497	17,569	18,711	19,927	21,222	22,602	24,071	25,635	27,302	27,591	23,977	13,010	0	0	0	0	0	0	0	0	0	0	0	0
Applications (S = Q + R)	14,333	52,173	120,852	134,394	3,283	9,379	16,497	17,569	18,711	19,927	21,222	115,602	24,071	25,635	27,302	27,591	23,977	13,010	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Working capital of the year (T =P−S)	0	0	0	−1,485	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878
Cumulative working capital (U = Σ T)	0	0	0	−1,485	11,393	24,271	37,149	50,027	62,905	75,784	88,662	8,540	21,418	34,296	47,175	60,053	72,931	85,809	98,687	18,565	31,444	44,322	57,200	70,078	82,956	95,834	108,713	28,591	41,469	54,347

3. Criteria for State Guarantee (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Revenue (=V)	57,835	59,570	61,357	63,198	65,094	67,047	69,058	71,130	73,264	75,462	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725
Corporate tax from S.C. ACET S.A. (W=E)	0	0	0	0	3,067	3,477	3,903	4,349	4,816	5,305	5,813	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650
Revenue from lease fee (X=I)	0	0	0	0	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089
Total current revenue (Y=V+W+X)	57,835	59,570	61,357	63,198	82,250	84,612	87,050	89,568	92,169	94,855	97,628	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464
Subsidy (Z=I+K+R+M)	0	0	0	1,485	5,682	18,207	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	30,577	25,170	12,645	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211	−1,211
Criteria for subsidy level (Z/Y)	0.0%	0.0%	0.0%	2.4%	6.9%	21.5%	36.8%	35.8%	34.8%	33.8%	32.8%	32.9%	32.9%	32.9%	32.9%	31.4%	25.8%	13.0%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%	−1.2%
Criteria for State Guarantee ((K+R)/Y)	0.0%	0.0%	0.0%	2.4%	8.4%	22.9%	38.2%	37.1%	36.1%	35.1%	34.1%	34.1%	34.1%	34.1%	34.1%	32.6%	27.1%	14.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Parameter Input Section	
Ratio of Sewerage Charge to Income (%)	1.62%
Coverage to Interest (%)	50.0%
Coverage to depreciation (%)	50.0%
Coverage to principal (%)	50.0%

Averaged profit rate	27.3%
Averaged criteria values for guarantee	28.3%
Highest subsidy ratio	36.8%



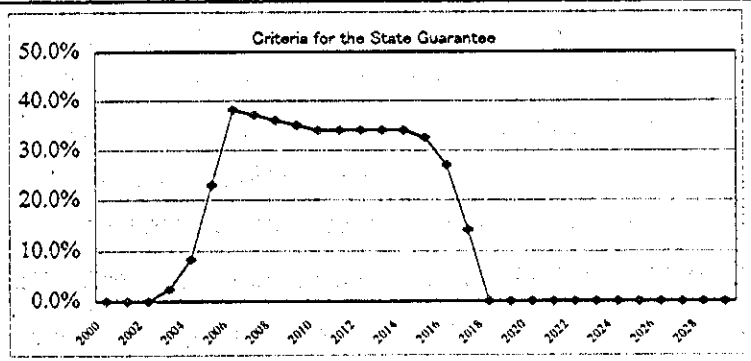


Table AII.6.1 Financial Statements of Tulcea Financial Plan (Case IB3)

1. Financial Statements of S.C. ACET S.A. (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (A)					25,827	26,904	28,025	29,200	30,429	31,715	33,053	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623
Operation and maintenance (B)					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Lavalin lease fee (C)					14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089
Lease fee calculation base					9,885	16,148	23,076	23,076	23,076	23,076	23,076	23,076	23,076	23,076	23,076	23,076	22,333	19,630	13,367	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439
Profit before tax (D = A-B-C)					8,072	9,149	10,270	11,445	12,674	13,960	15,298	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868	14,868
Corporate tax (E = 0.38 * D)					3,067	3,477	3,903	4,349	4,816	5,305	5,813	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650
Profit after tax (F = D - E)					5,004	5,673	6,368	7,096	7,858	8,655	9,485	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218	9,218
Working capital (G = F)					5,067	5,544	10,447	14,796	19,612	24,917	30,730	36,380	42,029	47,679	53,329	58,979	64,628	70,278	75,928	81,578	87,227	92,877	98,527	104,177	109,826	115,476	121,126	126,776	132,425	138,075
Cumulative W.C. (H = Σ G)					5,004	10,677	17,045	24,141	31,998	40,653	50,138	59,356	68,574	77,792	87,010	96,228	105,446	114,664	123,882	133,100	142,318	151,536	160,754	169,972	179,190	188,408	197,626	206,844	216,062	225,280

2. Tulcea City Sewerage Account (million ROL)

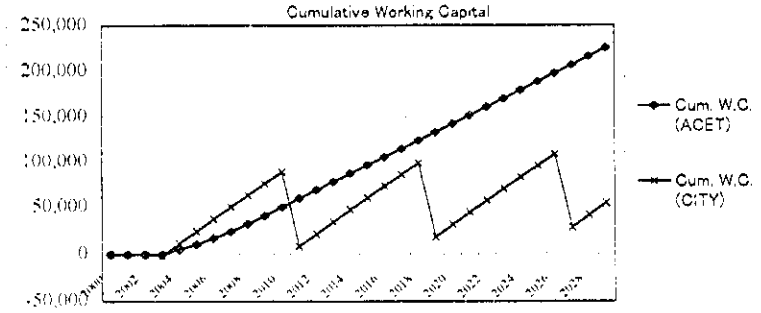
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue from lease fee (L = G)	0	0	0	0	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089
Depreciation (J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Payment of interest (K)	0	0	0	788	3,510	10,039	16,777	15,705	14,563	13,347	12,052	10,672	9,203	7,638	5,972	4,198	2,404	846	0	0	0	0	0	0	0	0	0	0	0	0
Profit (L = I-J-K)	0	0	0	-788	-2,399	-8,828	-15,566	-14,494	-13,352	-12,136	-10,841	-9,461	-7,992	-6,428	-4,761	-2,987	-1,193	365	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211	1,211
Loan (M)	10,033	36,521	84,596	93,587	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsidy from city/state budget (N)	4,300	15,652	36,256	40,109	5,582	18,207	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	30,577	25,170	12,645	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211
Depreciation (O = J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Sources (P = L+M+N+O)	14,333	52,173	120,852	132,908	16,161	22,257	29,375	30,447	31,589	32,805	34,100	35,480	36,949	38,514	40,140	40,449	36,855	25,880	12,879	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Investment cost (Q)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Payment of principal (R)	0	0	0	698	3,283	9,379	16,497	17,569	18,711	19,927	21,222	22,602	24,071	25,635	27,302	27,591	23,977	13,010	0	0	0	0	0	0	0	0	0	0	0	0
Applications (S = Q + R)	14,333	52,173	120,852	134,394	3,283	9,379	16,497	17,569	18,711	19,927	21,222	115,602	24,071	25,635	27,302	27,591	23,977	13,010	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Working capital of the year (T =P-S)	0	0	0	-1,485	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878
Cumulative working capital (U = Σ T)	0	0	0	-1,485	11,393	24,271	37,149	50,027	62,905	75,784	88,662	8,540	21,418	34,296	47,175	60,053	72,931	85,809	98,687	18,565	31,444	44,322	57,200	70,078	82,956	95,834	108,713	28,591	41,469	54,347

3. Criteria for State Guarantee (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Revenue (=V)	57,835	59,570	61,357	63,198	65,094	67,047	69,058	71,130	73,264	75,462	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725
Corporate tax from S.C. ACET S.A. (W=E)	0	0	0	0	3,067	3,477	3,903	4,349	4,816	5,305	5,813	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650	5,650
Revenue from lease fee (X=I)	0	0	0	0	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089	14,089
Total current revenue (Y=V+W+X)	57,835	59,570	61,357	63,198	82,250	84,612	87,050	89,568	92,169	94,855	97,628	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464	97,464
Subsidy (Z=I+X+R-M)	0	0	0	1,485	5,642	18,207	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	32,063	30,577	25,170	12,645	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211	-1,211
Criteria for subsidy level (Z/Y)	0.0%	0.0%	0.0%	2.4%	6.9%	21.5%	36.8%	35.8%	34.8%	33.8%	32.8%	32.9%	32.9%	32.9%	32.9%	32.9%	31.4%	25.8%	13.0%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%	-1.2%
Criteria for State Guarantee (-(K+R)/Y)	0.0%	0.0%	0.0%	2.4%	8.4%	22.9%	38.2%	37.1%	36.1%	35.1%	34.1%	34.1%	34.1%	34.1%	34.1%	32.6%	27.1%	14.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Parameter Input Section	
Ratio of Sewerage Charge to Income (%)	1.62%
Coverage to interest (%)	50.0%
Coverage to depreciation (%)	50.0%
Coverage to principal (%)	50.0%

Averaged profit rate	27.3%
Averaged criteria values for guarantee	28.3%
Highest subsidy ratio	36.8%



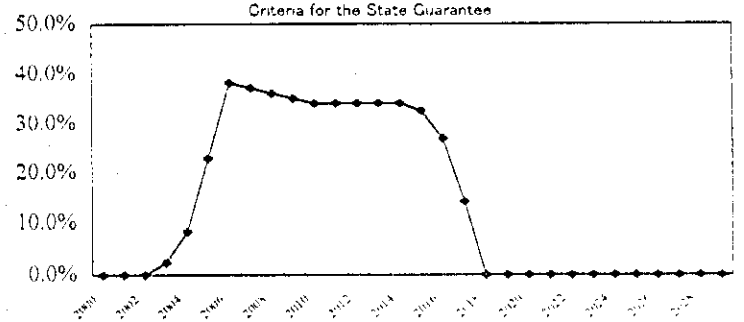


Table AII.6.2 Financial Statements of Tulcea Financial Plan (Case IIA3)

