CHAPTER 4:

DESCRIPTION OF PROJECT COMPONENT "B" AT EFORIE NORD

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4.1 Outline of Project Component "B" at Eforie Nord

The Project Component "B" at Eforie Nord is to execute a beach fill of about 12 ha with 467,000 m^3 of the sand taken from the riverbed of the Danube around Oltina (km 340 or so) or some area of good sand quarry, rehabilitating the two existing jetties and extending one of them to the depth of about –5 m, and constructing three submerged wide-crested breakwaters. Existing four groins are demolished and removed for the safety of beach users. Bird's-eye views of the present beach and the filled beach after the project implementation are shown in Figs. 4.1.1 and 4.1.2. The submerged breakwaters are provided with three seamarks each on their tops so as to warn their presence to people enjoying water sports.

Fig. 4.1.1: Bird's-eye view of the beach before project implementation at Eforie Nord

Fig. 4.1.2: Bird's-eye view of the beach after project implementation at Eforie Nord

Figure 4.1.3 shows the bathymetric map of the Eforie Nord area including the zone outside the construction works. The two jetties are given the identification numbers of J-1 and J-2 as shown in the figure. Beach fill is also made partially at the north of the jetty J-1 over the distance of 150 m.

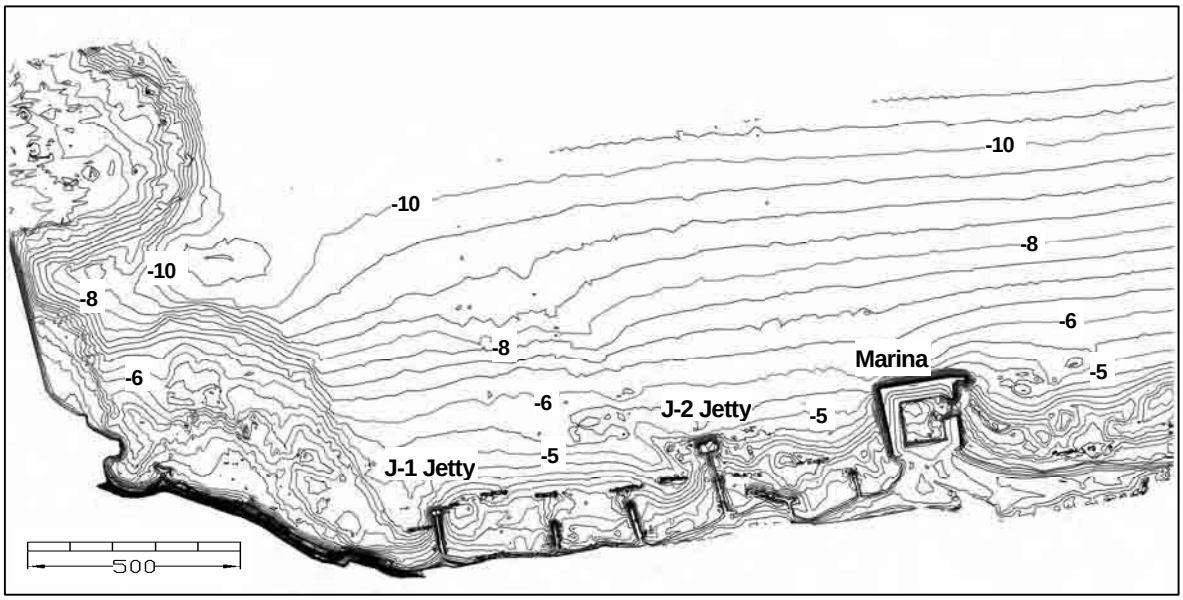

Fig. 4.1.3: Bathymetric map around the project site at Eforie Nord

4.2 Main Alternatives Studied and Main Reasons for Final Choice

4.2.1 Alternative Choices of the Components of Shore Protection Facilities

The shore protection facilities being planned at Eforie Nord have been determined after considering the following items of component choices:

1) Beach fill with increase of beach area by about 11 ha with the river sand: No option,

2) Rehabilitation of the two existing jetties (II-J-2 and II-J-5): No option,

3) Construction of the extended portion of the two jetties (EN-J-1 and EN-J-2):
Choice of 60 and 150 m for EN-J-1 and 0 and 25 m for EN-J-2,

4) Construction of submerged breakwaters:
Choice of two breakwaters (EN-B-1 and EN-B-2) or
three breakwaters (EN-B-1, EN-B-1' and EN-B-2), and
choice of submerged or emerged breakwaters.

In the Project Component "B" at Eforie Nord, use of the sand from the seabed around Midia Port is not contemplated, because the sea sand is too fine in grain size compared with the existing beach sand and not appropriate for beach fill here. There will be no objection against sand mining from the Danube from the viewpoint of environmental impact assessment, which will be discussed in **5.7** in this volume. The two existing jetties of II-J-2 and II-J-5 (the identification numbers are after **5.3.2** of Volume 1) are deteriorated with concrete slab having been damaged and armor stones having been scattered by waves. They have to be rehabilitated and there is no option to select.

Necessity of extending the two existing jetties needs to be examined from the viewpoints of maintenance supply of sand and the aesthetic aspect. The extended jetties will greatly reduce the alongshore sediment transport across them. The initial plan contemplated at the overall coastal protection plan presented in Volume 1 sets the extension lengths at 200 and 120 m for the jetties EN-J-1 and EN-J-2, respectively. A detailed bathymetric survey of the project area has revealed the isobath of –5 m is much closer to the shore than the bathymetric chart available previously. Thus the extension lengths will be 150 and 25 m. The two jetties with rehabilitated and extended portions are given the new identification numbers of the jetties J-1 and J-2, respectively. There are choices of the extension lengths of the two jetties as described in 3) in the above.

The Eforie Nord area has been experiencing a gradual retreat of the shoreline and cliff over many years as described in **4.1.3** of Volume 1. Because the project site is confined between the south breakwater of Constanța Port and the north breakwater of the marina "Yacht Club Europa", the sediment produced by the shoreline retreat must have been transported offshore by the cross-shore movement. To reduce the offshore loss of filled sand and to attenuate the incident wave energy, two man-made reefs (breakwaters) have been contemplated in the initial plan, but there is a choice of two reefs or three reefs. The reefs have been conceived as the submerged ones. However, they can be emerged ones, i.e. detached breakwater. Thus the choices of the shore protection facilities in Eforie Nord are the jetty extension length, the number of man-made reefs, and the crest elevation of the reefs.

From the viewpoint of the possible environmental impacts, there are only a few items to be considered because the new facilities are the extension of the existing jetties and the construction of submerged breakwaters. The extension length of the former may affect the ocean view to some extent. If the man-made reefs are submerged ones, they will not obstruct the ocean view because they cannot be seen from the beach. If the man-made reefs are emerged ones, they will obstruct the ocean view.

Water circulation may be hindered to some extent by installation of new man-made reefs compared to the present conditions with current six submerged breakwaters. There will be some impact in case of the emerged ones. However, there remain four openings with the total length of 530 m against the reef lengths of 600 or 675 m (two or three reefs). In case of Mamaia Sud, there are detached breakwaters emerged above the sea with the opening lengths same as the breakwater lengths. If the reefs are built with submerged ones, there will be the inflow of water over the reefs by wave actions. Thus, the degree of water circulation in Eforie Nord after the project will be almost the same as that of Mamaia Sud at present or greater than Mamaia in case of submerged breakwater construction. If there remains some apprehension on water quality, however, it is recommended to undertake field investigation and analyses on water circulation and diffusion processes, and eutrophication process.

4.2.2 Options for Shore Protection Facility Installation Plan

The three items of the choices of the facility components can be combined in several ways. However, under some practical considerations, the three combinations and one alternative of zero-option are selected here as the alternatives to be examined during the feasibility study. They are listed in Table 4.2.1.

The option A is the zero-option without any work to be executed on the shore area. The option B is the initial design introduced in the overall coastal protection and rehabilitation plan. The option C

does not extend the jetty J-2 but provides additional protection by installing the third submerged breakwater between the breakwaters B-1 and B-2 (the identification numbers EN-B-1 and EN-B-2 are abbreviated here). The breakwater B-1 is shortened and shifted toward the north slightly to make a room for the new submerged breakwater B-1'. This option will diminish the impedimental view of a long jetty and improve the aesthetic landscape. The option D is to cut the length of the jetty J-1 by 60% so as to improve the aesthetic impression further. It also aims to allow the filled sand to move northward beyond the jetty so that a smooth shape of the shoreline will be created across the jetty. For both the options B to D, the reliable estimation of the amount of sediment transport across the jetty is important for the evaluation of the maintenance volume of sand supply for the filled beach. The options B, C, and D employ the submerged breakwater with their crest at –0.5 m below the mean water level. The option E sets the crest elevations of the man-made reefs at +1.0 m (emerged ones or detached breakwaters) in the pattern of the option D.

Table 4.2.1: Options for shore protection facility installation plan at Eforie Nord

No.	Description	Sand source	Beach fill area (m)	Existing two jetties	Jetty extension (m)		Lengths of breakwaters			Breakwater crest elevation (m)
					J-1	J-2	B-1	B-1'	B-2	
A	Zero-option	none	–	–	–	–	–	–	–	–
B	Two jetties extension and two breakwaters	River sand	1200 x 80	Rehab.	150	25	325	0	275	–0.5
C	One jetty extension and three breakwaters	ditto	1200 x 80	Rehab.	150	0	200	200	275	–0.5
D	One short jetty and three breakwaters	ditto	1200 x 80	Rehab.	60	0	200	200	275	–0.5
E	One short jetty and three emerged breakwaters	ditto	1200 x 80	Rehab.	60	0	200	200	275	+1.0

Figures 4.2.1 and 4.2.2 show the sketch plans of the options B and D with the shoreline in one year after completion of beach fill. The option D has been selected as the design of shore protection facilities by the reasons described in the next sub-section. Isobaths are drawn in 0.5 m intervals, and the isobaths of ±0.0, –1.0, –2.0, –4.0, and –5.0 m are shown in thin blue lines. The yellow colored zone indicates the beach fill area above the mean water level. Both the submerged breakwater and the extended jetties are shown in red color.

4.2.3 Selection of Final Plan for Shore Protection Facilities at Eforie Nord

(1) Temporal variation of shoreline position after facility installation

All the alternatives listed in Table 4.2.1 have been examined for the future shoreline changes brought out by them. The shoreline position changes have been predicted with the same technique that was employed for prediction of shoreline change without any implementation of coastal protection and rehabilitation projects. The numerical simulation method based on the one-line theory has been briefly introduced in **4.5.1** of Volume 1. The methodology, assumptions employed, computation conditions, and others are described in **E.5** and **E.6** in Annex E of Volume 3. It should be noted that the simulation is carried out with the assumption that the average wave climate over the past ten years will continue during the project evaluation period.

The option A of "do-nothing" and the other options B to D have different capacity in mitigating future beach erosion. The shoreline change of the option A is predicted under the condition of no

limitation to shoreline retreat for demonstration purpose, even though the presence of existing coastal cliff will not allow the shoreline retreat to the extent predicted by the simulation. In reality, disappearance of sandy beach in the option A will cause enhancement of wave uprush onto the cliff as the result of deepening sea bed and bring forth damage to promenades, revetments and cliff itself. This mechanism is not covered by the simulation with one-line model in the Study, and it is recommended to be noted.

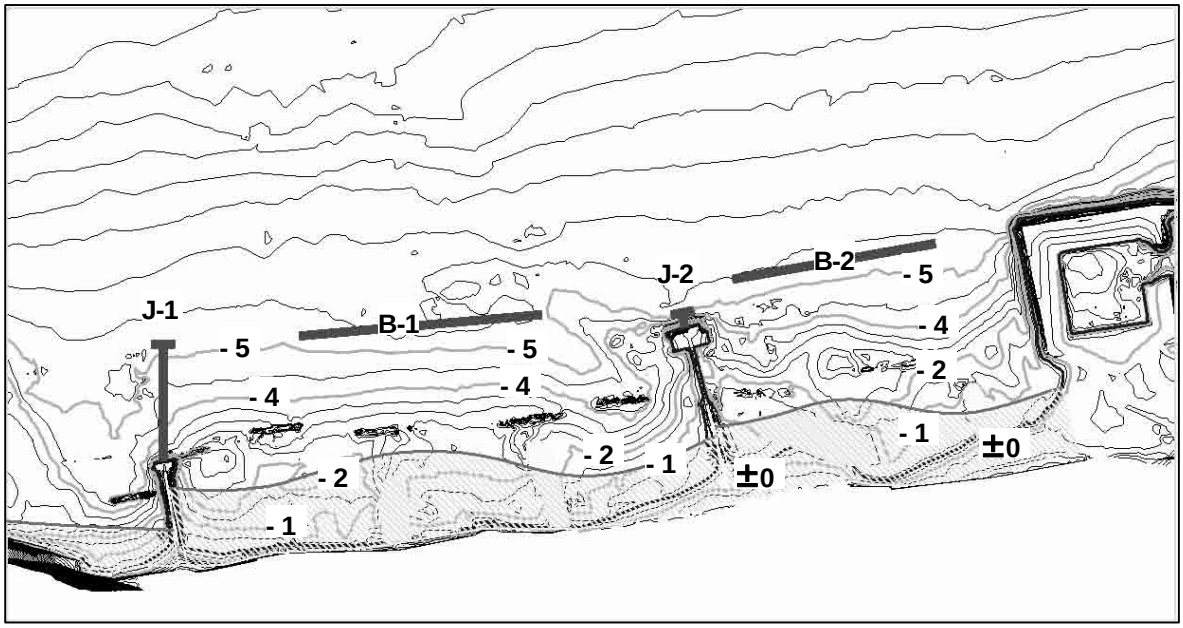

Fig. 4.2.1: Sketch of the option B for shore protection facilities at Eforie Nord with the shoreline in one year after the beach fill

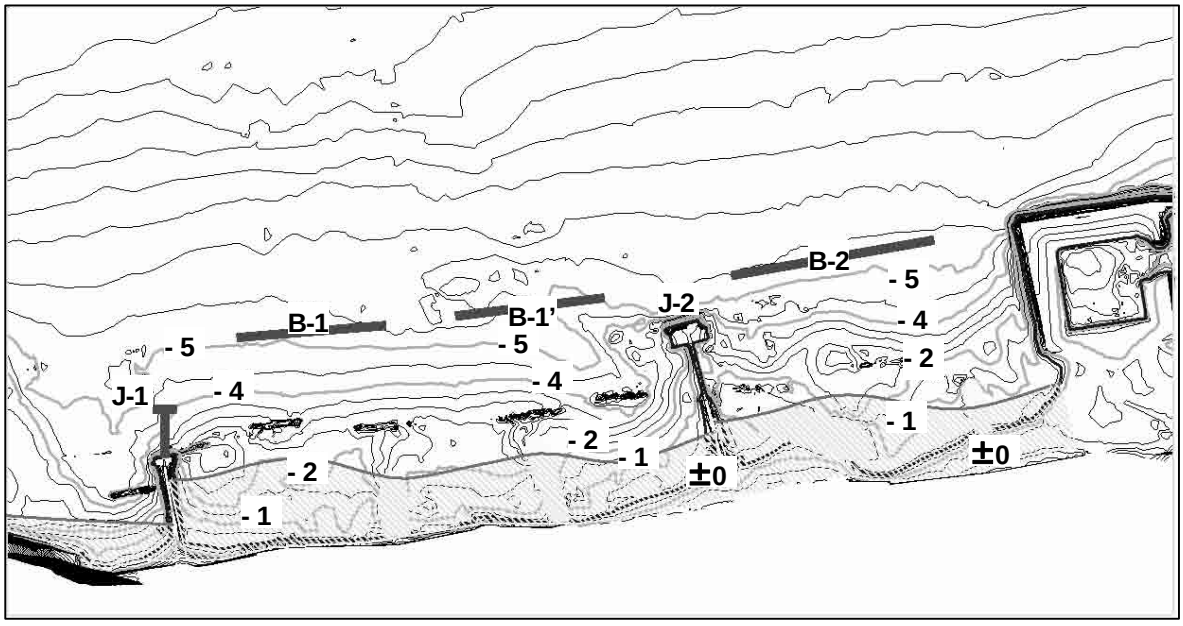

Fig. 4.2.2: Sketch of the option D for shore protection facilities at Eforie Nord with the shoreline in one year after the beach fill