1. Financial Statements of S.C. ACET S.A. (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (A)					25,827	26,904	28,075	29,290	30,429	31,715	33,053	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623
Operation and maintenance (B)					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Leveled lease fee (C)					23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807
Lease fee calculation base					17,801	20,746	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645	23,645
Profit before tax (D = A−B−C)					−1,646	−568	552	1,728	2,956	4,242	5,581	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150
Corporate tax (E = 0.38 * D)					0	0	210	656	1,123	1,612	2,121	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957
Profit after tax (F = D − E)					−1,646	−568	343	1,071	1,833	2,630	3,460	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193
Working capital (G = F)					0	0	210	866	1,990	3,602	5,722	7,079	9,636	11,593	13,550	15,507	17,465	19,422	21,379	23,336	25,293	27,250	29,207	31,164	33,121	35,078	37,035	38,992	40,949	42,906
Cumulative W.C. (H = Σ G)					−1,646	−2,214	−1,872	−801	1,032	3,662	7,122	10,315	13,508	16,701	19,894	23,087	26,281	29,474	32,667	35,860	39,053	42,246	45,439	48,632	51,825	55,018	58,211	61,404	64,597	67,790

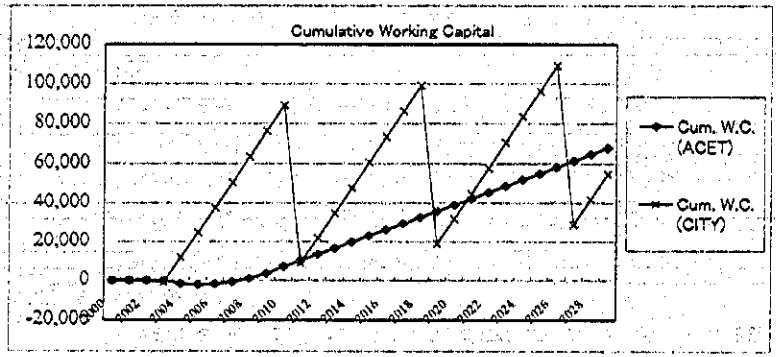
2. Tulcea City Sewerage Account (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue from lease fee (I = C)	0	0	0	0	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807
Depreciation (J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Payment of interest (K)	0	0	0	563	2,579	7,171	11,984	11,218	10,402	9,533	8,608	7,623	6,574	5,456	4,266	2,998	1,717	604	0	0	0	0	0	0	0	0	0	0	0	0
Profit (L = I−J−K)	0	0	0	−563	8,350	3,758	−1,055	−289	526	1,395	2,320	3,306	4,355	5,473	6,663	7,930	9,211	10,325	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929
Loan (M)	7,166	26,087	60,426	66,848	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsidy from city/state budget (N)	7,166	26,087	60,426	66,848	−6,005	2,941	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	11,777	7,915	−1,031	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929
Depreciation (O = J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Sources (P = L+M+N+O)	14,333	52,173	120,852	133,133	15,223	19,577	24,661	25,427	26,243	27,112	28,037	29,022	30,072	31,189	32,379	32,586	30,005	22,171	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Investment cost (Q)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Payment of principal (R)	0	0	0	498	2,345	6,699	11,783	12,549	13,365	14,234	15,159	16,144	17,193	18,311	19,501	19,708	17,126	9,293	0	0	0	0	0	0	0	0	0	0	0	0
Applications (S = Q + R)	14,333	52,173	120,852	134,194	2,345	6,699	11,783	12,549	13,365	14,234	15,159	109,144	17,193	18,311	19,501	19,708	17,126	9,293	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Working capital of the year (T =P−S)	0	0	0	−1,061	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878
Cumulative working capital (U= Σ T)	0	0	0	−1,061	11,817	24,695	37,574	50,452	63,330	76,208	89,086	8,964	21,843	34,721	47,599	60,477	73,355	86,233	99,112	18,990	31,868	44,746	57,624	70,503	83,381	96,259	109,137	29,015	41,893	54,772

3. Criteria for State Guarantee (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Revenue (=V)	57,835	59,570	61,357	63,198	65,094	67,047	69,058	71,130	73,264	75,462	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725
Corporate tax from S.C. ACET S.A. (W=E)	0	0	0	0	0	0	210	656	1,123	1,612	2,121	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957
Revenue from lease fee (X=I)	0	0	0	0	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807
Total current revenue (Y=V+W+X)	57,835	59,570	61,357	63,198	88,901	90,853	93,075	95,593	98,194	100,880	103,653	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489
Subsidy (Z=I+K+R−M)	0	0	0	1,061	−6,005	2,941	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	11,777	7,915	−1,031	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929	−10,929
Criteria for subsidy level (Z/Y)	0.0%	0.0%	0.0%	1.7%	−6.8%	3.2%	13.8%	13.4%	13.1%	12.7%	12.4%	12.4%	12.4%	12.4%	12.4%	11.4%	7.6%	−1.0%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%	−10.6%
Criteria for State Guarantee ((K+R)/Y)	0.0%	0.0%	0.0%	1.7%	5.5%	15.3%	25.5%	24.9%	24.2%	23.6%	22.9%	23.0%	23.0%	23.0%	23.0%	21.9%	18.2%	9.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Parameter Input Section	
Ratio of Sewerage Charge to Income (%)	1.62%
Coverage to Interest (%)	100.0%
Coverage to depreciation (%)	100.0%
Coverage to principal (%)	100.0%
Averaged profit rate	8.2%
Averaged criteria values for guarantee	19.0%
Highest subsidy ratio	13.8%



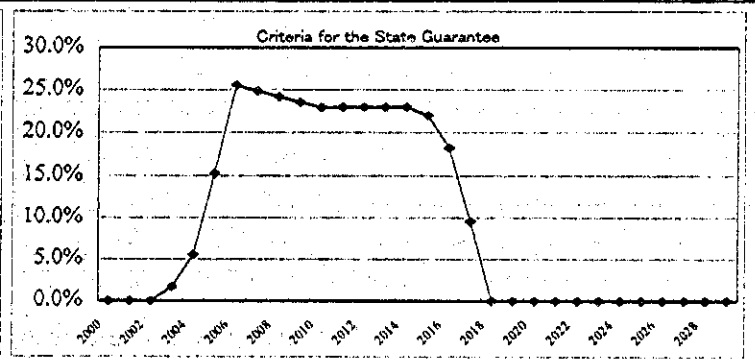


Table AII.6.2 Financial Statements of Tulcea Financial Plan (Case IIA3)

1. Financial Statements of S.C. ACET S.A. (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (A)					25,827	26,904	28,025	29,200	30,429	31,715	33,053	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623	32,623
Operation and maintenance (B)					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Leveled lease fee (C)					23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807
Lease fee calculation base					17,601	28,748	36,645	36,645	36,645	36,645	36,645	36,645	36,645	36,645	36,645	36,645	35,584	31,722	22,775	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Profit before tax (D = A-B-C)					-1,646	-568	552	1,728	2,956	4,242	5,581	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150	5,150
Corporate tax (E = 0.38 * D)					0	0	210	656	1,123	1,612	2,121	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957
Profit after tax (F = D - E)					-1,646	-568	343	1,071	1,833	2,630	3,460	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193	3,193
Working capital (G = F)					0	0	210	866	1,990	3,602	5,727	7,679	9,636	11,593	13,550	15,507	17,465	19,422	21,379	23,336	25,293	27,250	29,207	31,164	33,121	35,078	37,035	38,992	40,949	42,906
Cumulative W.C. (H = Σ G)					-1,646	-2,214	-1,872	-801	1,032	3,662	7,122	10,315	13,508	16,701	19,894	23,087	26,281	29,474	32,667	35,860	39,053	42,246	45,439	48,632	51,825	55,018	58,211	61,404	64,597	67,790

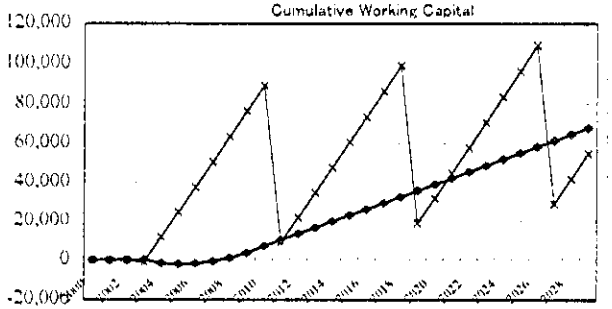
2. Tulcea City Sewerage Account (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue from lease fee (I = C)	0	0	0	0	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807
Depreciation (J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Payment of interest (K)	0	0	0	563	2,575	7,171	11,984	11,218	10,402	9,533	8,608	7,623	6,574	5,456	4,266	2,998	1,717	604	0	0	0	0	0	0	0	0	0	0	0	0
Profit (L = I-J-K)	0	0	0	-563	8,350	3,758	-1,055	-289	526	1,395	2,320	3,306	4,355	5,473	6,663	7,930	9,211	10,325	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929	10,929
Loan (M)	7,166	26,087	60,426	66,848	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsidy from city/state budget (N)	7,166	26,087	60,426	66,848	-6,005	2,941	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	11,777	7,915	-1,031	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929
Depreciation (O = J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Sources (P = L+M+N+O)	14,333	52,173	120,852	133,696	15,223	19,577	24,661	25,427	26,243	27,112	28,037	29,022	30,072	31,189	32,379	32,586	30,005	22,171	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Investment cost (Q)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	0	93,000	0	0
Payment of principal (R)	0	0	0	498	2,345	6,699	11,783	12,549	13,365	14,234	15,159	16,144	17,193	18,311	19,501	19,708	17,126	9,293	0	0	0	0	0	0	0	0	0	0	0	0
Applications (S = Q + R)	14,333	52,173	120,852	134,194	2,345	6,699	11,783	12,549	13,365	14,234	15,159	109,144	17,193	18,311	19,501	19,708	17,126	9,293	0	93,000	0	0	0	0	0	0	0	0	93,000	0	0
Working capital of the year (T =P-S)	0	0	0	-1,061	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878
Cumulative working capital (U = Σ T)	0	0	0	-1,061	11,817	24,695	37,574	50,452	63,330	76,208	89,086	8,964	21,843	34,721	47,599	60,477	73,355	86,233	99,112	18,990	31,868	44,746	57,624	70,503	83,381	96,259	109,137	29,015	41,893	54,772

3. Criteria for State Guarantee (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Revenue (=V)	57,835	59,570	61,357	63,198	65,094	67,047	69,058	71,130	73,264	75,462	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725
Corporate tax from S.C ACET S.A. (W=E)	0	0	0	0	0	0	210	656	1,123	1,612	2,121	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957	1,957
Revenue from lease fee (X=I)	0	0	0	0	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807	23,807
Total current revenue (Y=V+W+X)	57,835	59,570	61,357	63,198	88,901	90,853	93,075	95,593	98,194	100,880	103,653	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489	103,489
Subsidy (Z=I+K+R+M)	0	0	0	1,061	-6,005	2,941	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	12,838	11,777	7,915	-1,031	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929	-10,929
Criteria for subsidy level (Z/Y)	0.0%	0.0%	0.0%	1.7%	-6.8%	3.2%	13.8%	13.4%	13.1%	12.7%	12.4%	12.4%	12.4%	12.4%	12.4%	11.4%	7.6%	-1.0%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%	-10.6%
Criteria for State Guarantee (K+R)/Y)	0.0%	0.0%	0.0%	1.7%	5.5%	15.3%	25.5%	24.9%	24.2%	23.6%	22.9%	23.0%	23.0%	23.0%	23.0%	21.9%	18.2%	9.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Parameter Input Section	
Ratio of Sewerage Charge to Income (%)	1.62%
Coverage to Interest (%)	100.0%
Coverage to depreciation (%)	100.0%
Coverage to principal (%)	100.0%
Averaged profit ratio	8.2%
Averaged criteria values for guarantee	19.0%
Highest subsidy ratio	13.8%



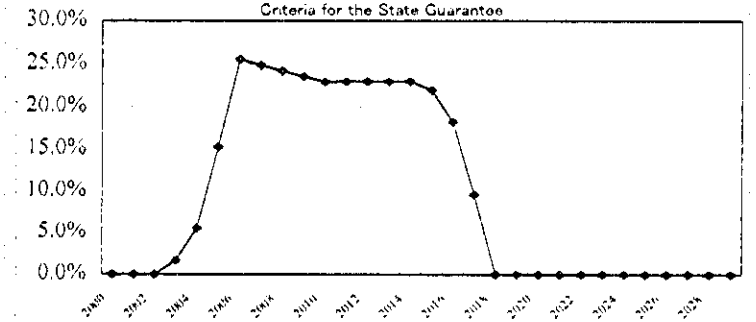


Table AII.6.3 Financial Statements of Tulcea Financial Plan (Case IIIB2)

1. Financial Statements of S.C. ACET S.A. (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (A)					15,305	15,943	16,608	17,304	18,032	18,794	19,587	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332
Operation and maintenance (B)					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Levried lease fee (C)					9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718
Lease fee calculation base					7,919	10,600	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,251	12,082	9,406	9,439	9,439	9,439	9,439	9,439	9,439	9,439	9,439	9,439	9,439	9,439
Profit before tax (D = A−B−C)					1,921	2,560	3,224	3,920	4,648	5,410	6,204	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948
Corporate tax (E = 0.38 * D)					730	973	1,225	1,490	1,766	2,056	2,357	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260
Profit after tax (F = D − E)					1,191	1,587	1,999	2,431	2,882	3,354	3,846	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688
Working capital (G = F)					730	1,703	2,928	4,418	6,184	8,240	10,597	12,857	15,118	17,378	19,639	21,899	24,159	26,420	28,680	30,941	33,201	35,461	37,722	39,982	42,242	44,503	46,763	49,024	51,284	53,544
Cumulative W.C. (H = Σ G)					1,191	2,778	4,777	7,208	10,089	13,444	17,290	20,978	24,666	28,354	32,042	35,730	39,418	43,106	46,794	50,482	54,170	57,858	61,546	65,234	68,922	72,610	76,298	79,986	83,674	87,362

2. Tulcea City Sewerage Account (million ROL)

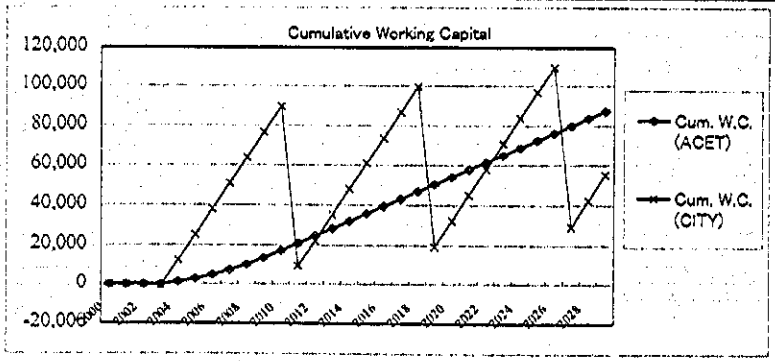
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue from lease fee (I = C)	0	0	0	0	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718
Depreciation (J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Payment of interest (K)	0	0	0	338	1,547	4,302	7,190	6,731	6,241	5,720	5,165	4,574	3,944	3,274	2,560	1,799	1,000	362	0	0	0	0	0	0	0	0	0	0	0	0
Profit (L = I−J−K)	0	0	0	−338	−4,708	−7,463	−10,351	−9,891	−9,402	−8,881	−8,326	−7,734	−7,105	−6,434	−5,720	−4,959	−4,191	−3,523	−3,161	−3,161	−3,161	−3,161	−3,161	−3,161	−3,161	−3,161	−3,161	−3,161	−3,161	−3,161
Loan (M)	4,300	15,652	36,256	40,109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsidy from city/state budget (N)	10,033	36,521	84,596	93,587	6,115	11,482	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	16,784	14,467	9,099	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161
Depreciation (O = J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Sources (P = L+M+N+O)	14,333	52,173	120,852	133,358	14,285	16,898	19,948	20,408	20,897	21,418	21,973	22,565	23,194	23,865	24,579	24,703	23,154	18,454	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Investment cost (Q)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Payment of principal (R)	0	0	0	299	1,407	4,020	7,070	7,529	8,019	8,540	9,095	9,686	10,316	10,987	11,701	11,825	10,276	5,576	0	0	0	0	0	0	0	0	0	0	0	0
Applications (S = Q + R)	14,333	52,173	120,852	133,995	1,407	4,020	7,070	7,529	8,019	8,540	9,095	102,686	10,316	10,987	11,701	11,825	10,276	5,576	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Working capital of the year (T = P−S)	0	0	0	−637	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	−80,122	12,878	12,878
Cumulative working capital (U = Σ T)	0	0	0	−637	12,242	25,120	37,998	50,876	63,754	76,632	89,511	9,389	22,267	35,145	48,023	60,902	73,780	86,658	99,536	19,414	32,292	45,171	58,049	70,927	83,805	96,683	109,561	29,440	42,318	55,196

3. Criteria for State Guarantee (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Revenue (=V)	57,835	59,570	61,357	63,198	65,094	67,047	69,058	71,130	73,264	75,462	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725
Corporate tax from S.C. ACET S.A. (W=E)	0	0	0	0	730	973	1,225	1,490	1,766	2,056	2,357	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260
Revenue from lease fee (X=I)	0	0	0	0	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718
Total current revenue (Y=V+W+X)	57,835	59,570	61,357	63,198	75,541	77,737	80,001	82,337	84,748	87,235	89,800	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703
Subsidy (Z=I+K+R−M)	0	0	0	637	6,115	11,482	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	16,784	14,467	9,099	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161
Criteria for subsidy level (Z/Y)	0.0%	0.0%	0.0%	1.0%	8.1%	14.8%	21.8%	21.2%	20.6%	20.0%	19.4%	19.4%	19.4%	19.4%	19.4%	18.7%	16.1%	10.1%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Criteria for State Guarantee (K+R)/Y)	0.0%	0.0%	0.0%	1.0%	3.9%	10.7%	17.8%	17.3%	16.8%	16.3%	15.9%	15.9%	15.9%	15.9%	15.9%	15.2%	12.6%	6.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Parameter Input Section	
Ratio of Sewerage Charge to Income (%)	0.96%
Coverage to Interest (%)	50.0%
Coverage to depreciation (%)	50.0%
Coverage to principal (%)	50.0%

Averaged profit rate	17.9%
Averaged criteria values for guarantee	13.2%
Highest subsidy ratio	21.8%



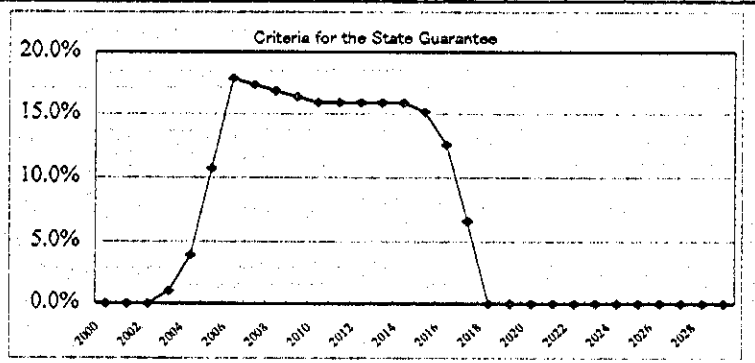


Table All.6.3 Financial Statements of Tulcea Financial Plan (Case IIIB2)

1. Financial Statements of S.C. ACET S.A. (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (A)					15,305	15,943	16,608	17,304	18,032	18,794	19,587	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332
Operation and maintenance (B)					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Leveled lease fee (C)					9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718
Lease fee calculation base					7,916	10,600	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,569	13,251	12,092	9,408	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439	6,439
Profit before tax (D = A-B-C)					1,921	2,560	3,224	3,920	4,648	5,410	6,204	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948	5,948
Corporate tax (E = 0.38 * D)					730	973	1,225	1,490	1,766	2,056	2,357	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260
Profit after tax (F = D - E)					1,191	1,587	1,999	2,431	2,882	3,354	3,846	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688	3,688
Working capital (G = F)					730	1,703	2,928	4,418	6,184	8,240	10,597	12,857	15,118	17,378	19,639	21,899	24,159	26,420	28,680	30,941	33,201	35,461	37,722	39,982	42,242	44,503	46,763	49,024	51,284	53,544
Cumulative W.C. (H = Σ G)					1,191	2,778	4,777	7,208	10,089	13,444	17,290	20,978	24,666	28,354	32,042	35,730	39,418	43,106	46,794	50,482	54,170	57,858	61,546	65,234	68,922	72,610	76,298	79,986	83,674	87,362