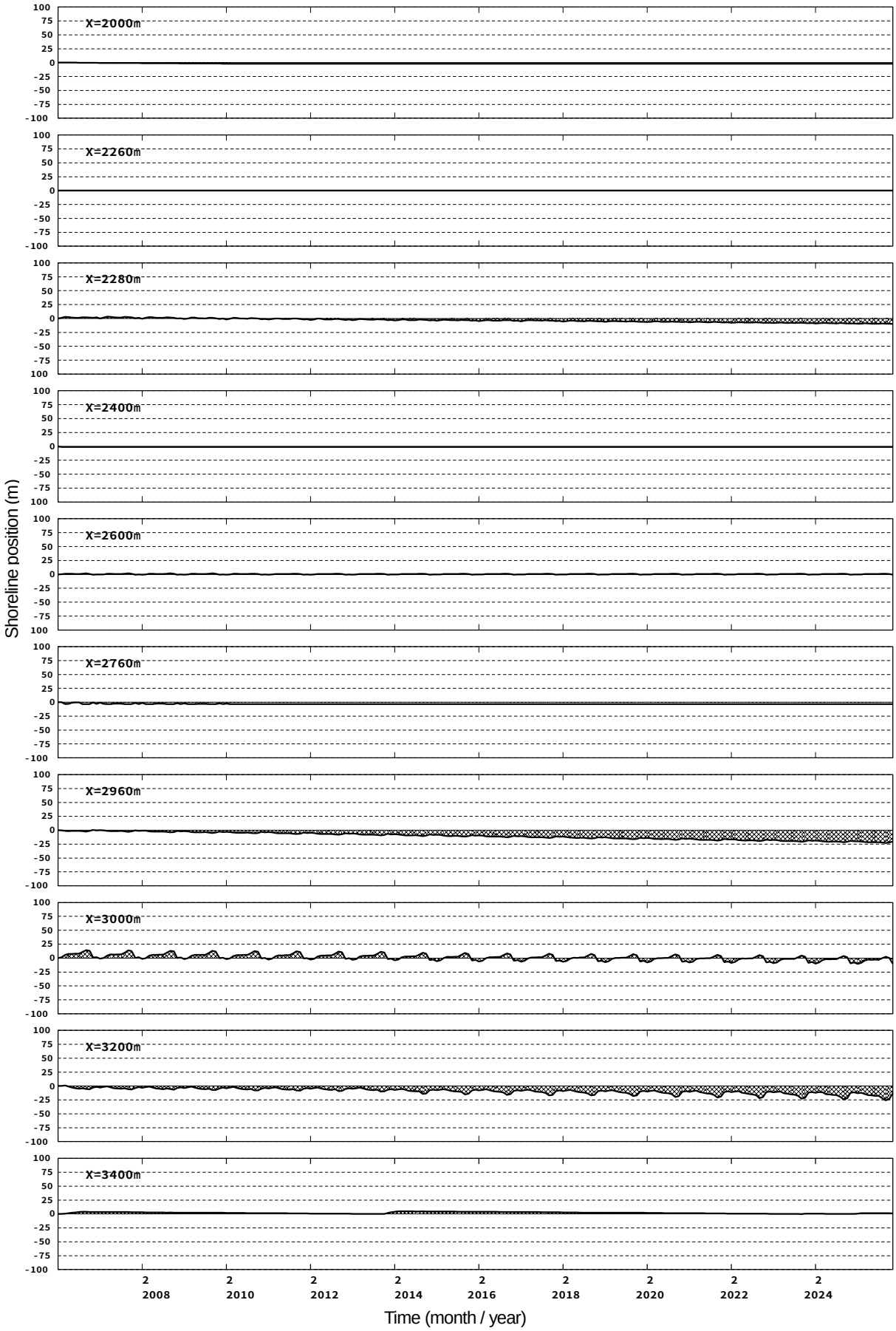

Fig. 4.2.3: Temporal variation of shoreline position in the plan A (zero-option)

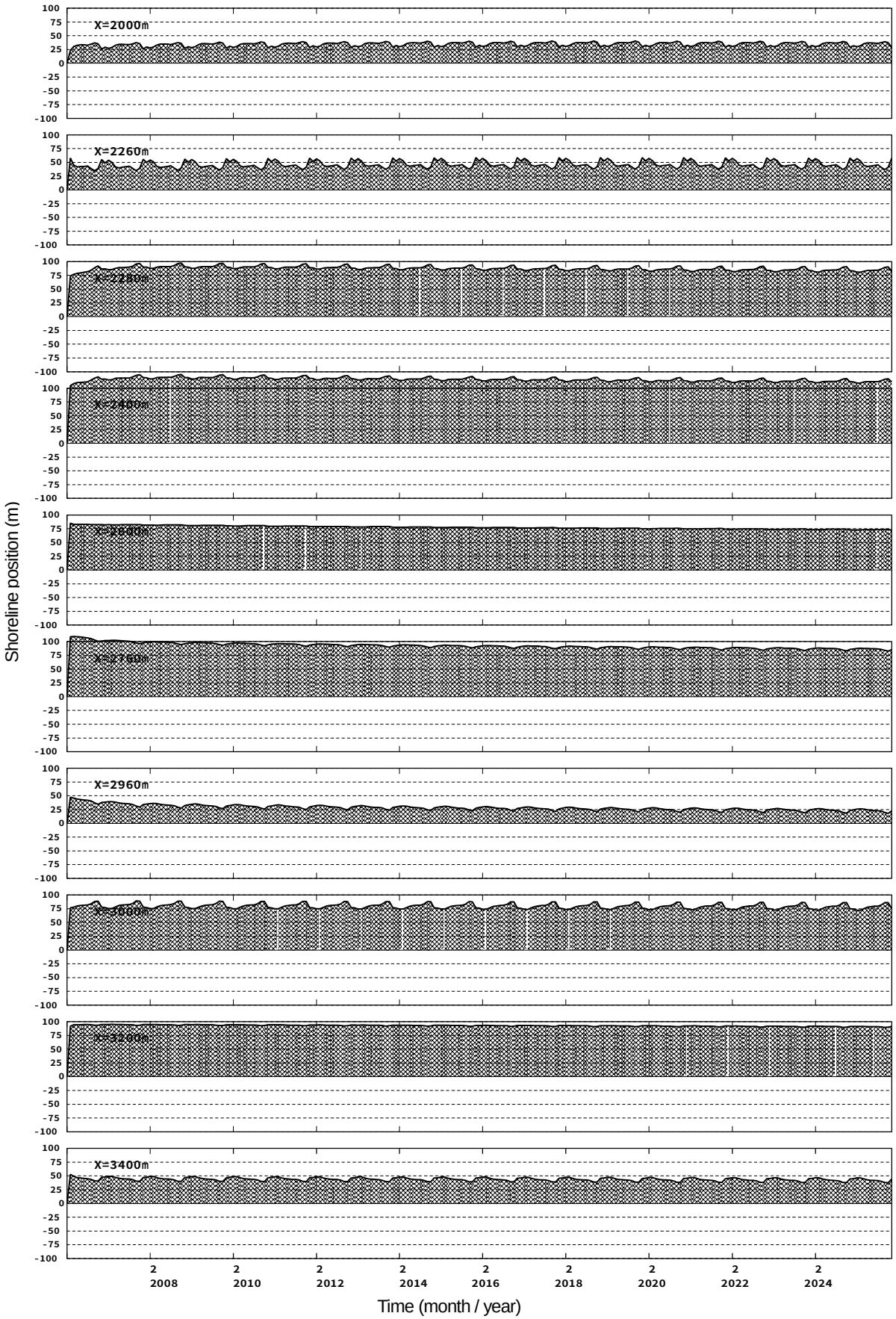

Fig. 4.2.4: Temporal variation of shoreline position in the plan D (short jetty extension with river sand)

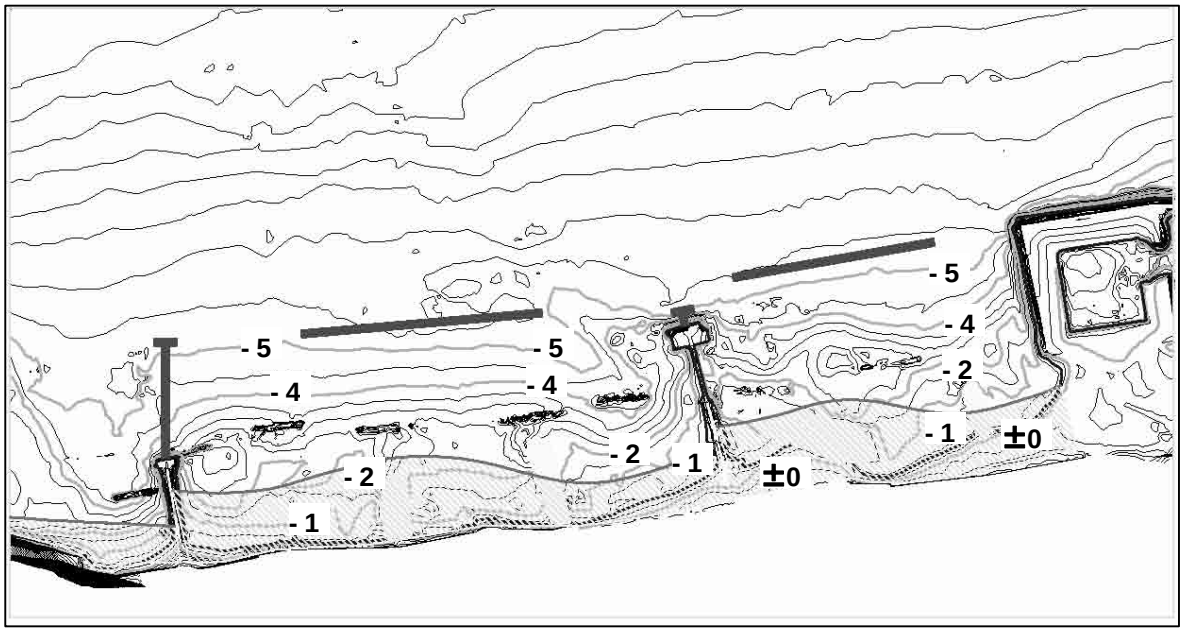

Fig. 4.2.5: Predicted shoreline position in 20 years for the option B

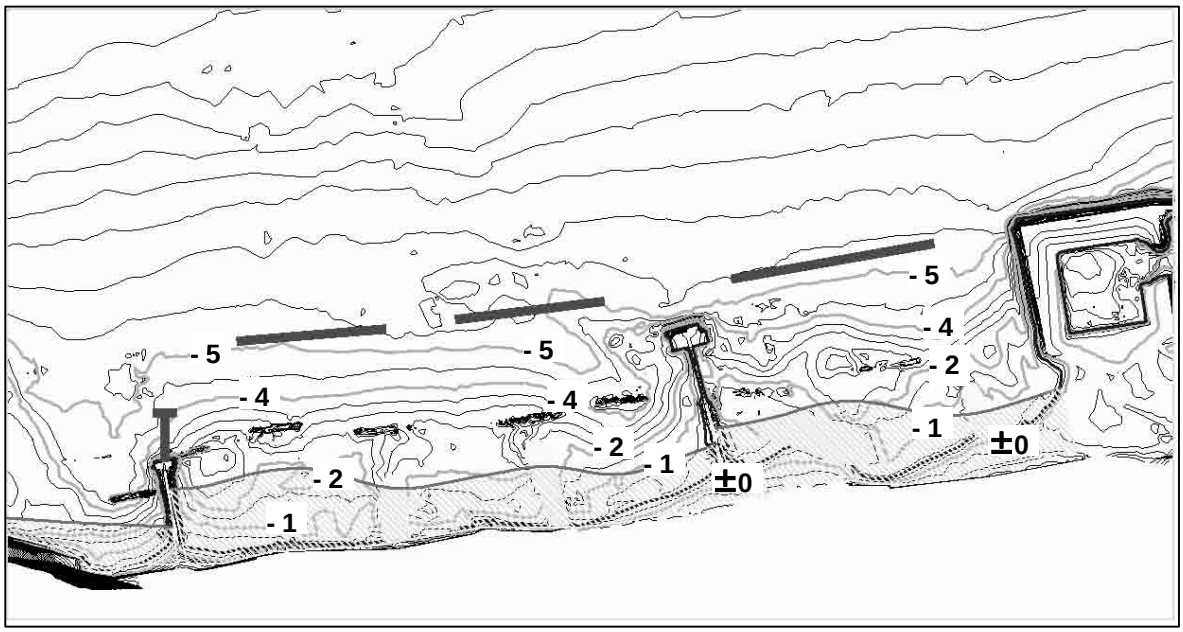

Fig. 4.2.6: Predicted shoreline position in 20 years for the option D

Figures 4.2.3 and 4.2.4 demonstrate the temporal variations of the shoreline positions over the period of twenty years, measured from the foot of the cliff. The beach fill area extends from the location x = 2,030 to 3,440 m. The shoreline locations are the results of numerical simulation with the model employed in the present study.

In the option A of "do-nothing" shown in Fig. 4.2.3, the shoreline retreats at the all locations with different magnitudes. The existing jetties J-1 and J-2 are located at x = 2,280 and 3,000 m, respectively. There are two groins between the former two, and two more groins between the jetty J-2 and the breakwater of the marina "Yacht Club Europa," one of which is a slanted one. The

most rapidly retreating location is at just the north of the jetty J-2. The middle portion between the jetty J-2 and the breakwater of the marina also experience a rapid shoreline retreat.

With installation of the submerged breakwaters in the options B to D, the shoreline is advanced to the distance of 100 m from the cliff foot by beach fill. The shoreline undergoes some evolution with a largest retreat at the location x = 2800 to 2990 m, which faces the opening between the jetty J-2 and the submerged breakwater B-1 (or B-1'). As shown in Fig. 4.2.4 for the case of the option D, the shoreline takes a wavy form soon after completion of the beach fill. The retreat of the shoreline means a certain amount of filled sand is transported behind the submerged breakwaters with the result of the shoreline advance there; the location x = 2400 m in corresponds the shadow zone of the submerged breakwater B-1 in the cases of the options C and D.

Reformation of the shoreline is rather fast. In a few years, the shoreline almost reaches to the equilibrium form in the options B to D and the further changes become very slow, as exhibited in the temporal shoreline change at the location x = 2960 m in Fig. 4.2.4. A certain amount of sand is transported northward across the jetty J-1. The sediment transport rate across the jetty J-1 is estimated as 710, 321, and 1059 m^3 per year for the options B, C, and D, respectively, at the elapsed time of two year after the beach fill; after that, the transport rate gradually decreases.

Figure 4.3.5 and 4.2.6 exhibit the shoreline shapes in twenty years after the beach fill operation for the options B and D, respectively. The beach width, which is planned at 100 m for the beach fill operation, will become 58 to 120 m in twenty years in the case of the option B. The beach width in twenty years in the cases of the options C and D will be 70 to 120 m and 65 to 118 m, respectively. A larger variation of the beach width in the option B than that of the option C or D is due to a large opening between the submerged breakwater B-1 and the jetty J-2, compared with the opening between B'-1 and J-2 in the options C and D.

The shoreline position change in the option E should be only slightly smaller than the case of the option D. The emerged crests of the detached breakwaters will reduce the wave transmission over the breakwaters compared with that of the submerged breakwaters of the option D. However, the effect of the reduction of wave energy transmission on shoreline change is not large, because the filled beach is bounded by the jetty J-1 in the north and the north breakwater of the marina in the south and thus the alongshore sediment transport is restricted.