2. Tulcea City Sewerage Account (million ROL)

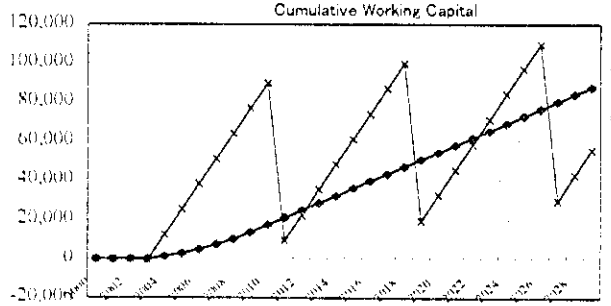
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue from lease fee (I = C)	0	0	0	0	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718
Depreciation (J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Payment of interest (K)	0	0	0	338	1,547	4,302	7,190	6,731	6,241	5,720	5,165	4,574	3,944	3,274	2,560	1,799	1,030	362	0	0	0	0	0	0	0	0	0	0	0	0
Profit (L = I-J-K)	0	0	0	-338	-4,706	-7,463	-10,351	-9,891	-9,402	-8,881	-8,326	-7,734	-7,105	-6,434	-5,720	-4,959	-4,191	-3,523	-3,161	-3,161	-3,161	-3,161	-3,161	-3,161	-3,161	-3,161	-3,161	-3,161	-3,161	-3,161
Loan (M)	4,300	15,652	36,256	40,109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsidy from city/state budget (N)	10,033	36,521	84,596	93,587	6,115	11,482	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	16,784	14,467	9,099	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161
Depreciation (O = J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Sources (P = I +M+N+O)	14,333	52,173	120,852	133,358	14,285	16,808	19,948	20,484	20,897	21,418	21,973	22,565	23,194	23,865	24,579	24,703	23,154	18,454	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Investment cost (Q)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Payment of principal (R)	0	0	0	299	1,407	4,020	7,070	7,529	8,019	8,540	9,095	9,686	10,316	10,987	11,701	11,825	10,276	5,575	0	0	0	0	0	0	0	0	0	0	0	0
Applications (S = Q + R)	14,333	52,173	120,852	133,995	1,407	4,020	7,070	7,529	8,019	8,540	9,095	102,686	10,316	10,987	11,701	11,825	10,276	5,575	0	93,000	0	0	0	0	0	0	0	93,000	0	0
Working capital of the year (T =P-S)	0	0	0	-637	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878
Cumulative working capital (U = Σ T)	0	0	0	-637	12,242	25,120	37,998	50,876	63,754	76,632	89,511	9,389	22,267	35,145	48,023	60,902	73,780	86,658	99,536	19,414	32,292	45,171	58,049	70,927	83,805	96,683	109,561	29,440	42,318	55,196

3. Criteria for State Guarantee (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Revenue (=V)	57,835	59,570	61,357	63,198	65,094	67,047	69,058	71,130	73,264	75,462	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725
Corporate tax from S.C. ACET S.A. (W=E)	0	0	0	0	730	973	1,225	1,490	1,766	2,056	2,357	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260	2,260
Revenue from lease fee (X=I)	0	0	0	0	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718	9,718
Total current revenue (Y=V+W+X)	57,835	59,570	61,357	63,198	75,541	77,737	80,001	82,337	84,748	87,235	89,800	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703	89,703
Subsidy (Z=I+K+R-M)	0	0	0	637	6,115	11,482	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	17,421	16,784	14,467	9,099	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161
Criteria for subsidy level (Z/Y)	0.0%	0.0%	0.0%	1.0%	8.1%	14.8%	21.8%	21.2%	20.6%	20.0%	19.4%	19.4%	19.4%	19.4%	19.4%	18.7%	16.1%	10.1%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Criteria for State Guarantee (X+R)/Y)	0.0%	0.0%	0.0%	1.0%	3.9%	10.7%	17.8%	17.3%	16.8%	16.3%	15.9%	15.9%	15.9%	15.9%	15.9%	15.2%	12.6%	6.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Parameter Input Section	
Ratio of Sewerage Charge to Income (%)	0.96%
Coverage to Interest (%)	50.0%
Coverage to depreciation (%)	50.0%
Coverage to principal (%)	50.0%

Averaged profit rate	17.9%
Averaged criteria values for guarantee	13.2%
Highest subsidy ratio	21.8%



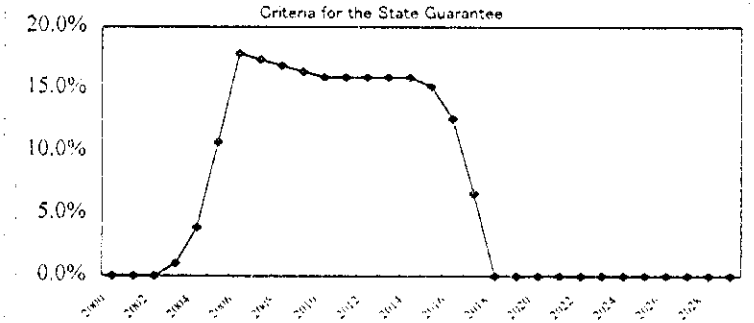


Table AII.6.4 Financial Statements of Tulcea Financial Plan (Case IVB2)

1. Financial Statements of S.C. ACET S.A. (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (A)					15,305	15,943	16,604	17,304	18,037	18,794	19,587	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332	19,332
Operation and maintenance (B)					3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666	3,666
Lease fee (C)					6,439	6,439	6,439	6,439	6,439	6,439	6,867	8,425	12,034	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026
Profit before tax (D = A-B-C)					5,200	5,838	6,502	7,199	7,927	8,689	9,054	7,241	3,632	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360
Corporate tax (E = 0.38 * D)					1,976	2,219	2,471	2,736	3,012	3,302	3,441	2,752	1,380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Profit after tax (F = D - E)					3,224	3,620	4,032	4,463	4,915	5,387	5,614	4,489	2,252	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360	-360
Working capital (G = F)					1,976	4,194	6,665	9,401	12,413	15,715	19,155	21,907	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287	23,287
Cumulative W.C. (H = Σ G)					3,224	6,844	10,875	15,338	20,253	25,640	31,254	35,743	37,995	37,635	37,274	36,914	36,553	36,193	35,833	35,472	35,112	34,752	34,391	34,031	33,670	33,310	32,950	32,589	32,229	31,869

2. Tulcea City Sewerage Account (million ROL)

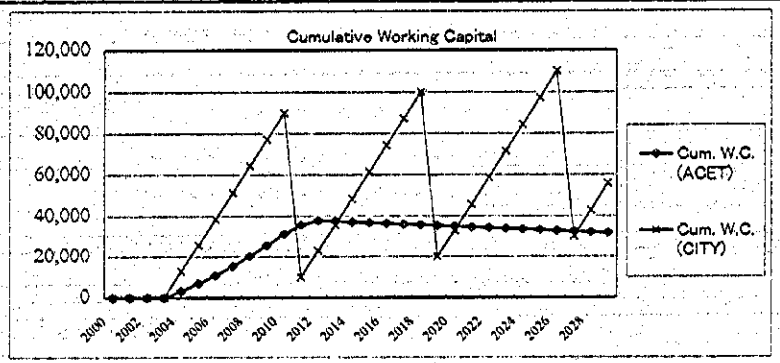
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenue from lease fee (I = C)	0	0	0	0	6,439	6,439	6,439	6,439	6,439	6,439	6,867	8,425	12,034	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026
Depreciation (J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Payment of interest (K)	0	0	0	0	0	0	0	0	0	0	354	1,627	4,545	7,664	7,353	7,034	6,706	6,370	6,024	5,669	5,304	4,930	4,545	4,150	3,744	3,328	2,900	2,461	2,009	1,546
Profit (L = I-J-K)	0	0	0	0	-6,439	-6,439	-6,439	-6,439	-6,439	-6,439	-6,365	-6,080	-5,389	-4,516	-4,205	-3,886	-3,558	-3,221	-2,876	-2,521	-2,156	-1,781	-1,397	-1,002	-596	-180	248	688	1,139	1,602
Loan (M)	10,033	36,521	84,596	93,587	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subsidy from city/state budget (N)	4,300	15,652	36,256	40,109	6,439	6,439	6,439	6,439	6,439	6,439	6,867	8,425	12,034	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026
Depreciation (O = J)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878	12,878
Sources (P = L+M+N+O)	14,333	52,173	120,852	133,696	12,878	12,878	12,878	12,878	12,878	12,878	13,381	15,223	19,523	24,389	24,700	25,019	25,347	25,683	26,029	26,384	26,749	27,123	27,508	27,903	28,308	28,725	29,153	29,592	30,044	30,507
Investment cost (Q)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	0	0	93,000	0	0	0	0	0	0	93,000	0	0
Payment of principal (R)	0	0	0	0	0	0	0	0	0	0	502	2,345	6,645	11,511	11,821	12,141	12,468	12,805	13,151	13,506	13,870	14,245	14,630	15,025	15,430	15,847	16,275	16,714	17,165	17,629
Applications (S = Q + R)	14,333	52,173	120,852	133,696	0	0	0	0	0	0	502	95,345	6,645	11,511	11,821	12,141	12,468	12,805	13,151	106,506	13,870	14,245	14,630	15,025	15,430	15,847	16,275	109,714	17,165	17,629
Working capital of the year (T =P-S)	0	0	0	0	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878	12,878	12,878	12,878	12,878	12,878	-80,122	12,878	12,878
Cumulative working capital (U = Σ T)	0	0	0	0	12,878	25,756	38,635	51,513	64,391	77,269	90,147	10,025	22,904	35,782	48,660	61,538	74,416	87,294	100,173	20,051	32,929	45,807	58,685	71,564	84,442	97,320	110,198	30,076	42,954	55,833

3. Criteria for State Guarantee (million ROL)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Revenue (=V)	57,835	59,570	61,357	63,198	65,094	67,047	69,058	71,130	73,264	75,462	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725	77,725
Corporate tax from S.C. ACET S.A. (W=E)	0	0	0	0	1,976	2,219	2,471	2,736	3,012	3,302	3,441	2,752	1,380	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Revenue from lease fee (X=I)	0	0	0	0	6,439	6,439	6,439	6,439	6,439	6,439	6,867	8,425	12,034	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026
Total current revenue (Y=V+W+X)	57,835	59,570	61,357	63,198	73,509	75,704	77,968	80,304	82,715	85,202	88,033	88,902	91,140	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752	93,752
Subsidy (Z=I+K+R=M)	0	0	0	0	6,439	6,439	6,439	6,439	6,439	6,439	6,867	8,425	12,034	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026	16,026
Criteria for subsidy level (Z/Y)	0.0%	0.0%	0.0%	0.0%	8.8%	8.5%	8.3%	8.0%	7.8%	7.6%	7.8%	9.5%	13.2%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%	17.1%
Criteria for State Guarantee ((K+R)/Y)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	4.5%	12.3%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%	20.5%

Parameter Input Section	
Ratio of Sewerage Charge to Income (%)	0.96%
Coverage to Interest (%)	50.0%
Coverage to depreciation (%)	50.0%
Coverage to principal (%)	50.0%

Averaged profit rate	6.5%
Averaged criteria values for guarantee	18.3%
Highest subsidy ratio	17.1%



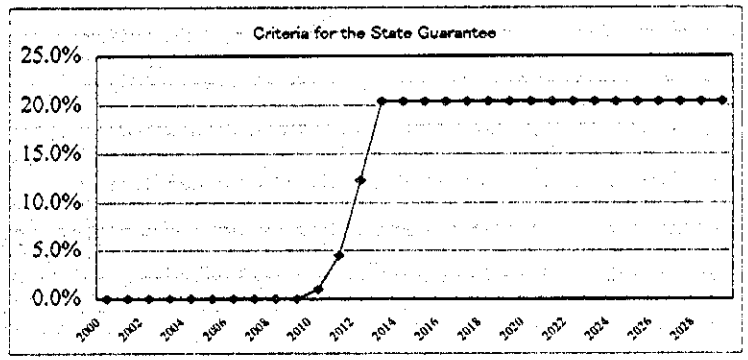


Table AII.6.5 Cost Benefit Stream for Tulcea WWTP Project

(Unit: million ROL)

Year	Project cost		Economic benefit (C)	Benefit - Cost (C-A-B)	Discounted cash flow**	
	Investment cost* (A)	O&M cost (B)			Cost	Benefit
2000	14,103	0		-14,103	14,103	0
2001	51,339	0		-51,339	46,671	0
2002	118,918	0		-118,918	98,280	0
2003	131,557	0		-131,557	98,841	0
2004	0	3,666	121,720	118,054	2,504	83,136
2005	0	3,666	121,720	118,054	2,276	75,579
2006	0	3,666	121,720	118,054	2,069	68,708
2007	0	3,666	121,720	118,054	1,881	62,462
2008	0	3,666	121,720	118,054	1,710	56,783
2009	0	3,666		-3,666	1,555	0
2010	0	3,666		-3,666	1,413	0
2011	91,512	3,666		-95,178	33,359	0
2012	0	3,666		-3,666	1,168	0
2013	0	3,666		-3,666	1,062	0
2014	0	3,666		-3,666	965	0
2015	0	3,666		-3,666	878	0
2016	0	3,666		-3,666	798	0
2017	0	3,666		-3,666	725	0
2018	0	3,666		-3,666	659	0
2019	91,512	3,666		-95,178	15,562	0
2020	0	3,666		-3,666	545	0
2021	0	3,666		-3,666	495	0
2022	0	3,666		-3,666	450	0
2023	0	3,666		-3,666	409	0
2024	0	3,666		-3,666	372	0
2025	0	3,666		-3,666	338	0
2026	0	3,666		-3,666	308	0
2027	91,512	3,666		-95,178	7,260	0
2028	0	3,666		-3,666	254	0
2029	0	3,666		-3,666	231	0
Total	590,453	95,316	608,600	-77,169	337,145	346,668

* Conversion factor = 0.984

** Discount rate = 10.0 %

EIRR=	12.5%
NPV =	9,523 million ROL
B/C =	1.03

APPENDIX-7 ENVIRONMENTAL IMPACT ASSESSMENT SURVEY

1. INTRODUCTION

1.1 THE OBJECTIVE AND SCOPE OF THE STUDY

According to "Scope of Work for the Feasibility Study on Wastewater Treatment Along the Danube River Downstream Reach in Romanian" agreed upon between Ministry of Public Works and Territorial Planning (hereafter called as MPWTP) and Japan International Cooperation Agency (hereafter called as JICA), Environmental Impact Assessment (hereafter called as EIA) would be carried out based on the Romanian regulations as a part of the Feasibility Study on Wastewater Treatment along the Danube River Downstream Reach in Romanian. The objectives of the EIA are as follows:

(1) To review the existing environmental conditions in EIA study area;
(2) To assess environmental impacts of the proposed projects, and
(3) To propose countermeasures for mitigating impacts and environmental monitoring plan.

The Environmental Impact Assessment areas cover three cities, which are Braila, Galati and Tulcea.

1.2 EIA SITUATION IN ROMANIA

The methodology for EIA is outlined in "Official Order of Romania, No. 125/1996," issued by MWFEP. The application procedures for EIA are prescribed under "Permitting Procedures for Economic and Social Activities Having an Environmental Impact According to the Environmental Protection Law No.137/1995, April 11th, 1996," by MWFEP.

The Order No.125 sets out the typical contents of an environmental assessment as follows:

(1) Introduction, methodology and goals;
(2) Engineering baseline including function of the project;
(3) Environmental baseline, including;

- geology
- soils
- water resources
- climatic data
- aquatic and terrestrial ecology, including flora, fauna, aquatic habitats and deltas
- socio-economic and cultural issues including the protection of historic buildings
- health, pollution and microclimatic issues, and
- noise, transport and affected population

(4) Pollution issues, including water pollution/water quality, air pollution, noise and vibration, radiation, waste management, and toxic/dangerous substance management;
(5) Environmental impact. This comprises two categories, initial study and monitoring study, which address, water impact, air impact, flora and fauna, soil and subsoil

impact, socioeconomic impact, health and cultural impacts, public health and safety;
(6) Mitigation/reduction or elimination of impact, and
(7) Evaluation of final impact and conclusion.

According to the Law, the wastewater treatment plant development and improvement program is required to submit the EIA to the local regulatory agencies for review and public debate. The comments made thereon are then incorporated in the EIA report, which is submitted to MWFEP for final approval.

Two steps are generally taken for the assessment; Initial Environmental Examination (IEE) and EIA. Although there are no IEE national guidelines at present, the IEE is basically designed as a means of reviewing the environmental integrity of projects to determine whether EIA-level studies must be performed. In this sense the IEE is used for project screening to determine which environmental impact items require a full-scale EIA.

In accordance with Law 137/1995 and other relevant regulations, EIA shall be carried out only be certified Natural or Legal Persons. The analysis of samples for EIA shall be completed only by specialized laboratories using adequate equipment and methodologies in conformity with the existing norms and regulations.

1.3 THE REGULATIONS USED IN EIA STUDY

The regulations used in EIA study are showed as follows:

(1) Environmental Protection Law, No. 137/1995;
(2) The Order of Ministry of Water, Forests and Environmental Protection (MWFEP), No. 125/1996 – EIA;
(3) The Water Law, No. 107/1996;
(4) NTPA 001 – Load Limits of Pollutants in Waste Water Discharged in Water Resources;
(5) NTPA 002 – Quality Indicators of Waste Water Discharged into Sewage Systems;
(6) STAS 4706/1988 – Surface Waters (Categories and Quality Condition);
(7) STAS 1342/1991 – Standard for Drinking Water Quality;
(8) The Order of MWFEP, No. 756/1997 – Environmental Protection for Soil Pollution;
(9) The Order of MWFEP, No. 462/1993 – Maximum Concentrations of Effluents Pollutants Emitted into the Atmosphere Given for Emissions Levels;
(10) STAS 12574/1987 – Maximum Allowable Concentrations for Air Pollutants in Human Settlements;
(11) The Governmental Decree, No. 71/1996 – Fire Precaution;
(12) The Order of Health Ministry, No. 1935/1996 – Hygiene at Working Places;
(13) The Work Protection Law, No. 90/1996;
(14) The Order of Health Ministry, No. 536/1997 – Noise Admissible Level at the Limit of the Developed Location;
(15) STAS 12025/2-81 – Vibration Standard, and
(16) STAS 10009/1988 – Urban Noise Standard.

1.4 EIA IMPLEMENTING ORGANIZATION AND SPECIALISTS

Research and Development National Institute for Environmental Protection (hereafter called as

ICIM Bucharest) which is selected as the implementing organization for EIA is certified by MWFEP for performing EIA with the certificate R-EIM-1-764 (be valid from Jan. 28, 1999 to Jan. 28, 2001) for transportation, power supply, civil and hydrotechnics constructions, waste management, tourism, industrial activities, water and wastewater treatment.