(2) Optimal facility installation plan at Eforie Nord

Despite a small difference in the sediment transport rates across the jetty J-1 indicated above, the sand-retaining capacities of the options B, C, and D is nearly the same. The factor affecting the sand-retaining capacity is the opening between the submerged breakwater B-1 or B'-1 and the jetty J-1. Because the option B has a larger opening than the options C and D, the former yields a quite wavy shape of the shoreline, which may not be favorable to beach visitors. The option C does not have the extension of 25 m of the jetty J-2 but have the total length of 675 m of the submerged breakwaters against the length 600 m in the case of the option D. Because the unit cost of the submerged breakwater is more expensive than that of the jetty extension at Eforie Nord, the option C will be more expensive than the option B. The option D has the jetty length shorter by 115 m than the option B, and thus its construction cost will be less than the option B. Table 4.2.2 summarizes the results of comparison and evaluation of the merits of various options. The grade A is the best and the grade F means failure.

The beach protection capacities of the options B, C, and D are almost the same as stated before. The option E has better beach protection capacity than the options B, C, and D, but it will exercise adverse impacts on the aesthetic aspects and water quality by decrease in water circulation. Thus, it is rejected as the optimal solution for the Eforie Nord project. Among the options B, C, and D, the option D will be executed with the smallest construction const, and thus it is selected as the optimal plan for coastal protection and rehabilitation in Eforie Nord.

Table 4.2.2: Comparison of the options examined and evaluation of their merits for Eforie Nord

No	Description	Sand source	Jetty extension (m)		Length of submerged breakwaters (m)			Remarks	Evaluat -ion
			J-1	J-2	B-1	B-1'	B-2		
A	Zero-option	None	–	–	–	–	–	Beach erosion continues and threat of cliff failure	F
B	Initial plan	River	150	25	325	–	275	Good protection capacity, but with larger amplitude of wavy shoreline	B
C	One jetty extension	ditto	150	0	200	200	275	Good protection capacity but slightly expensive than B	C
D	One short extension	ditto	60	0	200	200	275	Good protection capacity with low cost	A
E	Emerged breakwaters	ditto	60	0	200	200	275	Protection capacity is increased, but ocean view is hindered.	D

There might be a possibility of the option of no extension of the jetty J-1 in consideration of a relatively small contribution of the jetty extension to the beach stability. However, the numerical simulation of shoreline change has been carried out with the two representative energy-averaged waves from the northerly and southerly directions, which are listed in Table 4.5.1 of Volume 1. In reality, much larger waves attack the beach when big storms blow over the sea. In those occasions, the sediment transport becomes more active than those predicted by the simulation. Furthermore, the cross-shore currents and sediment transport are not considered in the present numerical model. To counteract against the cross-shore sediment transport and to prepare against the events of excessive sediment motion in stormy conditions, it is recommended to provide a certain extension of the jetty J-1.

4.3 Structural Components and Their Layout

(1) General

The project component "B" at Eforie Nord using the river sand of the Danube around Oltina or some other area for beach fill is composed of the following works and facilities:

1) Beach fill works with the sand volume of 467,000 m^3,
2) Construction of three submerged breakwaters with the length of 200, 200, and 275 m each,
3) Rehabilitation of jetty J-1 for the length of 135 m,
4) Extension of jetty J-1 for the length of 60 m,
5) Rehabilitation of jetty J-2 for the length of 80 m,
6) Removal of four existing groins, and
7) Construction and removal of temporary access road.

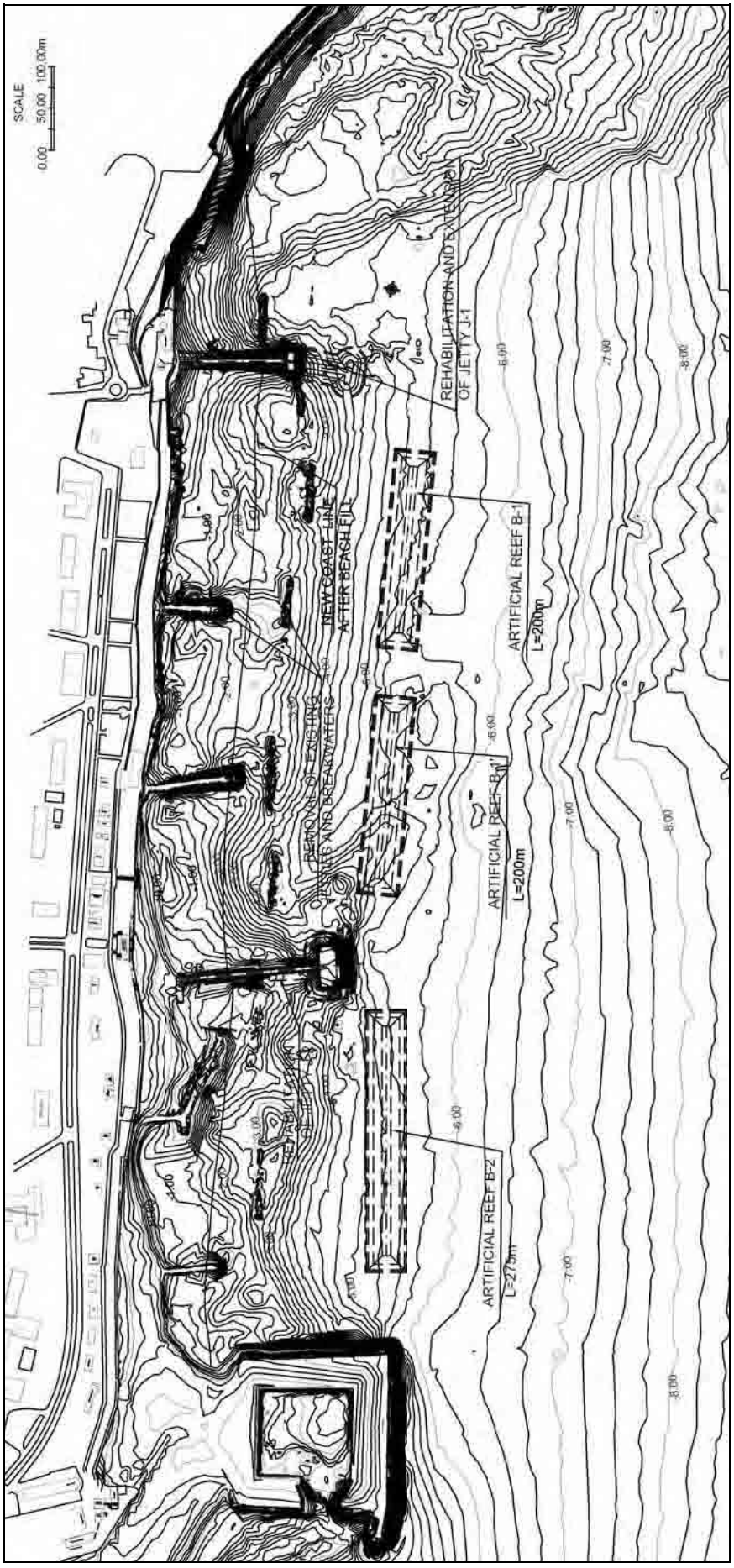

Fig. 4.3.1: General layout of shore protection facilities at Eforie Nord

(2) Beach fill works

Beach fill is to be made with coarse sand of the Danube around Oltina. Among twelve sediment samples taken in June 2006, five samples were composed of relatively coarse sand with the overall median diameter of 0.32 mm. The extraordinarily large flood in April 2006 seems to have brought relatively fine sand. When the project will be implemented, a search should be made for sand quarries of large grain size and the fill sand should be mined from such quarries because the stability of beach fill is greater with coarse sand than with fine sand. As described in 2.5.3 (5) of this volume, specification should be given for the median diameter of the fill sand to be within the range of d_{50} = 0.35 to 0.45 mm without no silt fraction.

The beach fill is designed with the width of 100 m from the foot of the shore cliff. The elevation of the backshore is set at the elevation of DL+2.2 m, according to **E.7.5** of Annex E of Volume 3. The foreshore is formed with the gradient of 1/22 down to the mean water level (DL±0.0 m). The beach fill in the inshore zone is planned with the gradient of 1/30. The position of the toe of beach fill is shown in Fig. 4.3.2. Typical profiles of beach fill are shown in Fig. 4.3.3.

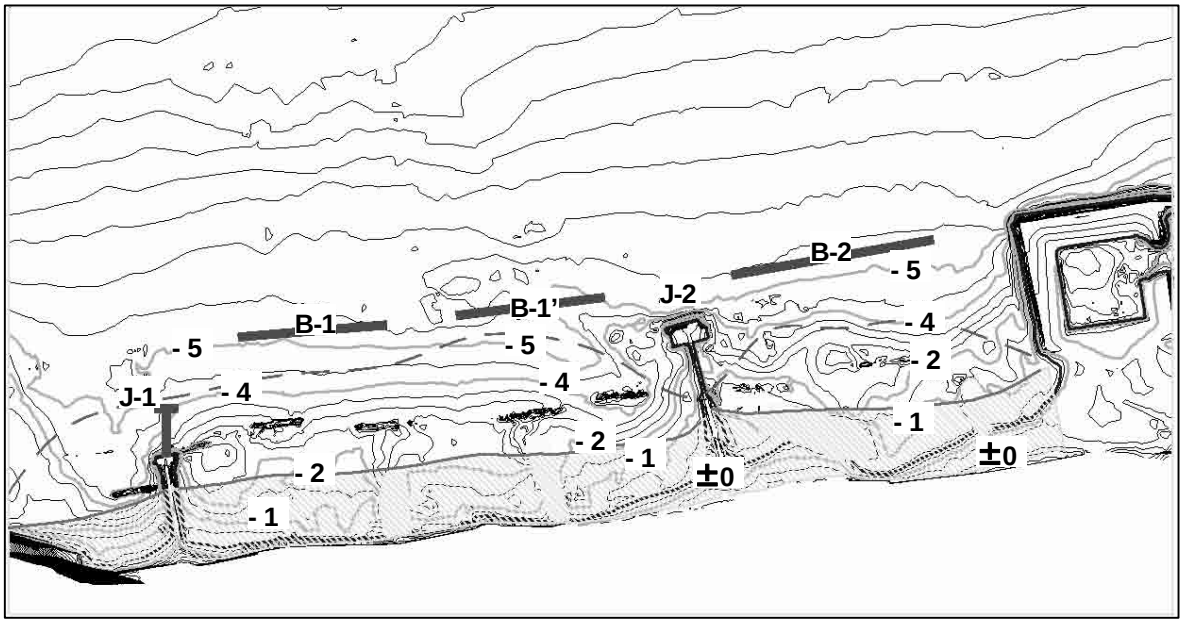

Fig. 4.3.2: Layout of beach fill, jetty extension and submerged breakwaters

There is a possibility that the inshore slope of the beach fill made of the sand with median diameter of d_{50} = 0.32 mm may become gentler than 1/30. If it occurs, a portion of the foreshore will be eroded and transported to the inshore zone until the stable inshore profile is formed. It will give an impression of beach erosion beyond the prediction by numerical simulation, but the main body of filled sand will not be lost. As presented in Fig. 4.2.4, the shoreline after beach fill is predicted to be stabilized in a short time with the resultant shoreline form in 20 years as shown in Fig. 4.2.6.

One factor not considered in the numerical simulation of the shoreline changes after the project implementation is the cross-shore sediment transport. The coastline of this area has receded by 30 to 80 m in the past 78 years as described in **4.1.3** of Volume 1. Based on this information, the model calibration and the future prediction without the project have been carried out with the mean shoreline retreat rate of 0.6 m per year. However, the shoreline change after the project

implementation has been made without consideration of the offshore sediment transport, because the submerged breakwaters are assumed to effectively prevent the offshore transport. If the offshore sediment may take place with a reduced transport rate after installation of the submerged breakwaters, there will be gradual retreat of the beach fill shoreline. However, the amount of retreat will be less than 10 m on the average and the filled beach will serve for beach visitors as well as for protection of the shore cliff against erosion at its foot.

(3) Submerged breakwaters

Three submerged breakwaters, two with the length of 200 m and the other with the length of 275 m, are designed at Eforie Nord. Their crest is set at the elevation of DL–0.5 m so as to make them unseen from the beach. The submerged crest is not effective in attenuate incoming waves so that they are large width of 10.4 m to enhance wave attenuation over them. The surface of the submerged breakwaters needs to be protected by special flat concrete blocks called "X blocks" patented by Tetra Corporation in Tokyo, Japan. One unit of X block has the dimensions of 2.05 m long, 2.05 m wide, and 0.964 m thick with the weight of 6.4 tons. Five rows of "X" blocks are installed on the crest.

Figure 4.3.4 shows the layout of the submerged breakwater B-1, while Fig. 4.3.5 shows a standard cross section to be built on the seabed at DL–5.50 m. Both the offshore and onshore slopes are given the gradient of 1 on 3. The core is made with rubble stones of 10 to 300 kg, but some of the core materials will be the recycled rocks and concrete blocks taken out from the four existing groins.

Each submerged breakwater will be provided with three sea marks, which will give cautions for people enjoying water sports by motorboats, etc. The sea mark is a steel pile with the diameter of 1.00 m and the length of 5.54 m filled with plain concrete. It is embedded in a square concrete base of 4.1 m wide and 0.964 m thick so that the portion of 4.6 m of the pile is protruded above the base. The base has the dimensions twice that of "X" blocks so that it occupies the space of four "X" blocks. Each sea mark composed of the pile and base has the total weight of 45.9 tons. Structural details of the joints between the steel pile and the base should be examined in the detailed design stage.

The quantities of materials for construction of the three submerged breakwaters are estimated as follows:

- Rubble stones 10 to 300 kg: 93,474 m^3
- Geotextile from sea side: 39,690 m^2
- "X" blocks of 6.4 ton from sea side: 7,787 pieces
- Sea marks: 9 pieces

(4) Rehabilitation and extension of jetty J-1

The quantities of materials for rehabilitation and extension of the jetty J-1 are estimated as follows:

Rehabilitation
- Rubble stones: 448 m^3
- Stone blocks of 0.8 to 1.5 ton: 973 m^3
- Concrete in the pavement: 339 m^3
- Stabilopods of 4.5 ton: 826 pieces
- Removal of existing concrete pavement 149 m^3

- Stone blocks of 1 to 3 ton removal and replacing: 279 m^3
- Crushed stone for circulation: 170 m^3

Extension
- Rubble stones: 6,340 m^3
- Stone blocks of 0.5 to 1.0 ton: 2,635 m^3
- Geotextile: 3,866 m^2
- Stabilopods of 4.5 ton: 1,416 pieces
- Crushed stone for circulation: 116 m^3

(5) Rehabilitation of jetty J-2

The quantities of materials for rehabilitation of the jetty J-2 are estimated as follows:

Rehabilitation
- Rubble stones: 350 m^3
- Stone blocks of 0.5 to 1.0 ton: 3,494 m^3
- Stone blocks of 0.8 to 1.5 ton and 1 to 2 ton: 3,677 m^3
- Concrete in the pavement: 933 m^3
- Stabilopods of 4.5 ton: 1,370 pieces
- Removal of existing concrete pavement 457 m^3
- Stone blocks of 1 to 3 ton removal and replacing: 128 m^3

(6) Removal of existing groins

There are four small groins in the project site, being designated as II-J-03, 04, 06, and 07 in **5.4** of Volume 1. They are located in the beach fill area and may pose some danger for beach visitors if they are left as they are, because they are partially buried with the filled sand. Therefore, they are to be taken out from their positions by breaking and crashing the concrete pavement and by lifting out armor blocks and rocks in the core. All the materials taken from the existing groins are to be utilized as the core materials of the submerged breakwaters and/or the extended portion of the jetty J-1.

The quantities of materials for removal of existing structures are estimated as follows:

- Removal of existing concrete: 371 m^3
- Stone blocks of 1 to 3 ton, removal and replacing: 5,101 m^3
- Stabilopods of 4.5 ton replaced from land side 85 pieces
- Stabilopods of 4.5 ton replaced from sea side: 915 pieces

The above quantities include those of the existing submerged breakwaters. Necessity of removing the submerged breakwaters should be reviewed again at the detailed design stage.