Address: Spl. Independentei nr. 194, sector 6, cod 77703, Bucharest 78, Romania

Tel: 40-(0) 1-637-3060
Fax: 40-(0) 1- 312-1393

The EIA survey works is performed by the following specialists:

- Team Leader for all the three projects – Dr. Alexei Atudorei
- Team Leader for each city

  Tulcea – Mr. Gabriela Pietrareanu
  Galati – Mr. Mihaela Chiarescu
  Braila – Dr. Vasile Calin

- Five experts for each city (sewerage, hydrologist, geologist, ecologist and sociologist)

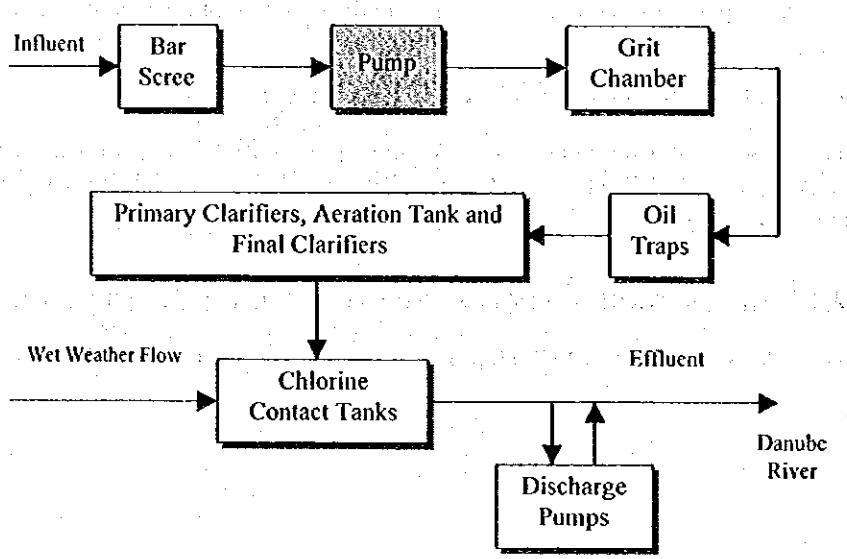
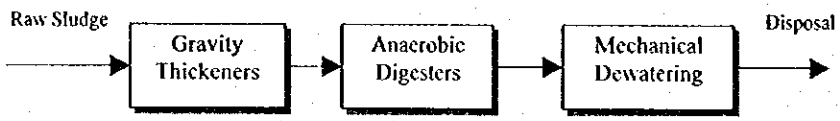
2. EIA FOR TULCEA WWTP PROJECT

The present environmental situations and the potential impacts on the environment after the construction of WWTP are defined and the results and possibilities to reduce or remove the environment impacts are shown in following paragraphs.

2.1 DESCRIPTION OF PROPOSED PROJECTS IN THE FEASIBILITY STUDY (F/S)

The details of proposed WWTP in F/S Study are summarized in Table AII.7.1

Table AII.7.1 Summary of proposed WWTP in Tulcea City

Item	Description of Proposed WWTP
1. Location	The proposed WWTP site with about 5.7 hectares is located at the eastern part of the City about 2 km downstream from the center of the City (Fig AII.7.1).
2. Capacity etc.	Service population in the year 2010: 73,000 (Total population: 100,000) Design average daily flow: 37,000 m^3/d Design maximum daily flow: 43,000 m^3/d Design maximum hourly flow: 53,000 m^3/d
3. Wastewater Characteristics	Design influent quality / Design effluent quality / Standard of NTPA 001 BOD_5: 130 mg/l / 18 mg/l / 20 mg/l SS: 140 mg/l / 20 mg/l / 60 mg/l T-N: 20 mg/l / 10 mg/l T-P: 3.5 mg/l / 1 mg/l
4. Treatment Method	Treatment method: Conventional activated sludge process Treatment-process flow diagram: Wastewater Flow  Sludge Flow 
5. Sludge Production and Disposal	Dewatered sludge production: 19 m^3/d (6,935 m^3/year) or: 3.8 ton/d (1,387 ton/year) Disposal method: landfill at Tulcea Solid Waste Disposal Site
6. Life of Facilities	The lift of facilities: Machinery and equipment – 30 years Civil facilities – 50 years

2.2 DESCRIPTION OF THE ENVIRONMENT

2.2.1 CLIMATE, AIR QUALITY (ODOR), NOISE AND VIBRATIONS

(1) Climate

The climate characteristics are summarized in Table AII.7.2.

Table AII.7.2 Summary of climate characteristics in Tulcea

Item	Description
1. Climate	The climate of Tulcea County belongs to the continental climate sector.
2. Sun Radiation	The total sun radiation: 125 Kcal/cm·per year
3. Temperature	The average annual temperature in Tulcea City: 11℃ The average monthly temperature in July (the hottest month): 22.9℃ The average monthly temperature in Jan. (the coldest month): 1.5℃
4. Freezing Day	The average number of freezing day in Sulina town: 84.2 days The average number of freezing day in continental side of the county: 100 days
5. Precipitation	The average annual precipitation: 439 mm The average monthly precipitation in June (the max. month): 52.5 mm The average monthly precipitation in Feb. (the min. month): 27.2 mm
6. Wind	The average annual frequency: NW - 19.9% W - 14.4% S - 10.9% The average annual frequency of the calm: 23.1 % The average annual velocity: 2.8 – 4.8 m/s

Source: Tulcea City and ICIM

(2) Air Pollution (Odor)

Regarding air pollution, the estimation has been made based on the measurements of APA (EPA) and of ICIM Bucharest.

Out of 364 samples taken in the Eastern zone of the city, where WWTP site might be influenced, only 3 samples, that is 0.82 percent, were proved to exceed the Maximum Allowable Values (MAV) with ammonia, [1]. MAVs are defined by STAS 12547/1987.

The pollution sources are stationary and they are the economic units, located in the eastern industrial platform of the city. These economic units use refrigeration facilities in their production process and heavy oil is used as fuel for production and heating. SO_2 and particulate are considered the most important pollutants emitted by combustion processes.

Regarding odor, the results of measurements in/around proposed WWTP site are presented in Table AII.7.3. The locations of sampling points are shown in Fig. AII.7.1, and the samples are taken at 2.5 m above the ground level.

Table AII.7.3 Some results of air pollution measurements in the WWTP site (July 1999)

Parameter	Boundary fence	50m from boundary fence	150 m from boundary fence	Limits for 30 minutes sampling period according to RS 12574/1987
H_2S (mg/m^3)	0	0	0	0.015
NH_3 (mg/m^3)	0.115	0.105	0.95	0.3
Odor Level	1	1	1	5

Source: ICIM

The results of survey show that hydrogen sulfide and ammonia concentrations as well as the odor level in/around proposed WWTP site are keeping at a relatively low level.

(3) Noise

Equivalent Continuous Sound Level ($L_{Aeq, T}$) is used to assess noise level. $L_{Aeq, T}$ is the A-weighted energy mean of the noise level averaged over the measurement period. It can be considered as the continuous steady noise level which would have the same total A-weighted acoustic energy as the real fluctuating noise measured over the same period of time, and defined as:

$$L_{Aeq,T} = 10 * \lg\left(\frac{1}{T}\int_0^T \left(\frac{p_A(t)}{p_0}\right)^2 dt\right)$$

Where: T = the total measurement time
$P_A(t)$ = the A-weighted instantaneous acoustic pressure, and
P_0 = the reference acoustic pressure ($20*10^{-6}$ Pa)

Noise must be analyzed at two observation levels:

- at the working place, where there are imposed noise limits in order to not affect the workers' hearing capacity;
- at the open place, where noise limits are imposed for the population's comfort.

Indoor noise level (noise dose) at working places must be under 90 dB (A). Maximum admissible limits (external noise) based on which the environmental state assesses in an objective area are specified in STAS 10009-88 and provide at the yard boundary fence of an industrial area, a max. value of 65 dB (A). Concerning the location of dwellings, this will be made in such a way so that to ensure a max. value of 50 dB(A) for the noise level on the outside of the most exposed building.

The location map of measuring points is showed in Fig. AII.7.1, and the points are situated at 1.5 m height and 30 m distance, from the axes of the road. The results of noise measurements around WWTP site are presented in Table AII.7.4, which indicated that the present noise level in/around WWTP site is under Romania Standard (STAS 10009-88)

Table AII.7.4 Results of noise measurements (July 1999)

Sampling Point	Noise-dB (A) ($L_{Aeq,T}$)		
	Hourly Interval		
	6:00-22:00	22:00-6:00	Over 24 h
Point 1 (see Fig. AII.7.1)	55.7	45	54.5
Point 2 (see Fig. AII.7.1)	53.5	51	53.2
Point 3 (see Fig. AII.7.1)	51.8	45	51
Maximum Allowable Values (MAV)	65	65	65

Source: ICIM

(4) Vibration

The Romanian Standard for vibration is set in STAS 12025, in which the level of "vibration" is established as following:

$$S = 10 \log (A/A_0) \text{ (vibration)}$$

Where:

$$A = a^2 / f \ (m^2/s^2)$$

Where:

$$A = a^2 / f \ (m^2/s^2)$$

Where: a = vibration acceleration amplitude at the frequency "f"
F = frequency in Hz
A_0 = reference level equal with 0.1 cm^2/s^2

The effects of vibration on the building structure, established also by the above mentioned STAS, are shown in Table AII.7.5.

Table AII.7.5 Summary of the effects of vibration on the building structure

Level of vibrations	Vibration Category	Effects on buildings structure
10 - 20	Slight	No damage
20 - 30	Medium	No damage
30 - 40	Strong	Slight damages
40 - 50	Hard	Fissure on the walls
50 - 60	Heavy Hard	Destruction of the building

Source: ICIM

The results of the measurement performed by ICIM Bucharest using a Bruel & Kjaer instrument, at the points presented on the Fig. AII.7.1, are shown in Table AII.7.6, which indicates the present vibration levels in/around WWTP site show relatively low values.

Table AII.7.6 Results of vibration survey

Location	Acceleration (m/ s^2)	Frequency (Hz)	Level of Vibrations	Vibrations Category
Point 1	2 - 5	15 - 25	12.2	Slight
Point 2	2 - 5	15 - 25	12.2	Slight
Point 3	1 - 4	15 - 25	10.3	Slight

Source: ICIM

2.2.2 GEOLOGY AND TOPOGRAPHY

(1) Geology

Tulcea town is located in the South-east part of Romania. The County of Tulcea covers a area of 8,430 km^2, that is 3.5 percent of the whole area of Romania. The county is on the fourth place in Romania as for the size of the area. The county is situated in the area between the Danube River, Chilia Branch and the Black Sea. The Danube River Delta that is the youngest and lowest form of relief in Romania, is situated in the Eastern part of the county. The Danube River Delta is continuously formed going into the Black Sea by the sediments carried by the Danube River and settled between the three branches following in the Delta zone: Sf.Gheorghe, Chilia and Sulina. The geological features of the zone are: cutted crystal foundation on which Triassic, Jurassic, Sarmatian and Pliocene deposits are disposed, and then the plain or deltaic formation-clay, clay sands and sands-are deposited.

In the Tulcea City zone there are sedimentary and greenstone formations over the crystal rock foundation.

(2) Seismology

The origin of most earthquakes in Romania comes from the Carpatian Curve Zone (Vrancea region) at the 100-200 km depth. The condition of propagation does not significantly affect Tulcea zone. In the Romania the constructions are designed taking into consideration the earthquake regime by means of the methodology indicated by the norms P100-92 of the Ministry of Public Works and Territorial Planning. The relations that are used for dimensioning are based on the two coefficients:

x = coefficient of construction importance, and

k_S= coefficient which is defined for each zone of the country;

k_S= Earthquake peak acceleration / Gravity acceleration

Besides the earthquake loads evaluation of the Corner Period -"T_c" is also defined for each county (T_c= 2 π x Effective peak velocity / Effective peak acceleration).

For Tulcea City these values are:

k_S= 0.16 ("D"zone)

The corner period is T_c=1.5s.

(3) Soil and Topography

The existing soil in the Tulcea City zone is defined as alluvial soil. Tulcea City is located at 30

m altitude (above the Black Sea level) on the right side of the Danube River at the distance of 71.3 km from the Black Sea.

The proposed WWTP is located in the Northeast part of the city. The City-owned WWTP site of about 5.7 hectares land is located at the left bank of the Danube River. The land is relatively flat and low-lying with the ground surface elevation ranging from 2.5 m to 3.5 m above the M.W.L. The WWTP site has been approved by the Decision of Tulcea City Council Nr.29 on the 27 May 1996 and the Urbanism Regulation updated (in accordance with GD 525/1996) by the Local Council Decision Nr.19, on the 19 February 1999. This land area can accommodate the activated sludge WWTP to treat the maximum daily wastewater flow of 43,000 m^3/day.

In the vicinity of the plant site there are two factories, one is the fish factory named TULCO Tulcea and another one is the beer factory. There are few residences within a distance of 300 m from the western boundary of the site, but to the east, there is a wide Government-owned vacant land that could be used for plant expansion when it becomes necessary in future.

Access to the site can be made through the major road, running from west to east along the Danube River. From the major road, unpaved public road of about 300 m long and 6 m wide is available.

2.2.3 FLORA AND FAUNA

Romania's flora includes over 3,500 plant species of which the Danube River Delta includes about 1,150 plant species.

Out of 8,600 species of birds spread all over the world, about 300 species, that is 3.4 percent of the bird species living in the world, can be found in the Danube River Delta. The number of bird species in the Danube River Delta represents 78 percent of species living in Romania. Almost 300 bird species travel from Asia, Africa, Europe and Polar regions. [6]

The mammals- a few species out of approximately 100 species - living in Romania are mostly considered threatened.

The dominant species living in Tulcea County are specific to the steppe zones (about 7 percent of the Romanian territory) where the average annual rainfall is 450-500 mm and where higher temperature values are met.

The vegetation in the Tulcea zone consists in agricultural plants (cereals, etc) other plants which are mentioned below (dominant and rare species). The wood flora consists of willows (*Salix alba, Salix fragilis, Salix purpurea, etc.*) and poplars (*Populus alba, Populus nigra*).

There are small zones in which oak forestry (*Quercus robur*) can be met. The pastures comprise a good diversity of plants, the main species being *Agrositis salonifera, Agrositis canina, Alopecurus pratensis* (fox tail- coada vulpii). Along with these plants numerous species of *Carex, Juncus, Scirpus, Phragmites communis* (reeds) are met in the wetland zones.

Fauna is also rich in the zone and the mentioned below. There are mink (*Mustela lutreola*), atters, wild boars, pelicans, small and big egret (*Egretta garzetta*), spoon bill (*Platalea leucorodia*), white vulture, vipers and lizards, etc.

The main fish with economic interest are: sturgeons, herrings, carps, breams, sheet fish (*Silurus glanis*), etc.

The dominant species of plants are: [6]

- *Poa bulbosa*
- *Festuca valesiaca* (paiusul)
- *Stipa capillata*
- *Stipa stenophylla*
- *Stipa lessingiana*
- *Biotriochloa ischaemum*
- *Artemisia austriaca* (wormwood-pelinita)
- *Agropyron cristatum*
- *Bromus tectorum*
- *Setaria viridis*
- *Euphorbia stepposa* (dogmilk-laptele cainelui)
- *Echium rossicum* (snake head - capul sarpelui)
- *Vicia tennifolia*
- *Inula germanica*
- *Centaurea orientalis*
- *Astragalus asper*
- *Medicago falcata*
- *Thymus marschallianus* (sowory)
- *Adonis vernalis*
- *Muscari sp.*(rook onion-ceapa ciorii)
- *Iris pumila and Iris graminea* (iris -stinjenel)
- *Paeonia tenuifolia* (steppe peony - bujor)
- *etc.*

Shrubs

- *Prunus spinosa* (porumbar)
- *Prunus tenella* (almond tree-migdalul)
- *Rosa gallica* (steppe cherry tree- ciresul de stepa)
- *Prunus fructicosa*
- *Paliurus spina-christi*
- *Jasminum fructicans* (sawage jasmin)
- *Quercus penduculiflora* (oak)
- *Querucus pubescens (oak)*
- *Acertataricum* (tatar maple - artar tataresc)
- *Carpinus orientalis*
- *Prunus mahaleb (Turkish cherry tree-cires turcesc)*
- *Cornus mas (cornel tree-corn)*
- *Frakinus ornus*
- *Cornus sanguinea*
- *Cartaegus monogyna*

Animals

- *Citellus citellus* (ground squirrel - popandau)
- *Mustella eversmani Leaa* (steppe fitch - dihorul de stepa)
- *Lepus europaeus* (hare - iepure)

- *Cricetus cricetus* (hamster - harciog)
- *Vormela peregusna Gueld* (variegated fitch- dihor pestrit)
- *Vipera amodites montadoni* (viper - vipera)
- *Reticuliterms lucifugus Rossi* (termites)
- *Testudo graeca ibera Pall* (turtle - broasca testoasa)
- *Coluber jugularis caspius* (snake-sarpe)
- *Scolopendra cingulata latr.* (circiioc)

Major birds that can be found in the zone are sparrows, swallows (*Hirundo rustica*), partriges, quails, woodpeckers, etc.

The Danube River delta has become a component of the list of the Programme "Man and Biosphere" in 1990 based on the "Convention on the Wetlands of International Importance, Especially as Waterfowl Habitat" (Ramsar 1971).

The total preserved area for the Danube River Delta is 5,912 km^2 of which 592.8 km^2 is strictly protected (comprising 16 zones), 3,332 km^2 - buffer zone and the rest of surface is considered transitional zone.

The species of rare plants and animals, or threatened to become extinct in the Danube River Delta are mentioned in the following list: [6]

Plants

- Convolvulus persious
- Plantage coronopus
- Petunia parviflora
- Nymphae alba
- Nymphae candida
- Ephedra distochia
- Merenderas sobolifera
- Convallaria majalis
- Periploca gracca

Animals

- Acipenser nudriventis
- Acipenser sturio
- Acipenser ruthenus
- Acipenser guldenstaedti
- Huso huso
- Vipera ursini renardi
- Neliaetus albicilla
- Falco peregrinu
- Platalea leucorodia
- Plegadis falcinellus
- Tadorna tadorna
- Tadorna ferruginca
- Netta rufina
- Falco cherrug
- Falco vespertinus

- Himantopus himantopus
- Recurvirostra avesetta
- Columba oenas
- Bubo bubo
- Caprimulgus europaeus
- Canis lupus
- Lutra lutra
- Mustela erminea
- Mustela nivalis
- Vormela peregusna

As a special terrestrial ecosystem the Forest of Niculitel (11 hectares) is considered to be an important area which has kept a "high degree of naturalness", though having an important landscape value.

2.2.4 WATER RESOURCES

(1) Ground Water

Groundwater level in proposed WWTP site is 0.70 m to 2.20 m measured under the natural level of the land.[2] The variation of the level might be + or - 1m, according to the season over the year and the precipitation-evaporation regime over the years.

Generally speaking, the ground water quality corresponds to the quality required by the RS (STAS) 1342/91. In case of Tulcea City it must be mentioned that a centralized system of raw water is coming mainly from the Danube River. Water intaken from the groundwater and surface water resources in the county of Tulcea is presented in the Table AII.7.7.

Table AII.7.7 Water intaken and discharged in the County of Tulcea [1]

×1,000 m^3/year (1995)

Water Use	Surface Water	Ground water	Total Intake	Total Discharge
Drinking Water	20,509	2,820	23,329	8,762
Industrial Water	18,388	11,084	18,498	16,367
Irrigation	18,162	1,805	18,246	-
Fowls	130	-	1,935	842
Total	57,189	4,819	62,008	25,971

Source: ICIM

Tulcea City is supplied mainly with surface water abstracted from the Danube River (19,575,000 m^3), and only 240,000 m^3 from the existing ground water resources (1995). [1]

The groundwater intake used for supplying a part of Tulcea City is located in the zone of village Bogza.

The quality of groundwater intaken corresponds to the standard requirements (STAS 1342/91) except Permanganate Value and Ammonia which exceed 12 mg/l and 0.5 mg/l, respectively. [3]

(2) Surface Water

Rivers

99 percent of the inland rivers belong to the tributary area of the Danube River. Only one percent of the inland rivers-located in Tulcea County-discharge their waters directly to the Black Sea. The hydrographic network of the Tulcea county territory is divided in two groups: one group belonging to the tributary area of the Danube River, and another one belonging to the tributary area of the Black Sea, in the eastern part of the county.

The City's major urban and industrial districts are located at the right bank of the Bratul Tulcea (Tulcea Branch), an arm running between the stretches of land Chilia and Sf. Gheorghe. The Tulcea branch stretches about 19 km with the maximum width of about 300 m, the deepest portion being 39 m. The branch carries about 40 % of the total river water flow.