(7) Temporary access road

The project site is located at the north of the marina "Yacht Club Europa," to which a road with concrete pavement is extended. This road will be used for transport of materials and equipments, but it needs rehabilitation after the completion of works. Between the jetties J-1 and J-2, no beach is present, however. A temporary work road for the length of 500 m has to be built with a wide rubble mound protected by stone blocks of 0.5 to 1 ton against waves.

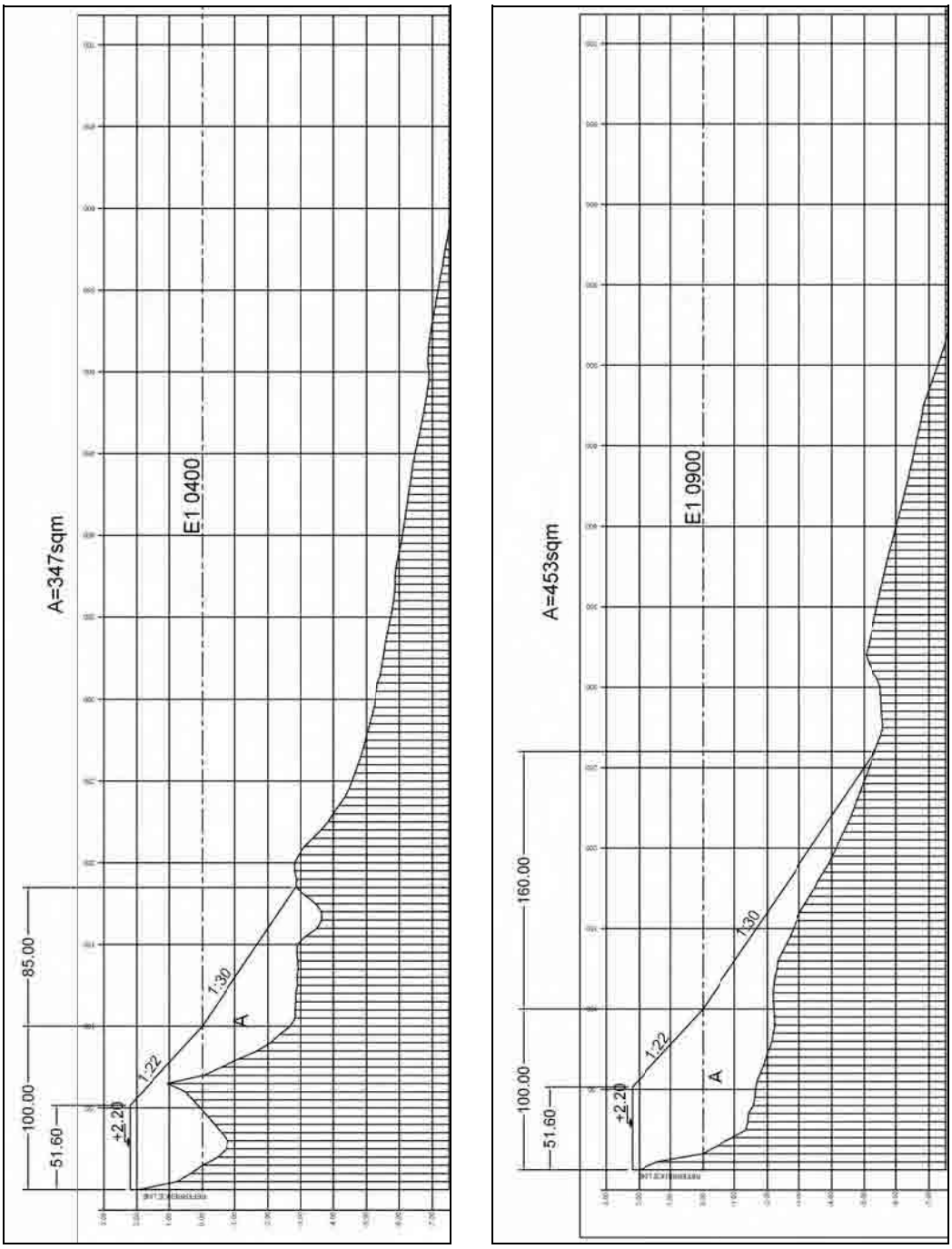

Fig. 4.3.3: Examples beach fill profiles

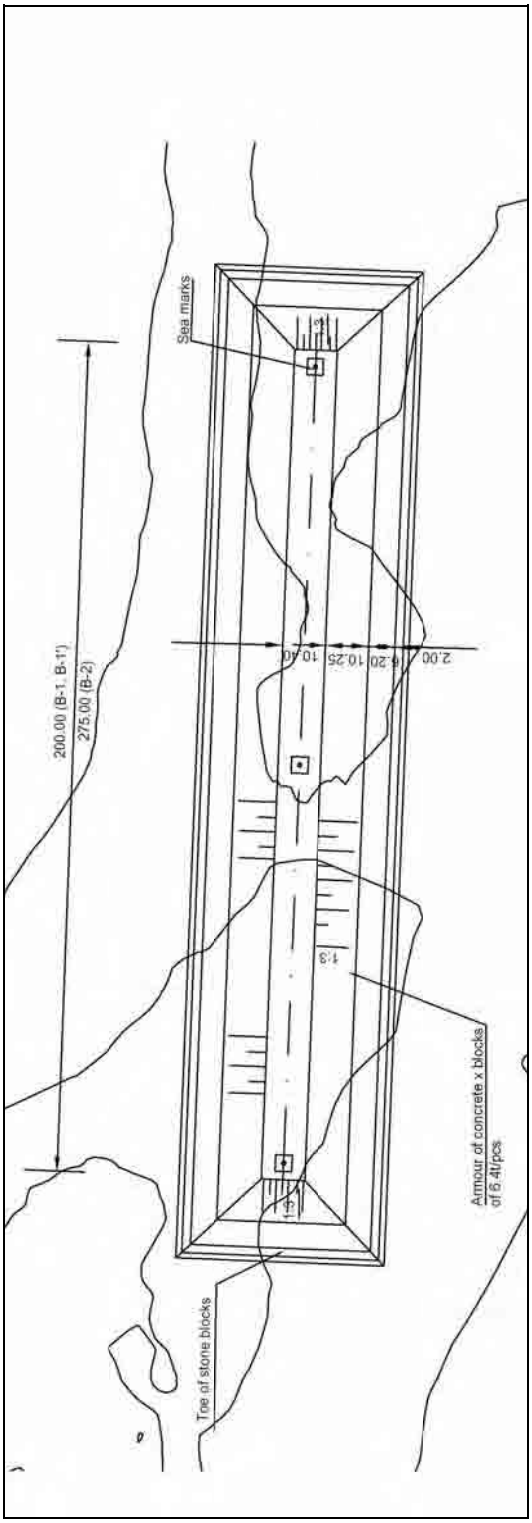

Fig. 4.3.4: Layout of submerged breakwater

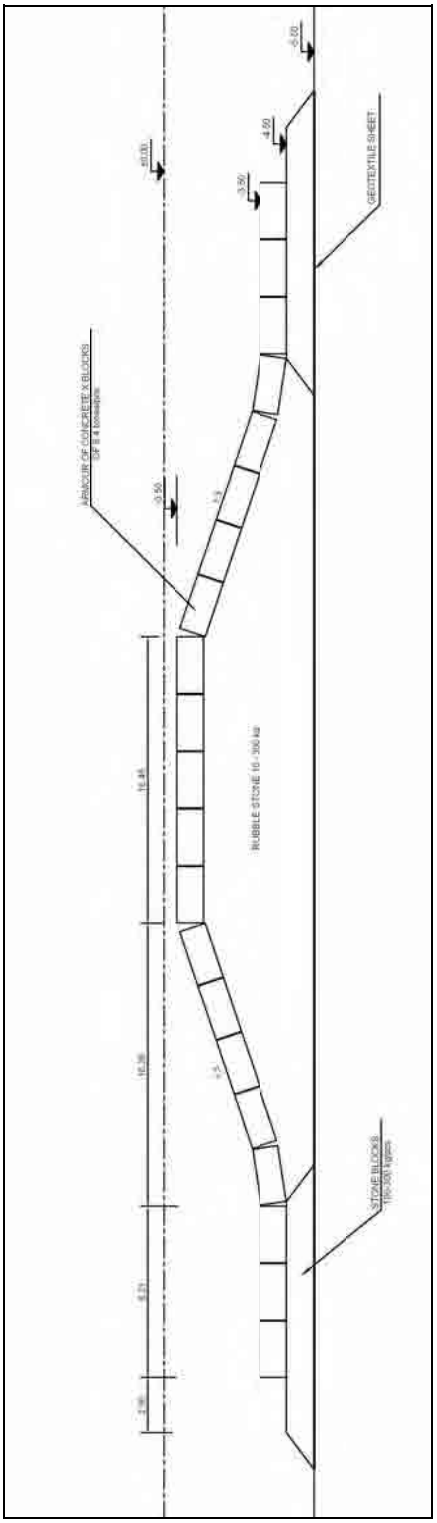

Fig. 4.3.5: Standard cross section of submerged breakwater

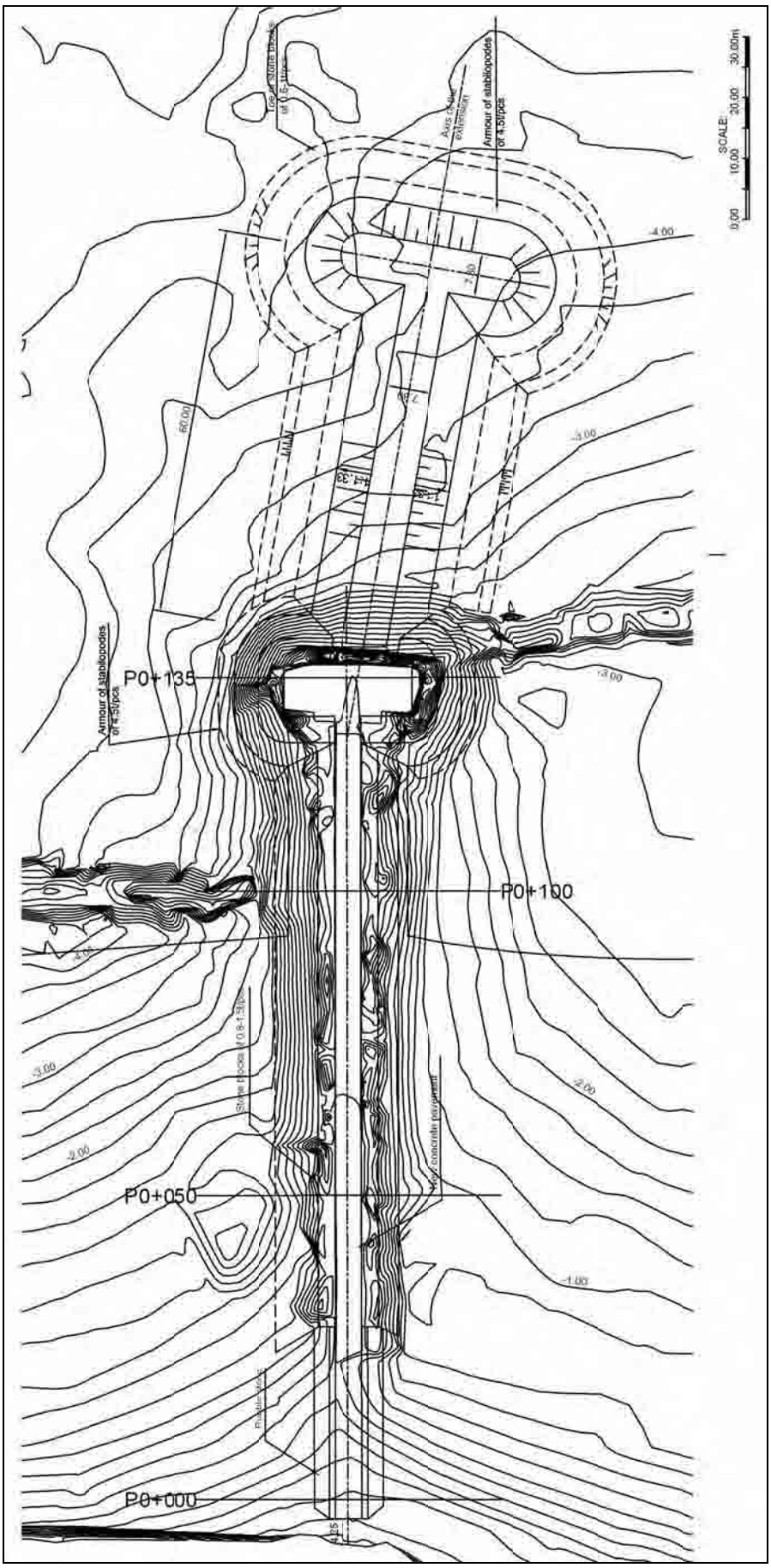

Fig. 4.3.6: Plan shape of rehabilitation and extension of jetty J-1

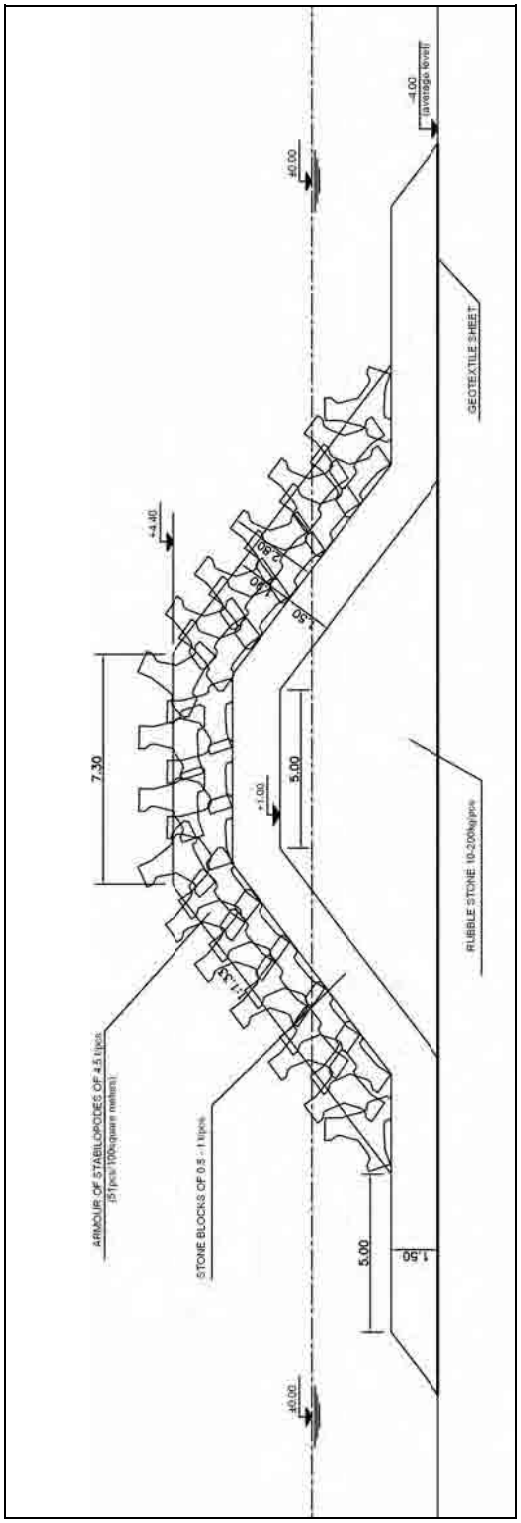

Fig. 4.3.7: Cross section of the head portion of extended jetty J-1

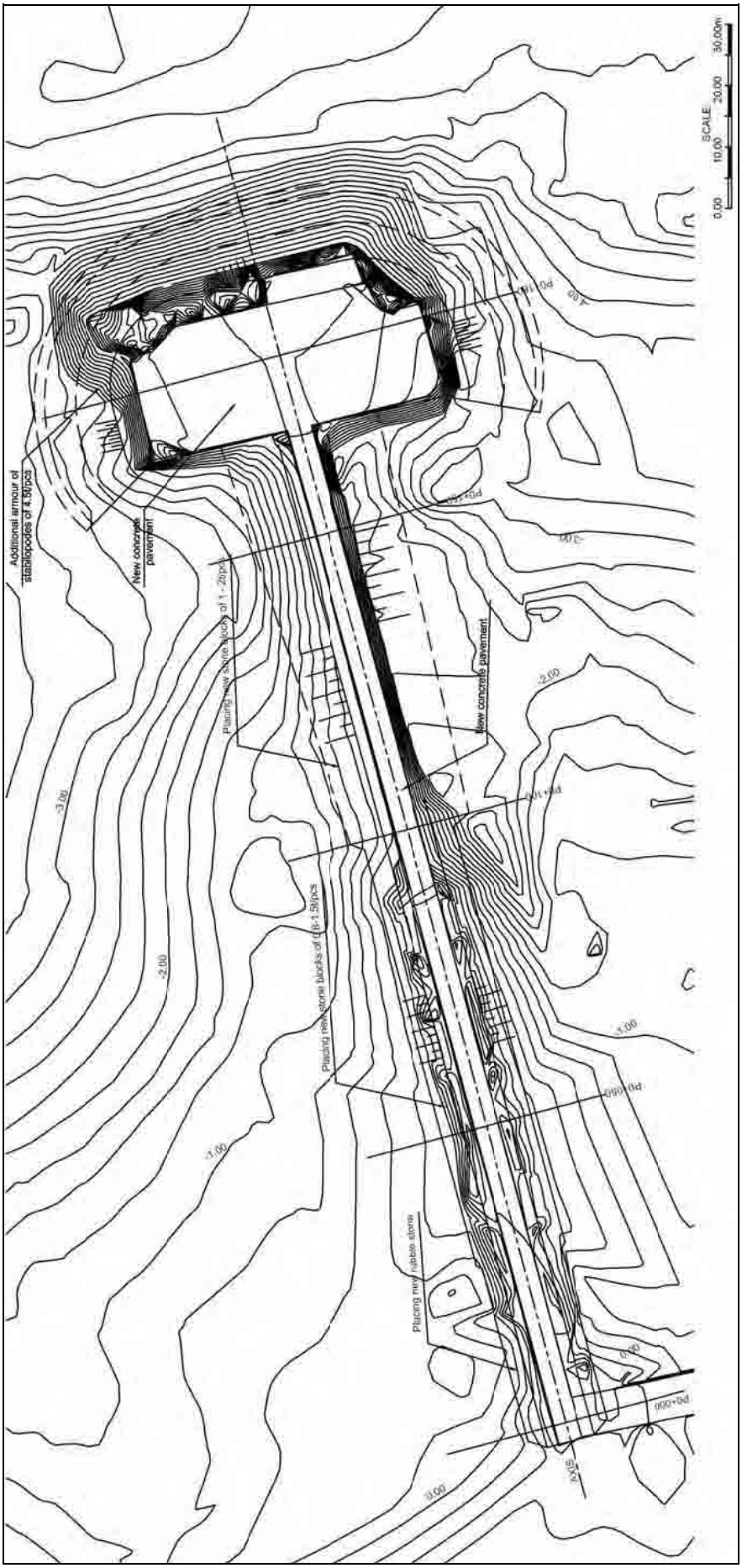

Fig. 4.3.8: Plan shape of Jetty-2 rehabilitation

The quantities of materials for construction and removal of the temporary access road are estimated as follows:

- Rehabilitation of existing roads: 2,100 m^2
- Rubble stone: 3,968 m^3
- Stone blocks of 0.5 to 1.0 ton: 2,864 m^3
- Stone blocks of 0.5 to 1.0 ton removal and replacing: 470 m^3

4.4 Implementation Schedule and Construction Plan

(1) Execution schedule

Because of the uncertainty of the exact data when the fund for the Project is secured and the Project Implementation Unit (PIU) is established, the implementation schedule is counted from the year after the provision of the fund. Execution of the construction works is planned to begin in January of the third year and to be completed in June of the fourth year. The schedules of execution, equipment mobilization, and labor mobilization are listed in Tables E.3.1 to E.3.3 in Appendix **E.3** of this volume. The schedule of construction works is summarized below.

Removal of the four existing groins will begin in early February and end in late May, of the third year. Rehabilitation and extension of the jetty J-1 and rehabilitation of the jetty J-2 are to be carried out simultaneously in the period from early February to the end of May of the third year. Construction of submerged breakwaters will be made in the period of 11 months from February to December of the third year, because the works are done mainly with floating cranes on the sea and will not disturb the people enjoying around beach.

A part of beach fill works will be done in March to May of the third year but the majority will be carried out in the period of eight months from mid-September of the third year to May of the fourth year.

(2) Equipment mobilization

Beach fill sand is mined by a dredger of floating crane barge with grab bucket, which has the productivity of 160 m^3/h. Three convoys each composed of 4 barges (1,200 m^3 capacity) carries the mined sand is transported from the mining site around Oltina via the Danube – Black Sea Canal to the quay at Agigea in South Constanța Port. From there 25-ton dump trucks with the capacity of 15 m^3 transport the sand to Eforie. At the peak of beach fill works, 164 transports will be required for which 28 trucks will run along the roads four times a day. Although the fill sand volume at Eforie is more than twice that at Mamaia, the execution period for beach fill is 100 days for Mamaia and 242 days for Eforie. Thus, the truck traffic of the Eforie component is lighter than the Mamaia component. Sand placement on beach is made with assistance of 3 bulldozer of 180 HP.

For marine works for construction of three submerged breakwaters, “X” blocks are fabricated at the Agigea area and transported to the construction site by a 1000-ton barge towed by a tugboat of 2 x 300 HP. They are installed on the submerged breakwaters by a floating crane of 15 ton capacity. The tugboat and floating crane also work for installation of geotextile sheets.

Rehabilitation and extension of the jetty J-1 and rehabilitation of the jetty J-2 are executed from land side with mobile cranes and other equipments.

Removal of existing structures is executed by a mobile crane from land side. When removal of submerged breakwaters is required, a floating crane will be mobilized for lifting 4.5-ton stabilopods.

4.5 Cost Estimate of Project Component "B"

(1) Project cost

The project cost is estimated as 28.72 million Euro, among which the net construction cost is 24.22 million Euro, based on the market price in the summer of 2006. The works-wise cost breakdown is listed Table 4.5.1, while the currency-wise cost breakdown is listed in Table 4.5.2.

Table 4.5.1: Works-wise cost breakdown of project cost at Eforie Nord using river sand

(units: million Euro)

No.	Item	Quantity	Amount
1	Construction works		
	Beach fill	467,000 m^3	8.82
	Submerged breakwaters (3 units)	675 m in total	12.14
	Rehabilitation of Jetty J-1	146 m	0.46
	Extension of Jetty J-1	60 m	0.99
	Rehabilitation of Jetty J-2	200 m	1.02
	Removal of existing groins	1 unit	0.45
	Temporary access road	500 m	0.34
	Net construction cost		24.22
2	Management and monitoring cost		0.82
3	Engineering Service		1.70
4	Taxes and duties		0.61
5	Base cost		27.35
6	Contingency		1.37
7	TOTAL		28.72

Note: 1) The engineering service fee is estimated as 7% of the net construction cost.
2) The taxes and public charges are estimated as 2.5% of the net construction cost.
3) The contingency is estimated as 5% of the total cost in 7).
4) All the cost is based on the market price in the summer of 2006.

Table 4.5.2: Currency-wise cost breakdown of project cost at Eforie Nord using river sand

(units: million Euro)

No.	Item	Foreign Cost	Local Cost	Total Cost
1	Material	0.64	5.50	6.14
2	Equipment	0.00	11.96	11.96
3	Labor cost	2.40	3.72	6.12
	Skilled	2.40	2.53	4.93
	Unskilled	0.00	1.19	1.19
4	Management (PIU) and monitoring cost	0.25	0.57	0.82
5	Engineering service	1.02	0.68	1.70
6	Taxes and duties	0.00	0.61	0.61
7	Base cost	4.31	23.04	27.35
8	Physical Contingency (Base Cost ×5%)	0.22	1.15	1.37
9	TOTAL	4.53	24.19	28.72

(2) Management and monitoring cost

The management and monitoring cost for the Project Component "A" at Mamaia Sud has been discussed in **3.3.4** of this volume. By referring to the cost mentioned there, the management cost for the Project Component "B" is 360,000 Euro.

The environmental monitoring cost is incurred from the year 2009 when the construction works will begin. The cost is 80,000 Euro for the period of 2009 to 2010. The physical monitoring cost is shared with the Component "A" by one-half each. The capital investment is 251,250 Euro and the cost for the period from 2007 to 2010 is about 381,000 Euro, which is the same as the Component "A." Thus, the total management and monitoring cost for the Component "B" is 821,000 Euro.

It should be mentioned here that the environmental and physical monitoring must be continued for many years to come. The annual cost for the environmental monitoring at the two project sites is about 17,000 Euro and the annual cost for the physical monitoring for the whole coast is about 65,000 Euro. Adding together, the annual monitoring cost becomes 82,000 Euro. It is the responsibility of the Romanian Government, especially the Ministry of Environment and Water Management and the National Administration "Romanian Waters" to allocate the necessary budget for the environmental and physical monitoring and to rationally expend it for the sound operation of the integrated coastal zone management.

(3) Maintenance cost

The present project of coastal protection and rehabilitation at Eforie Nord does not foresee any significant maintenance work except for the environmental and physical monitoring. Submerged breakwaters and jetties will function for scores of years even though they may deteriorate or experience a certain amount of subsidence. Existing shore protection facilities reviewed in **5.4** of Volume 1 are examples of long durability even though many of them have been deteriorated.

The filled beach is not a permanent structure, but it will be gradually deformed by wave and current actions with a certain volume of filled sand transported northward beyond the sand-retaining jetty. Nevertheless, the shoreline of the filled beach is expected to be stabilized in several years according to the prediction by numerical simulation. One unknown factor is the

cross-shore sediment transport, which may bring out sediment offshore. The rate of offshore sediment transport will be small by the presence of three submerged breakwaters, but there still remains a possibility of shoreline retreat beyond the prediction by numerical simulation. When the shoreline retreat will become excessively large, a new rehabilitation project should be planned and implemented. Regular monitoring of beach morphology is thus the important work to be continued for many years after the project implementation.

By the reasons explained in the above, no maintenance cost is included in the present project cost estimate. See **3.3.4 (3)** for further explanation.

4.6 Estimate of Total Project Cost at Mamaia Sud and Eforie Nord

The estimated costs of the project components "A" and "B" are added together to yield the total project cost. The total project cost when the river sand from the Danube is used for both Mamaia Sud and Eforie Nord is estimated as 40.23 million Euro on the basis of the market price in the summer of 2006 and its currency-wise breakdown is listed in Table 4.6.1. The total project cost when the sea sand around Midia Port is used for Mamaia Sud is estimated as 47.69 million Euro and its currency-wise breakdown is listed in Table 4.6.2.

For the whole project of the Components "A" and "B," the management and monitoring cost for the period of the first to fourth years is estimated as 1,660,000 Euro by adding the cost for the two components together.

The present project cost does not include the maintenance cost, because no significant maintenance works seem to be necessary in the present project. See **3.3.3 (3)** for further explanation.

Table 4.6.1: Total project cost with the case of using river sand for Mamaia Sud

(units: million Euro)

No.	Item	Foreign Cost	Local Cost	Total Cost
1	Material	1.01	7.14	8.15
2	Equipment	0.00	17.30	17.30
3	Labor Cost	3.25	4.78	8.03
	Skilled	3.25	3.30	6.55
	Unskilled	0.00	1.48	1.48
4	Management (PIU) and monitoring cost	0.50	1.16	1.66
5	Engineering Service	1.41	0.94	2.35
6	Taxes and Duties	0.00	0.84	0.84
7	Base Cost	6.17	32.16	38.33
8	Physical Contingency (Base Cost ×5%)	0.31	1.61	1.92
9	TOTAL	6.48	33.77	40.25

Table 4.6.2: Total project cost with the case of using sea sand for Mamaia Sud

(units: million Euro)

No.	Item	Foreign Cost	Local Cost	Total Cost
1	Material	2.19	7.66	9.85
2	Equipment	3.99	15.23	19.22
3	Labor Cost	4.80	6.10	10.90
	Skilled	4.80	4.00	8.80
	Unskilled	0.00	2.09	2.09
4	Management (PIU) and monitoring cost	0.50	1.16	1.66
5	Engineering Service	1.68	1.12	2.80
6	Taxes and Duties	0.00	1.00	1.00
7	Base Cost	13.16	32.26	45.42
8	Physical Contingency (Base Cost ×5%)	0.66	1.61	2.27
9	TOTAL	13.82	33.87	47.69

CHAPTER 5:

POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

Chapter 5 Potential Environmental Impacts and Mitigation Measures

5.1 Water

5.1.1 Basic Data on Water Quality

After 1990 the general economical decline in Romania led to a continuous diminishing of the nutrients loads of the Danube waters and consequently of their concentrations in the coastal waters. As a result the frequency of bloomings and episodes of hypoxia decreased considerably and a general improvement of the environmental state of the marine environment has been observed. However, the year 2005 was marked by significant increases of all nutrient concentrations. The increases were attributed to the exceptional discharges of the Danube River in 2005, although the increase of total inorganic nitrogen fits into the slight increasing tendency recorded in the last years.

The National Institute of Marine Geology and Geo-ecology (GeoEcoMar) data obtained in 2006, within the framework of the JICA commissioned field survey of the priority project areas, indicate a returning to normality of total inorganic nitrogen concentration. However, the phosphorus concentrations remain locally relatively high, especially in the Mamaia Sud area, despite the intensive phytoplankton activity demonstrated by dissolved oxygen saturations. This indicates moderate local inputs of nutrients, the most likely sources being the discharge of fresh water from the Lake Tabacarie for Mamaia Sud and discharge of municipal waters of Eforie Nord. The small “river” from the Lake Tabacarie flows into the sea at about 200 m point south from the south jetty in Mamaia Sud. The area of this lake is 84 ha, the catchment-basin is 9.6 km^2 and the water is polluted with urban drainage. The field work results show that this drainage spreads partially to the sea in front of the Mamaia Sud beach.

As for other contaminants, the heavy metals pollution does not represent a problem. Excepting for Pb, the values (means and/or variation range) reported both by the Environment Protection Agency Constanța (EPAC) and NIMRD "Grigore Antipa" are significantly lower than the tentative values for the coastal marine waters.

The concentration of pesticides was found to be rather low, with some slightly elevated concentrations of lindane near the Danube discharge (GEF/BSEP 1997). The concentrations reported by EPAC are significantly lower than the tentative quality criteria for coastal marine waters.

Table 5.1.1 lists the average values of physico-chemical parameters and nutrient concentrations in surface water from the Mamaia Sud and Eforie Nord areas. Generally, the water from both areas belongs to quality class I; two values exceeding the Class I limit but less than the limit for quality class II were recorded for orthophosphates (PO_4^{3-} = 0.17 and 0.19 mg/l, $P\text{-}PO_4^{3-}$ = 0.055 and 0.062 mg/l) in the Mamaia Sud area (order no. 1146/2002). Both, together with a few other higher values still within the limit for Class I, were attributed to the influence of the Lake Tabacarie discharge. O_2 Saturation from both areas satisfies ultra-oligotrophic and oligotrophic stage (>70%).