Among the rivers in the tributary area of the Danube River are following ones: Rosti, Aiorman, Cerna, Plopi, Jijila, Luncavita which have the tributary areas less than 100 km^2 and the most important river-Topologul with the surface area of its basin 345 km^2 and the length of 38 km. The surface area of Topologul River basin and length belonging to Tulcea County are 165 km^2 and 20 km, respectively.

The Danube River is the most important surface water resource in the zone. Water abstracted from the Danube River for different purposes was presented in Table AII.7.7.

The multi-annual average flow (MAF) of the Danube River at the entrance of the county of Tulcea is 6,000 m^3/s. Out of the average flow value only about 13 percent is transported through Macin Branch which is a boundary between the county of Tulcea and the county of Braila.

The average flow (AF) of the Danube River into the Black Sea is 6,340 m^3/s, the additional flow being issued on the left side by the Siret River -230 m^3/s and Prut River - 110 m^3/s. The annual average flow values have variation of 1.5 times AF in the rainy years to 0.63 times AF in the droughty years.

The MAF of suspended matter is 1,800 kg/s at the entrance of Tulcea County and about 2,200-2,400 kg/s at the Ceatal Ismail point. The scoured sediments are not significant while comparing with the flow values of suspended matter (one percent of values of the suspended matter carried).

The Danube River water quality in Tulcea reach belongs to the second category whereas downstream the river become on the first category on two branches (Sulina and Sf.Gheorghe) and remain in the second category on Chilia branch. This could be explained by the self-purification process in those two branches - Sulina and Sf.Gheorghe.

A dam is built to defend the site of WWTP from flood events. Anyhow according to the existing data, [1] no event has been occurred up to now.

Lakes

Tulcea County is unique in Romania with respect of the huge area covered by lakes and wetlands. Out of the whole surface area of the county (849,875 ha)-353,386 ha are covered by waters. A lagoon system is formed by the lakes Razelm, Golovita, Babadag.

The lake Ciuperca is situated in the outskirt of Tulcea City in the Western part of the city. It has a volume of 0.31 million m^3 having as the main function-recreational area (bathing) for the population living in Tulcea City. Regarding the water quality of this lake it is mentioned that it is classified in the first category (STAS 4706/88) [5]. It has to be mentioned that in some periods of time the organic substances in the lake water exceeds the values indicated for the first category and the quality category goes to the second one. This situation appears due to the wastewater discharges from SC CONPREF SA, SC CIMEX SA and SC DONARIS SA [5].

2.3 IMPACTS ON ENVIRONMENT

2.3.1 IMPACTS ON SOCIOECONOMIC CONDITIONS

(1) Resettlement

Illegal inhabitants have encroached in the proposed land for the proposed WWTP. This impact should be minimized to the extent possible, since involuntary resettlement is usually a traumatic experience for affected people, apart from legal, institutional and social consequences to the project implementation. The resettlement could be threatened with delays or additional costs.

At present the number of illegal inhabitants is limited (7 small houses, under 35 inhabitants), and the problem resettlement will be solved by Tulcea City Hall before starting the construction. Based on the results of unit costs survey, the costs relating to resettlement are roughly estimated as shown on Table AII.7.8, which indicates total resettlement costs will be about 767 millions Lei (or 48,000 US $).

Table AII.7.8 Estimated costs of resettlement

Description	Quantity	Unit Cost (Lei)	Total Amount (Lei)	(US $)
1. Existing Constructions			108,000,000	6,750
1.1 Houses (one-storied houses)	7	10,000,000	70,000,000	4,375
1.2 Huts	6	3,000,000	18,000,000	1,125
1.3 Pigsties and hen coops	20	1,000,000	20,000,000	1,250
2. Animals			166,808,000	10,426
2.1 Pigs (90 kg/capita)	46	25,600	105,984,000	6,624
2.2 Cows (400 kg/capita)	4	21,200	33,920,000	2,120
2.3 Asses	5	1,600,000	8,000,000	500
2.4 Hens (3 kg/capita)	80	13,600	3,264,000	204
2.5 Geese (5 kg/capita)	230	13,600	15,640,000	978
3. Movement Transport 10 km/time×1 time/house×7 houses	70	25,000	1,750,000	109
4. New Dwelling Costs 3 rooms/apartment, 7 apartment	7	70,000,000	490,000,000	30,625
Total Costs			766,558,000	47,910

(2) Noise, Vibration and Traffic

Noise and Vibration

The noise sources of the WWTP are:

1) Pumping stations (during operation period)
2) Aeration equipment (during operation period)
3) Mobile sources, most of them consisting in vehicles and machinery used during WWTP construction period.

Neither densely residential areas nor facilities as hospitals and schools, which require a quiet atmosphere, are located in the vicinity of WWTP site. Therefore, the effect of noise from WWTP on environment during the operation period will be not expected so seriously.

During the construction, however, several different types of heavy construction equipment will be simultaneously put in operation. Although at this stage precise construction schedules and methods can hardly be determined yet, the possible noise levels from construction equipment may be reasonably estimated assuming appropriate construction procedures.

The possible noise power levels at the different distances have been calculated as a reference for a condition that two bulldozers, one power shovel and two dump trucks are simultaneously put in operation. The estimated compound noise levels at the locations of 10 m, 20 m, 30 m, 50 m, 80 m, 100 m are shown as Table AII.7.9, which indicate that the countermeasures for noise should be considered during construction period.

Concerning the vibration, so significant vibration sources exist.

Table AII.7.9 Estimation of the noise generated from vehicles and machinery

Distance from Source (m)	Noise Power Level dB(A)			
	Bulldozer	Power Shovel	Dump Truck	Compound Noise Level
10	85.69	79.03	80.77	89.15
20	79.66	73.01	74.75	84.23
30	76.14	69.49	71.22	80.70
50	71.70	65.05	66.78	76.26
80	67.16	60.96	62.70	72.18
100	65.67	59.02	60.75	70.23
150	62.14	55.49	57.22	66.70

Traffic

The results of traffic-flow survey at present access road indicate that the traffic-flow is around 175 to 220 vehicles/day among which the traffic-flow during the period of 7 a.m. to 4 p.m. represents 80% of the daily flow. This means in the day-time the traffic-flow is ranged from 16 to 20 vehicles/hr, therefore, traffic congestion problem could be negligible.

(3) Water Rights and Rights of Common

As mentioned in previous section, at present all the wastewater used to be discharged directly into the Danube River through seven wastewater outfalls without any treatment. According to the F/S Study after WWTP being put into operation the existing outfalls will be closed and all of the wastewater will be collected and treated at WWTP, and the pollution load discharged to the Danube River will be reduced obviously. Therefore, the project implementation will not create the impact on the fishing rights.

Before and after the project implementation, there are no changes about the volume of wastewater discharged to the Danube River. Besides this, the intake for water supply system of Tulcea City is located in the upstream of 9 km from the center of the City, and the nearest intake in the downstream of Tulcea City is located at about 15 km as far as WWTP outfall. Therefore, it could be considered that the effect of wastewater on water rights is negligible.

In Tulcea there is only one authorized swimming area on the left side of the Danube River bank opposite to the Hotel Delta. In addition, the inhabitants usually swim along the Danube River bank where are unauthorized areas by the local health authorities. However, as mentioned above in the future the existing outfalls will be closed and all of the wastewater will be collected and treated at WWTP, then discharged at the downstream of the City. It is estimated that the rights of common will be improved by the project implementation.

(4) Public Health Condition

Treated Wastewater

The results of wastewater characteristics survey at existing outfalls along the Danube River reach of Tulcea City revealed that the number of total Coliform Group in raw wastewater, which now is discharged directly into The Danube River, is about 1×10^7 no./100ml to 1×10^8

no./100ml. While the number of total Coliform Group in The Danube River (1 km downstream from the outfall of proposed WWTP, Aug. 1999) is 2.4×10^3 no./100ml to 3.5×10^3 no./100ml, which has exceeded the standard (1×10^2 no./100ml, STAS 12585/1987) of water for swimming purposes.

According to the F/S Study after WWTP being put into operation all of the existing outfalls will be closed and all of the wastewater will be collected and treated at WWTP. The number of total Coliform Group in WWTP effluent will be meet the standard (1×10^6 no./100ml, NTPA 001) of wastewater discharged in water resources. Hence, during WWTP operation stage the public health condition will be improved certainly.

Sludge

The excess sludge generated from WWTP will be transported and disposed at the Solid Waste Disposal Site (SWDS) located in the southwest of the City about 8 km from the center of the City. The impacts of excess sludge will be discussed in following paragraph.

(5) Waste

At present the capacity of SWDS in Tulcea is enough for disposing excess sludge (19 m^3/d or 3.8 t/d) generated from WWTP. However, the results of wastewater characteristics of leachate from SWDS in Tulcea indicated that the concentrations of the organic substances (BOD_5: 2,988 mg/l, COD_{Mn}: 6,770 mg/l), NH_4-N (548 mg/l) and oil (278 mg/l) etc. in the leachate have exceeded the standard (NTPA 002/1997) of wastewater discharged into municipal sewage system substantially. In addition, the number of total Coliform Group is also relative high (5.4×10^8 no./100ml). All of these may contribute a negative impact on groundwater. Therefore, countermeasures are considered to be necessary.

(6) Hazards

The results of geological survey indicated that the surface (0 to 2m) at WWTP site is unhomogeneous filling and the bottom (2 to 15 m) is gray fine-medium sand, and N-value of WWTP site ranges from 10 to 50. Taking into consideration the WWTP site locates in the seismic region, a careful aseismatic structure design will be considered in the planning and design of the wastewater treatment facilities.

Biogas resulting from sludge digester is a potential explosive fuel. So in some conditions there exists the possibility of producing accidents with major effects both on facility operation and maintenance staff (such as burning, different physical or mental injuries sometimes even lethal) and on technological objectives. Receiver water and/or soil and subsoil in the area might be affected by spillage of liquids following the breaking or destruction of technological objectives.

These events may appear in case of the incorrect operation and maintenance of sludge fermentation tanks and/or of biogas tanks.

In addition, the chlorination process is to be carefully controlled, avoiding overdosing of chlorine and by respecting the operation and maintenance instructions.