Table 5.1.1: Physico-chemical characteristics and nutrient concentrations in surface water from the Eforie Nord and Mamaia Sud areas

Parameter	Mamaia Sud		Eforie Nord	
	Mean	Variation range	Mean	Variation range
Salinity, psu	13.5	12.0 – 14.1	14.0	13.8 – 14.2
Conductivity[1)], mS/cm	22.5	20.2 – 23.6	23.3	23.1 – 23.6
pH[1)], pH units	8.45	8.33 – 8.52	8.45	8.38 – 8.49
T, °C	19.5	18.0 – 21.7	19.2	17.8 – 22.0
Eh[2)], mV	358.3	310 – 418	372.5	355 – 386
DO, mg/l	10.99	8.45 – 11.11	10.44	9.60 – 11.84
O2 Saturation, %	117.5	104.0 – 127.2	120.8	114.2 – 142.5
Turbidity, ftu	6	3 – 12	6	3 – 11
Apparent Color, Pt-Co units	33	19 – 65	31	19 – 61
PO_4^{3-}, mg/l	0.09	0.02 – 0.19	0.05	0.01 – 0.11
$N - NO_2^-$, mg/l	0.006	0.004 – 0.012	0.009	0.004 – 0.044
$N - NO_3^-$, mg/l	0.102	0.088 – 0.115	0.106	0.066 – 0.146
SiO_2, mg/l	0.066	0.018 – 0.291	0.038	0.023 – 0.101

1): standardized for 25°C;
2): standardized for the standard hydrogen electrode.

5.1.2 Water Impact Prognosis

Main sources of water pollution may be the turbidity associated with sand mining and beach filling operation. Accidental spills of fuel and other oil products from the equipment may need to be accounted for but no heavy metal pollution is to be expected. The river sand from the Danube has no silty components, while the sand mined off Midia Port will contain some silty components.

Present mining of aggregate for commercial use is made by employing bucket dredgers and floating cranes equipped with grab buckets. Dredged aggregate is loaded on hopper barges, which are towed or pushed along the Danube to the unloading quays. Sand for beach fill mined from the sand bars of the Danube will be transported through the Danube – Black Sea Canal to the unloading quays, from where dump trucks will be mobilized to carry sand to the designated beaches. The unloading quay will be at Basarabi for the beach fill at Mamaia and the south harbor of Constanța for the beach area south of Agigea. When the river sand is dredged, turbidity will not increase by dredging operation, because of coarseness of the sand.

When the sea sand is used, it will be dredged by some trailing hopper suction dredge such as the Dunărea of the River Administration of the Lower Danube, Galati. The dredge will store sand in her hopper and navigate from Midia Port to the offshore of beach fill site. Then the dredge will eject sand to the beach through floating pipelines activated by her pumps. When the sea sand is dredged, turbidity will be increased by the dredging operation, but the sediment will settle down after some time.

Beach fill is carried out by bringing sand from the outside and placed on the beach and in the sea. The source of beach fill sand is presently considered either the riverbed of the Danube or the seabed around Midia Port.

During the filling operations the seawater turbidity will increase significantly, depending on the finer material content of the filling sand. However, the increase will be temporary and, as all operations will be done off-season, it will not affect the tourism industry.

Table 5.1.2 lists the results of the evaluation of water impact by beach fill operations on Mamaia Sud and Eforie Nord. Low impact is expected by using river sand for beach fill because of coarseness of the sand. However, moderate impact is expected by using sea sand for beach fill because of the finer material content of the sand.

Table 5.1.2: Evaluation of water impact at Mamaia Sud and Eforie Nord

No.	Description	Sand source	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	Beach fill	River	-1	0
C	Beach fill	Sea	-2	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

5.1.3 Impact Mitigation Measures

Impact mitigation measures are as follows;

- Some silt protection measures will be employed to mitigate the water pollution. Silt protecting screens need to be spread when the sea sand is used for beach fill.
- Every care will be taken to minimize oil spill from working vessels and other equipments.
- Although impact after construction was evaluated 0, monitoring work should be continued both during and after construction works of the project implementation.
- The authorities are requested to take appropriate measures to avoid the pollution of the Mamaia Sud shore by the discharge from the Lake Tabacarie.

5.2 Air

5.2.1 Basic Data on Air Quality

Weather condition in Constanța area shows four typical seasons and is influenced by the presence of the Black Sea. The annual air temperature variation is smaller than those in other inland areas in Romania. The mean temperature through the year is 11.3 degrees. The mean temperatures in the summer season (June to August) and in the winter season (December to February) are around 21 degrees and 1 degree, respectively. A characteristic of the air temperature in Constanta is the large difference between the absolute maximum and minimum monthly temperatures. For example, the maximum temperature in January during the period from 1901 to 1990 was 18.8 degrees, while the minimum temperature in the same month was –24.7 degrees showing a difference of 43.5 degrees.

According to the report published by the Environmental Protection Agency Constanța on monitoring NH_3, SO_2, NO_2 and rates of particle deposition, the yearly average general pollution coefficients are rather low indicating low atmospheric pollution, despite some temporary exceedings of the quality norms (Order 592/2002). Some factories in Constanta are

included in the list of the industrial units which generate frequent exceedings of the maximum admissible concentrations of air quality parameters. Constanța is not included in the list of hot spots for air pollution.

Table 5.2.1: Monthly air temperature at Constanța

(Celsius degrees)

Year \ Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
1901 - 1990	mean	0.0	1.1	4.4	9.5	15.1	19.6	22.1	21.9	18.2	13.2	7.6	2.8	11.3
	max.	18.8	23.3	30.8	31.9	36.5	36.9	38.5	36.8	34.8	31.0	26.5	21.0	
	min.	-24.7	-25.0	-12.8	-4.5	1.8	6.4	7.6	8.0	1.0	-12.4	-11.7	-21.6	
2002	mean	0.3	7.4	8.1	9.8	17.2	21.6	25.8	23.2	18.9	13.7	10.2	-0.8	13.0
	max.	17.2	21.7	25.4	20.1	27.2	30.6	33.2	32.4	30.7	24.0	21.8	14.3	
	min.	-12.4	-1.8	1.2	-0.5	8.8	10.0	17.4	17.0	9.0	4.0	1.0	-13.6	
2003	mean	1.0	-2.8	2.8	7.7	17.9	22.4	23.1	24.2	17.6	12.3	8.7	3.2	11.5
	max.	13.0	8.9	13.6	19.8	29.0	32.5	31.2	31.6	27.6	25.5	21.8	12.9	
	min.	-10.7	-12.9	-5.8	-0.2	7.7	13.6	16.0	13.8	9.4	-0.9	0.7	-7.0	

Source: Romanian Statistical Yearbook-2003, 2004

5.2.2 Sources of Pollution during Project Execution

During the project execution air pollution may be caused by dredging activities, transport of dredged sand and construction works.

According to an impact study on sand mining[1], the total fuel consumption was calculated at about 224kg/day, 5,088 kg/month and 45.84 ton/year for mining 125,000 m^3/year of sand from the Danube River bed.

The activities are as follows:

Working time: 12 hours/day, 20 days/month and 9 month/year
Equipment: draglines mounted on floating platforms (NOBAS), electrical power generators.

Mobile sources which may cause air pollution in populated areas are shipment barges with the 500, 1000 and 1500 tones capacity, dump trucks and construction equipment. The mobile emission sources, cars and equipment cause the emission in atmosphere of a complex of organic and inorganic pollutants: NO_x, SO_x, hydrocarbons (HC), carbon monoxide (CO) and particulate matter (PM).

[1] Environmental Impact Study for the "Ostrovu Ciocanesti" Economic Objective, Calarasi District, SC. ARGOS SA. CERNAVODA, 1999.

Table 5.2.2: Maximum daily traffic during the construction period

Unit: trips/day

Location	Sand transport by 25-ton truck	Stone transport by 16 ton truck
No.1 – Blvd. Aurel Vlaicu at the northern limits of the City of Constanta, close to Mamaia resort.	194	-
No.2 – The National Road DN39 (Constanta - Mangalia - B/C Bulgaria), km 13+800, at the northern incidence to the Town of Eforie Nord	168	38
No.3 – Blvd. Aurel Vlaicu at the western limits of the City of Constanta, between Blvd. Bratianu and the intersection with Blvd. Baba Novac	194	-

Table 5.2.2 lists the maximum daily traffic during the construction period at the three locations as shown in Fig.5.2.1, where a traffic survey was carried out. Table 5.2.3 and Table 5.2.4 list the equipments to be mobilized for Mamaia Sud and Eforie Nord respectively.

5.2.3 Air Impact Prognosis

Air pollution will be limited to the exhaust fumes of the equipments used for the execution of dredging, transport of materials and construction works.

Cochirleni ballast extraction place, one of the candidate sites for sand mining is located at km 305 on the Danube. There are three shoals forming islands with dense forests, and the dredging work is carried out between the shoals. The riverbank is a meadow and a shrub zone. It is far from town, and some fisherman huts are seen. Pasturing of cows is done. The environment of the other candidate sites in the Danube is more or less the same. Therefore, impact of exhaust gas on population is very low.

A traffic survey was conducted from 21st to 23rd of June 2006 by IPTANA S.A. under the contract with the Study team. According to the survey, the number of the traffic of existing large vehicles traveling on the roads, which are equivalent of the dump trucks to be used for sand and stone transport, was more than one thousand per 12 hours; i.e. 1,329 at Location No. 1, 1,372 at Location No. 2 and 4,234 at Location No. 3. Those traffic volumes are shown in Fig. 5.2.2 to Fig.5.2.4. The daily trips of dump trucks for construction works are estimated as less than 200 as listed in Table 5.2.2. If the above daily trips of dump trucks up and down the lanes are added to the existing traffic, the added impact of exhaust gases on roadside environment is minimal (an increase of 5% to 15% of the actual emissions).

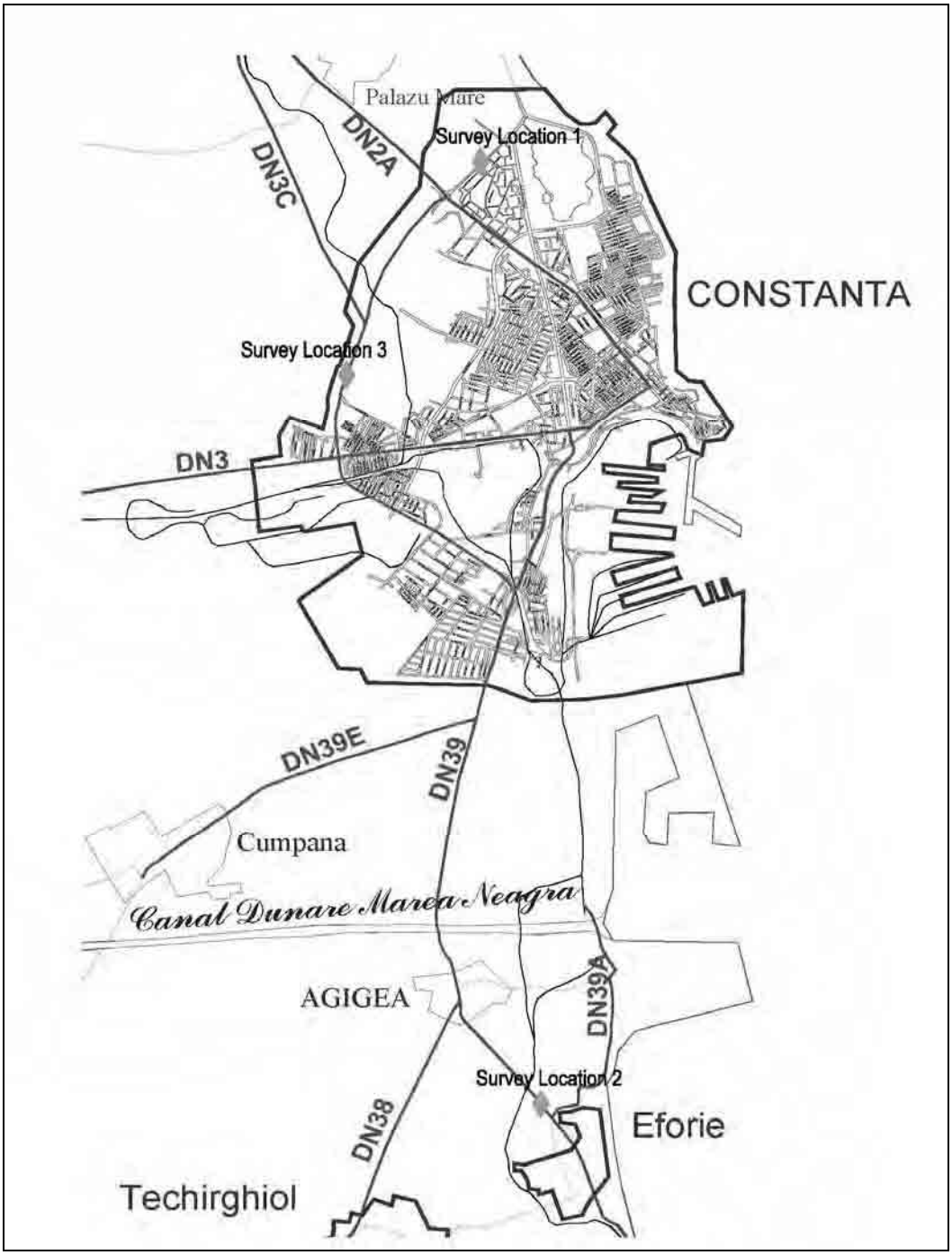

Fig.5.2.1: Map of traffic survey locations

Table 5.2.3: Equipment list for Mamaia Sud

WORKS TYPE	No.	Description of equipment	Quantity
BEACH FILL	1	Trucks 25 t	50
	2	Bulldozer	3
	3	Excavator for sand loading in the trucks	6
	4	Barges 1500-2000 t for sand transportation	12
	5	Pushing boat	3
	6	Unloading crane	4
	7	Dredger 600-750 l	1
	8	Floating crane with grabs	1
BAGS GROINS	9	Truck 25 t for sand supply	1
	10	Mobile crane for loading the bags	1
	11	Truck 16 t for supply the bags to site	1
	12	Chain grabbing bucket for placing of bags excavation, filling etc.	1
	13	Truck 16 t for supplementary works	2
SUBMERGED GROIN	14	Chain grabbing bucket for excavation	1
	15	Excavator for sand container bags preparation	1
	16	Mobile crane for container bags loading and placing	1
	17	Truck 25 t for sand supply	1
RETAINING JETTY	18	Excavator	1
	19	Tug boat for geotextile installation	1
	20	Truck 16 t for rubble stone and block stone transportation	8
	21	Bulldozer for pushing of rubble stone	1
	22	Mobile crane for stone blocks arrangement and stabilopods installation and pavement concrete pouring	1
	23	Truck 16 t for stabilopods transportation	4
	24	Truck mixer for pavement concrete transportation	1
REHABILITATION OF THE EXISTING BREAKWATERS	25	Truck mixer 5 m^3 for concrete transportation	2
	26	Mobile crane for concrete pouring and stabilopods handling	2
	27	2 x 300 HP tug boat for geotextile installation	1
	28	Truck 16 t for stone transportation	10
	29	Crane for loading the stone on the barges	1
	30	1000 t barge for transportation and placing	1
	31	2 x 300 HP tug boat for barges transportation	1
	32	Floating crane 15 tf for stone & blocks installation	1
	33	2x300 HP tug boat for floating crane transportation	1
	34	Mobile crane for loading the stabilopods in the truck	1
	35	Truck 16 t for stabilopods transportation from storage to quay	5
	36	Mobile crane for loading the stabilopods on the barge	2
	37	1000 t barge for stabilopods transportation	1
	38	2x300 HP tug boat for barge transportation	1
	39	Floating crane 15 t for stabilopods placing	1
	40	2x300 HP tug boat for floating crane transportation and assistance	1
	41	120 HP launch for works inspections	1

Table 5.2.4: Equipment list for Eforie Nord

WORKS TYPE	No.	Description of activities	Quantity
BEACH FILL	1	Trucks 25 t	28
	2	Bulldozer	3
	3	Excavator for sand loading in the trucks	5
	4	Barges 1500-2000 t for sand transportation from Oltina to Agigea	12
	5	Pushing boat	3
	6	Unloading crane	6
	7	Dredger 600-750 l	1
	8	Floating crane with grabs	1
REHABILITATION OF EXISTING JETTY "J2"	9	Truck mixer	1
	10	Mobile crane	1
	11	Hammer-head crane	1
	12	Grab crane	1
	13	Truck 16 t	1
	14	Truck 16 t for stone blocks transportation	7
	15	Grab crane for blocks installation	1
	16	Truck 16 t for stabilopods transportation	2
	17	Mobile crane for stabilopods loading	1
	18	Crane for stabilopods installation	1
	19	Truck mixer for concrete transportation	2
REHABILITATION AND EXTENSION OF EXISTING JETTY "J1"	20	Truck mixer 5 m^3	3
	21	Mobile crane for concrete pouring	1
	22	Tug boat 2x300 HP	1
	23	Trucks 16 t for rubble stone & stone blocks transportation	12
	24	Grab crane for stone installation	1
	25	Trucks 16 t for stabilopods transportation	5
	26	Crane for stabilopods installation	1
	27	Hammer-head crane	1
	28	Mobile crane with grab	1
	29	Truck mixer for pavement concrete	1
NEW ARTIFICIAL REEFS	30	Truck for "X" blocks concrete transportation	5
	31	Mobile crane	2
	32	Tug boat 2x300 HP for geotextile installation	1
	33	Truck 16 t for rubble stone transport between Sibioara to Constantza Port	36
	34	Crane for loading the stone on the barge	2
	35	1000 t barges	2
	36	Tug boat 2x300 HP for barge transportation	1
	37	Floating crane 15 tf for rubble stone installation	1
	38	Tug boat 2x300 HP for floating crane transportation & assistance	1
	39	Mobile crane for loading "X" blocks on the trailer	1
	40	Trailers 20 t inclusive tractors for "X" blocks transportation	4
	41	Mobile crane for loading of "X" blocks on the barges	1
	42	1000 t barge for "X" blocks transportation and placing	1
	43	Tug boat for barge transportation	1
	44	Floating crane 15 tf for "X" blocks placing	1
	45	Tug boat for floating crane transportation	1

WORKS TYPE	No.	Description of activities	Quantity
REMOVAL OF EXISTING JETTIES AND BREAKWATERS	46	Mobile crane for removal of stabilopods from land side	1
	47	Truck 16 t for stabilopods transportation	1
	48	Hammer head crane for concrete removal	1
	49	Excavator	1
	50	Truck 16 t for transportation	1
	51	Excavator for stone removal	1
	52	Truck 16 t for transportation	5
	53	Floating crane for removal of stabilopods	1
	54	Tug boat for crane transportation & assistance	1
	55	Barge 500 t	1
	56	Tug boat for barge transportation	1
	57	Mobile crane for stabilopods unloading from barge and loading in the truck	1
	58	Truck 16 t for unloading stabilopods transportation	1
	59	Mobile crane for unloading stabilopods from the truck	1
	60	Diver equipment for connection of stabilopods	1
	61	Launch 150 HP for inspection of works	1

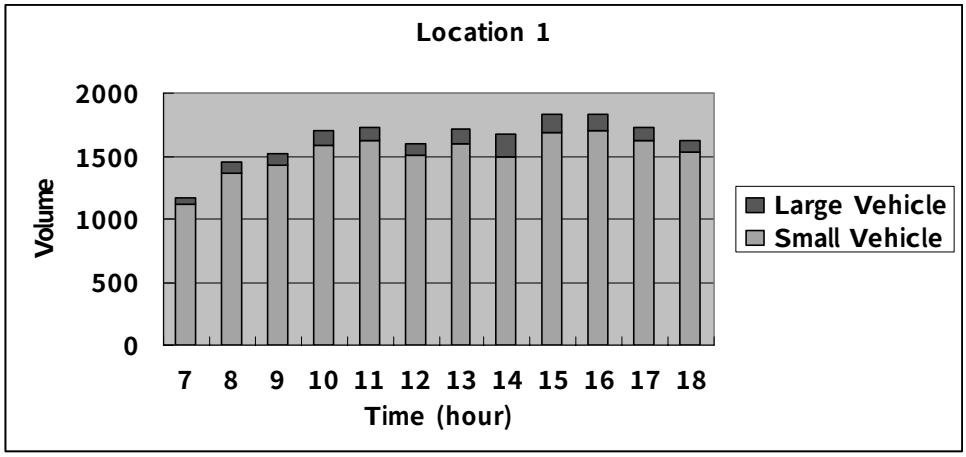

Fig. 5.2.2: Traffic volume at Location No. 1 – Blvd. Aurel Vlaicu at the northern limits of the City of Constanta, close to Mamaia resort.

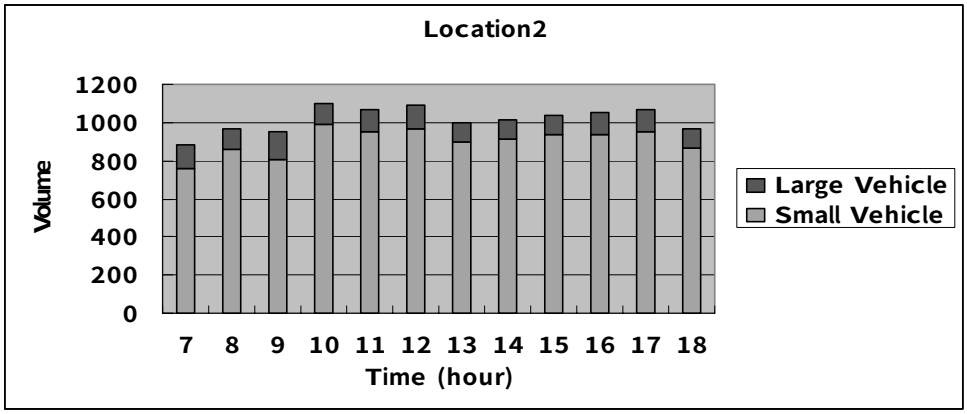

Fig. 5.2.3: Traffic volume at Location No. 2 – The National Road DN39 (Constanta - Mangalia – B/C Bulgaria), km 13+800, at the northern incidence to the Town of Eforie Nord

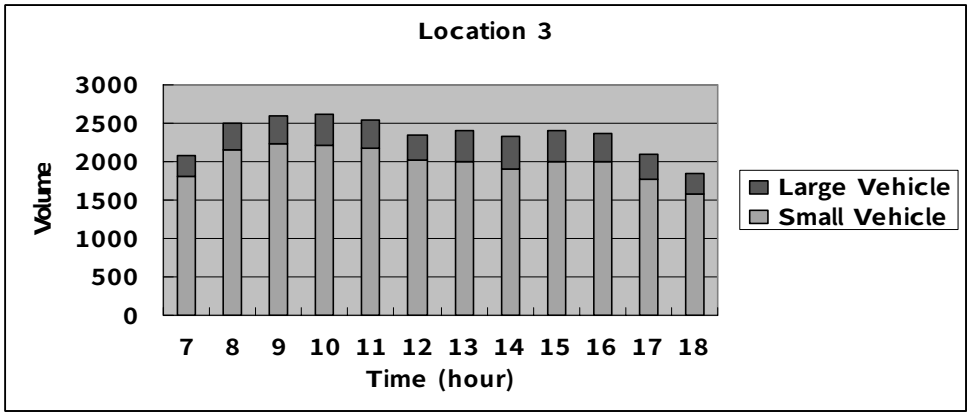

Fig.5.2.4: Traffic volume at Location 3 – Blvd. Aurel Vlaicu at the western limits of the City of Constanta, between Blvd. Bratianu and the intersection with Blvd. Baba Novac

Mamaia is situated on a littoral strip between the Black Sea and Lake Siutghiol, having 8 km long and 100 – 250 m wide beaches on the Black Sea shore. Mamaia is opened from early May till late September, but most visitors are coming between June 15 and August 25 when is the peak season and the atmosphere is brilliant. The land use there is resort hotels with a campground, cinemas, tennis and mini-golf courts, pools, bowling, etc. without residential blocks. Eforie Nord is a small town with resort hotels on the Black Sea shore with restaurants, bars, discos, open air cinema. The residential blocks are more than 100 m away from the beach. Visitors to Eforie Nord are coming during the same period as Mamaia.

As the construction works will be done off-season, the impact of air pollution on tourists will be negligible for both locations

Table 5.2.5: Evaluation of air impact

No.	Description	Sand source	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	Land transport	river	-2	0
C	Sea transport	sea	-1	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

Table 5.2.5 lists the results of comparison of the options examined and evaluation of air impact. Low impact is expected by sea transport of sand and stone for beach fill because of sea route. However, moderate impact is expected by land transport of sand and stone for beach fill although a small percentage of dump trucks are added to the existing traffic.

5.2.4 Impact Mitigation Measures

The following impact mitigation measures are proposed:

- Proper maintenance and operation of construction equipment such as excavation equipments and dump trucks.
- Watering work on the street.

5.3 Noise and Vibration

5.3.1 Basic Data on Noise and Vibration

Noise and vibration are regularly monitored by EPAC at four locations – South bus station, Heating power-station (CET), Capitol and Culture houses in Constanța. The yearly averages of noise levels at those locations with intense traffic were quite high for the years 1996-1998 but decreased significantly since 1999, actually being under the admissible limit for markets and commercial spaces (80 dB) and even under the admissible limit for parks (75 dB) (Standard for protection to noise – Ministry of Transport, Construction and Tourism). Occasional measurements of noise levels during summer time were done in the resort areas of the Romanian littoral, but no specific values are mentioned in the EPAC reports for 2004 and 2005.

5.3.2 Mobile Source of Noise and Vibration during Construction Works

According to an impact study on sand mining[2], in the extraction site the noise is produced by the diesel engines of the technical equipment. The acoustical power level is 80-90 dB at 80-150 Hz which may exceed a little bit the noise limit for equipments to be used outside buildings (Governmental Decision no. 539/2004).

Mobile sources which may cause noise and vibration in urban areas are dump trucks and construction equipments.

The type and number of dump trucks and heavy equipments to be used were shown in Table 5.2.3 and Table 5.2.4.

5.3.3 Noise and Vibration Impact Prognosis

The acoustical power level, 80-90 dB produced by the sand mining operation is not considered a threat to human health because the operation site is several km away from any human settlement.

Traffics of dump trucks carrying beach fill sand, stones, and concrete blocks on roads may cause some noise and vibrations. According to the traffic survey results, more than one thousand large vehicles with similar acoustical emissions are already passing in 12 hours, the supplementary acoustic discomfort will be minimal.

Working of backhoes, bulldozers, and other construction equipment on beaches and in the sea will not disturb residents, because the construction sites are far away from residential areas. At the same time, as the construction works will be done off season, the resultant increase of the noise level will not disturb the tourists. Table 5.3.1 lists the acoustical power level of construction equipments.

[2] Environmental Impact Study for the "Ostrovu Ciocanesti" Economic Objective, Calarasi District, SC. ARGOS SA. CERNAVODA, 1999.

Table 5.3.1: Acoustical power level of construction equipment

Name of equipment	Type	acoustical power level (Lw) dB(A)
Backhoe	8 t	110 – 114
	15 t	111 – 115
	32 t	112 – 116
Bulldozer	0.2 m^3	103 – 107
	0.4 m^3	106 – 110
	1.2 m^3	111 - 115
Truck-mounted crane	25 t	103 - 107
	35 t – 37 t	104 - 108

Source: Institute of Noise Control Engineering Japan

Table 5.3.2 lists the results of comparison of the options examined and evaluation of noise and vibration impact. Low impact is expected by sea transport of sand and stone for beach fill because of sea route. However, moderate impact is expected by land transport of sand and stone for beach fill although a small percentage of dump trucks are added to the existing traffic.

Table 5.3.2: Evaluation of noise and vibration impact

No	Description	Sand source	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	Land transport	river	-2	0
C	Sea transport	sea	-1	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

5.3.4 Impact Mitigation Measures

Impact mitigation measures are as follows:

– No construction activities during the night-time.
– Adequate maintenance of the engines to avoid malfunctions resulting in supplementary noise.
– Adequate instructions for truck drivers for safe and noise-free traffics.

5.4 Fauna, Flora and Biodiversity

5.4.1 Basic Data on Biodiversity

(1) Vegetation and fauna

The vegetation is represented by steppe grass land, cereal crops, and plants resistant to dryness, determined by the climatic conditions and soil morphology (sand and loess).The steppe area is characterized by the chernozem presence with associations of *Fistuga valesiaca, F. pseudovina, Stipa capillata*, etc. Today the cereal crops substituted for the natural vegetation. In very few forests *Quercus predescens* and *Quercus pedunculiflora* are predominant. In the Romanian Plain, the local lithological and hydrogeological conditions determine the appearance of different soils, the most important being the hydromorphic and halomorphic

soils. On the halomorphic soils we find plants like *Salicornia herbaceea, Sulsala soda, Artemisia maritime*, etc. For the river meadow vegetation we find the next varieties: *Salix, Populus, Alnus, Tamarix, Carex rostrata*, etc.

The steppe specific fauna is dominated by rodents like *Citellus citellus, Cricetus cricetus,* etc. The most frequent birds are *Coturnix coturnix, Perdix perdix*, etc. Reptiles are *Elaphe quatorliniata, Sauromates pallas*, etc. The specific fish are carp, *Leuciscus cephalus*, bleak pike, etc.

The sand mining perimeter is entirely situated several kilometers away from any locality, and within its limits there are no constructions or historical and architectural objectives of public interest.

There are natural reservations, Caiafele and Moroiu forests (area of 477.9 hectares) located between 303 and 315km on the left bank of the Danube, which are important nesting places for different birds (some of these are protected birds). In these easily flooded areas there are old willows, secular poplars and lianas. A typical swamp fauna can be seen in Ialomita Swamp, near the Rasova locality.

(2) Biological analyses of the sea water areas

Biological analyses were made for the four potential sand source areas and the two nearshore water areas of Mamaia Sud and Eforie Nord. The analyses include the following:

- identification of macrofauna species
- identification of meiofauna groups
- evaluation of population size: density and biomass
- assessment of size classes structure of filtrating epibiotic species

For the two main potential sand sources (Sulina and Cap Midia) and the two shallow water areas in front of Mamaia South and Eforie North tourist beaches, aiming to assess the qualitative and quantitative state of biological compartment of the coastal ecosystem, 39 stations were carried out in 2006. The locations of sampling stations are shown in Figure C.3.1 to Figure C.3.4 of Appendix C.

In the four studied sectors, 48 species or type of bottom organisms, dwellers in sediments, are randomly distributed in the stations and from one sector to another (Table 5.4.1). The average density of benthic population is about 51,000 sps/m^2, consisting of worms (63.65%), molluscs (24.57%), crustaceans (11.76%) and some other organisms (0.01%). The average biomass of the bottom organisms is about 230 g/m^2, from which 92.07% are molluscs, 7.01% crustaceans, only 0.86% worms and 0.07% other organisms (Table 5.4.2). Starting from these average values we have to underline that, in this shallow water zone characterized by high energy of waves and currents, there are great fluctuations between densities and biomasses from one station to another. The sampling sectors covering the zone of interest are distributed on the north to south general direction along the ecological gradient controlled by the Danube River discharge.

The parameters characterizing benthic associations in the four sectors (Table 5.4.3) underline the following differential aspects:

- Eforie North: richest biodiversity, highest densities and biomass expressed by number of individuals or weight per area unit and by the index of diversity, great biomasses as absolute wet weight, moderate – low ratio of H/H_{MAX}; the molluscs recorded in the sector have larger body size;
- Mamaia South: very similar with the Eforie North sector, although the specific diversity is smaller; the ratio HD/H_{MAX} has the highest value, explaining that the populations of different species have comparable number of individuals;
- Cap Midia: lowest diversity and density of populations: being a harbour-influenced sector, here the worm populations are more abundant;
- Sulina: specific diversity is rather high thanking to the heterogeneity of fauna comprising species of both freshwater and brackish water (marine) origin; dominant forms belong to meiobenthos and in this sector, strongly influenced by the Danube River, are recorded the smallest values of densities and biomasses;
- According to the distributions value of the different parameters the four analyzed sectors can be grouped in two categories:
    - Sectors of large fluctuations, with less abundant benthic populations (dominated usually by worms – organism with high potential of recovering their numerical structure after severe disturbances), under the stress of freshwater or pollution – Sulina and Cap Midia: this category of seabed represents the potential sand sources necessary to rebuilt eroded beach sectors along the tourist resorts; the extraction of sand seems to be not so much harmful to the ecosystem;
    - Sectors of higher specific diversity, higher abundance of populations (dominated usually by molluscs), reflecting a better stability of ecosystem, even in the conditions of slight and permanent erosion.

Some details concerning the analyzed samples can be summarized as in the following:

A. The highest specific diversity, with 38 taxa, was recorded in the Eforie North area, followed by Sulina and Mamaia South (Table 5.4.3).

B. Figure 5.4.1 shows dendrograme of similarity obtained from the parameters for each sampling stations as shown in Table 5.4.3. A dendrograme is a tree diagram frequently used to illustrate the arrangement of the clusters produced by a clustering algorithm. Dendrogrames are often used in computational biology to illustrate the clustering of different categories of parameters taken under analysis. On the basis of the cluster analysis the 39 stations performed in 2006 at the Romanian Black Sea shallow water can be primarily grouped in two clusters of abundance: lower and higher density/biomass of benthic organisms.

Thirty nine stations among four shallow water areas are divided into two groups by a dendrograme analysis. One is composed of 7 stations, none of which is among Eforie. The other is composed of 22 stations, either of which is among all the four areas. Furthermore, the other stations are divided into 2 sub-groups, one being composed of 13 stations, either of which is among all the four areas, and the other, 9 stations, none of which is among Cap Midia and Mamaia.

Table 5.4.1: General characterization of the Romanian shallow water benthos population in the Sulina, Cap Midia, Mamaia and Eforie North beaches

(F% - Constancy (or Frequency), D_{AVG} – average density (indvs.m^{-2}), D_{ECO} – ecological density, D_D% - dominancy for density, W_D - index of ecological significance, RkD – rank taxa for W_D, B_{AVG} – average biomass (g.m^{-2}), B_{ECO} – ecological biomass, D_B% - dominancy for biomass, W_B - index of ecological significance, RkB – rank taxa for W_B.

Crt. no	TAXA	F%	D_{AVG}	D_{ECO}	D_D%	W_D	RkD	B_{AVG}	B_{ECO}	D_B%	W_B	RkB
1	Nematoda	100.00	27764.18	27764	54.09	73.55	1	0.05	0.05	0.02	1.45	12
2	Leptoplana tremellaris	2.56	1.30	51	0.00	0.08	42	0.04	1.52	0.02	0.21	30
3	*Monocelis lineata*	2.56	7.77	303	0.02	0.20	29	0.00	0.18	0.00	0.07	37
4	Turbellaria varia	35.90	1857.53	5175	3.62	11.40	6	0.07	0.21	0.03	1.08	14
5	*Prostomatella sp.*	2.56	1.30	51	0.00	0.08	43	0.00	0.10	0.00	0.05	39
6	Nemertini varia	7.69	7.77	101	0.02	0.34	23	0.02	0.20	0.01	0.23	29
7	Polychaeta	79.49	2953.57	3716	5.75	21.39	3	1.77	2.23	0.77	7.84	6
8	Oligochaeta	7.69	79.32	1031	0.15	1.09	15	0.02	0.21	0.01	0.23	28
9	Chrysallida terebellum	2.56	1.30	51	0.00	0.08	44	0.00	0.15	0.00	0.07	38
10	*Cyclope neritea*	23.08	33.52	145	0.07	1.23	14	6.59	28.57	2.88	8.15	5
11	*Hydrobia ventrosa*	7.69	6.48	84	0.01	0.31	27	0.02	0.21	0.01	0.23	27
12	*Mohrensternia lineolata*	2.56	1.30	51	0.00	0.08	45	0.01	0.25	0.00	0.09	34
13	*Rissoa parva*	2.56	1.30	51	0.00	0.08	46	0.01	0.25	0.00	0.09	35
14	*Angulus exiguus*	15.38	66.05	429	0.13	1.41	13	4.75	30.89	2.07	5.65	8
15	*Cardium edule*	10.26	1941.21	18927	3.78	6.23	9	31.74	309.47	13.85	11.92	3
16	*Corbula mediterranea*	56.41	9895.53	17542	19.28	32.98	2	142.61	252.82	62.22	59.24	1
17	*Donax trunculus*	2.56	2.59	101	0.01	0.11	38	2.28	88.89	0.99	1.60	11
18	*Mya arenaria*	5.13	21.61	421	0.04	0.46	20	21.54	419.97	9.40	6.94	7
19	*Mytilus galloprovincialis*	12.82	14.25	111	0.03	0.60	19	1.07	8.33	0.47	2.44	10
20	*Venus gallina*	2.56	1.30	51	0.00	0.08	47	0.36	14.14	0.16	0.64	17
21	Bivavlvia - Veliconcha	38.46	625.16	1625	1.22	6.84	8	0.06	0.16	0.03	1.02	15
22	Halacarida	2.56	1.46	57	0.00	0.09	39	0.00	0.00	0.00	0.01	48
23	Balanus improvisus	51.28	728.45	1420	1.42	8.53	7	4.56	8.90	1.99	10.10	4
24	Larve - Cypris	15.38	604.77	3931	1.18	4.26	10	0.02	0.12	0.01	0.35	21
25	Copepoda	71.79	2446.03	3407	4.77	18.50	4	0.05	0.07	0.02	1.24	13
26	Leptinogaster histrio	25.64	173.38	676	0.34	2.94	12	0.01	0.03	0.00	0.28	25

Crt. no	TAXA	F%	D_{AVG}	D_{ECO}	D_D%	W_D	RkD	B_{AVG}	B_{ECO}	D_B%	W_B	RkB
27	*Cypria ophthalmica*	5.13	2.91	57	0.01	0.17	32	0.00	0.00	0.00	0.02	45
28	*Ibyocypris gibba*	2.56	1.46	57	0.00	0.09	40	0.00	0.00	0.00	0.01	47
29	*Ampelisca sarsi*	51.28	1657.93	3233	3.23	12.87	5	9.01	17.56	3.93	14.19	2
30	*Bathyporea guilliamsoniana*	15.38	16.84	109	0.03	0.71	18	0.01	0.07	0.00	0.26	26
31	*Cardiophilus baeri*	2.56	1.46	57	0.00	0.09	41	0.00	0.03	0.00	0.03	43
32	*Chaetogammarus tenellus behningi*	2.56	2.91	114	0.01	0.12	37	0.00	0.08	0.00	0.05	41
33	*Corophium curvispinum*	5.13	2.91	57	0.01	0.17	33	0.00	0.02	0.00	0.05	40
34	*Corophium sp. - juvenili*	5.13	5.83	114	0.01	0.24	28	0.00	0.00	0.00	0.02	44
35	*Euxinia maeotica*	5.13	56.13	1095	0.11	0.75	16	0.04	0.77	0.02	0.30	24
36	*Microdeutopus gryllotalpa*	5.13	3.89	76	0.01	0.20	30	0.00	0.02	0.00	0.04	42
37	*Nototropis guttatus*	10.26	7.77	76	0.02	0.39	22	0.02	0.20	0.01	0.30	23
38	*Euridice dollfusi*	5.13	16.76	327	0.03	0.41	21	0.05	0.88	0.02	0.32	22
39	*Jaera sarsi*	7.69	7.28	95	0.01	0.33	26	0.01	0.14	0.00	0.19	31
40	*Idotea baltica*	2.56	5.10	199	0.01	0.16	36	0.15	5.97	0.07	0.41	19
41	*Cumella limicola*	10.26	27.20	265	0.05	0.74	17	0.00	0.04	0.00	0.14	32
42	*Cumella pygmaea euxinica*	2.56	1.30	51	0.00	0.08	48	0.00	0.01	0.00	0.01	46
43	Cumopsis goodsir	7.69	7.69	100	0.01	0.34	25	0.00	0.06	0.00	0.12	33
44	*Iphinoe maeotica*	35.90	245.97	685	0.48	4.15	11	0.04	0.10	0.02	0.76	16
45	*Gastrosaccus sanctus*	5.13	3.89	76	0.01	0.20	31	0.00	0.06	0.00	0.08	36
46	*Crangon crangon*	5.13	2.59	51	0.01	0.16	35	0.18	3.54	0.08	0.64	18
47	*Diogenes pugilator*	7.69	7.77	101	0.02	0.34	24	1.90	24.75	0.83	2.53	9
48	Chironomida	2.56	5.83	227	0.01	0.17	34	0.15	5.86	0.07	0.41	20
	GROUP		**D_{AVG}**		**D_D%**			**B_{AVG}**		**D_B%**		
	VERMES		32672.73		63.65			1.97		0.86		
	MOLLUSCA		12611.56		24.57			211.04		92.07		
	CRUSTACEA		6038.20		11.76			16.06		7.01		
	VARIA		7.28		0.01			0.15		0.07		
	TOTAL		**51329.77**		**100**			**229.23**		**100**		

Table 5.4.2: Average values of densities, biomasses and dominance of different benthic taxonomic groups in the four studied sectors

Study area	N Taxa	VERMES	MOLLUSCA	CRUSTACEA	VARIA	TOTAL
		Density - sps.m^{-2}				
Eforie North	34	26827.40	19848.48	6290.51	-	52966.39
Mamaia	19	20655.61	18758.00	7142.29	-	46555.89
Cap Midia	16	24627.86	5470.49	4965.44	-	35063.80
Sulina	21	33147.73	184.66	681.82	710.23	34042.61
						Density - % (Dominance)
Eforie North	34	50.65	37.47	11.88	-	100
Mamaia	19	44.37	40.29	15.34	-	100
Cap Midia	16	70.24	15.60	14.16	-	100
Sulina	21	97.37	0.54	2.00	2.09	100
						Biomass - g.m^{-2}
Eforie North	34	1.86	281.66	11.80	-	295.33
Mamaia	19	2.45	282.83	15.23	-	300.51
Cap Midia	16	3.03	196.29	39.32	-	238.64
Sulina	21	0.65	81.92	0.21	0.79	83.36
						Biomass - % (Dominance)
Eforie North	34	0.63	95.37	4.00	-	100
Mamaia	19	0.82	94.11	5.07	-	100
Cap Midia	16	1.27	82.25	16.48	-	100
Sulina	21	0.78	98.27	0.25	0.95	100
Study area	N Taxa	VERMES	MOLLUSCA	CRUSTACEA	VARIA	TOTAL

Table 5.4.3: Characterization of parameters* for sampling stations in the Romanian shallow water

	D sps.m^{-2}	B g.m^{-2}	N.sp	H_{MAX}	H_D	H_B	H_D/H_{MAX}	H_B/H_{MAX}	E_D	E_B	1-D	1/D	1-B	1/B
Su 01	8920.45	0.5454125	5	2.32	0.39	1.47	0.17	0.63	0.90	0.45	0.10	1.11	0.55	2.22
Su 02	2897.73	6.111167045	10	3.32	2.44	0.33	0.73	0.10	0.26	0.92	0.74	3.83	0.08	1.09
Su 03	16534.09	0.148185227	5	2.32	0.48	1.70	0.21	0.73	0.86	0.39	0.14	1.17	0.61	2.55
Su 04	88096.59	817.7904398	9	3.17	0.29	0.02	0.09	0.01	0.94	1.00	0.06	1.07	0.00	1.00
Su 05	34261.36	0.543654545	5	2.32	0.42	1.18	0.18	0.51	0.89	0.59	0.11	1.13	0.41	1.70
Su 06	177500.00	4.366598864	3	1.58	0.34	0.45	0.21	0.28	0.90	0.85	0.10	1.11	0.15	1.17
Su 07	397.73	0.1198125	3	1.58	1.15	0.90	0.72	0.57	0.55	0.59	0.45	1.81	0.41	1.70
Su 08	738.64	0.154595455	2	1.00	0.39	0.06	0.39	0.06	0.86	0.98	0.14	1.17	0.02	1.02
Su 09	10000.00	0.528318182	3	1.58	0.47	0.22	0.30	0.14	0.83	0.94	0.17	1.20	0.06	1.07
Su 10	1079.55	3.336005682	8	3.00	2.57	0.81	0.86	0.27	0.21	0.73	0.79	4.81	0.27	1.36
CM011	45151.52	421.0215657	8	3.00	1.44	0.46	0.48	0.15	0.50	0.85	0.50	2.02	0.15	1.18
CM012	334090.91	326.117099	12	3.58	1.22	1.49	0.34	0.42	0.66	0.51	0.34	1.52	0.49	1.96
CM013	1111.11	1.035046465	4	2.00	1.94	0.57	0.97	0.28	0.27	0.79	0.73	3.67	0.21	1.27
CM021	30656.57	346.1883687	9	3.17	2.32	1.41	0.73	0.44	0.22	0.49	0.78	4.49	0.51	2.06
CM022	56616.16	365.1059	5	2.32	1.71	0.96	0.74	0.41	0.37	0.62	0.63	2.74	0.38	1.62
CM023	92626.26	72.1099	10	3.32	1.31	1.28	0.40	0.39	0.61	0.50	0.39	1.65	0.50	2.02
CM031	26161.62	233.6475	8	3.00	2.30	1.28	0.77	0.43	0.24	0.56	0.76	4.24	0.44	1.77
CM032	40707.07	179.6035	8	3.00	1.96	0.94	0.65	0.31	0.38	0.68	0.62	2.65	0.32	1.48
CM033	39090.91	202.9673	7	2.81	1.81	0.79	0.65	0.28	0.39	0.70	0.61	2.60	0.30	1.42
MA05	24292.93	145.7588	10	3.32	2.07	0.72	0.62	0.22	0.31	0.75	0.69	3.26	0.25	1.34
MB05	56111.11	491.3204	14	3.81	2.30	1.07	0.60	0.28	0.29	0.63	0.71	3.42	0.37	1.60

	D sps.m^{-2}	B g.m^{-2}	N.sp	H_{MAX}	H_D	H_B	H_D/H_{MAX}	H_B/H_{MAX}	E_D	E_B	1-D	1/D	1-B	1/B
M0103	56565.66	392.9439	13	3.70	2.31	1.05	0.62	0.28	0.28	0.68	0.72	3.56	0.32	1.47
M0105	65050.51	375.9293	10	3.32	2.06	0.57	0.62	0.17	0.34	0.83	0.66	2.92	0.17	1.21
M0203	62979.80	512.9913	12	3.58	2.40	1.01	0.67	0.28	0.25	0.69	0.75	4.03	0.31	1.44
M0205	34393.94	266.2922	7	2.81	1.74	0.81	0.62	0.29	0.37	0.70	0.63	2.68	0.30	1.42
M010	2388.00	40.6982	3	1.58	1.48	0.13	0.94	0.08	0.38	0.97	0.63	2.67	0.03	1.03
M011	60695.00	297.3140	5	2.32	1.92	0.12	0.83	0.05	0.29	0.97	0.71	3.39	0.03	1.03
M020	3980.00	0.8863	3	1.58	1.57	0.33	0.99	0.21	0.34	0.89	0.66	2.94	0.11	1.12
M021	99102.00	480.9935	7	2.81	1.43	0.15	0.51	0.05	0.46	0.96	0.54	2.18	0.04	1.04
EA05	141363.64	1114.4906	22	4.46	1.97	0.92	0.44	0.21	0.37	0.72	0.63	2.72	0.28	1.38
EB05	39292.93	367.3982	13	3.70	1.99	1.12	0.54	0.30	0.37	0.65	0.63	2.73	0.35	1.54
E013	19696.97	167.4983	10	3.32	1.69	0.21	0.51	0.06	0.39	0.95	0.61	2.54	0.05	1.05
E015	124494.95	1022.2211	17	4.09	1.93	0.65	0.47	0.16	0.39	0.82	0.61	2.59	0.18	1.22
E0203	17222.22	53.2160	13	3.70	2.43	0.35	0.66	0.10	0.22	0.90	0.78	4.60	0.10	1.11
E0205	42323.23	216.8651	12	3.58	2.07	1.80	0.58	0.50	0.35	0.36	0.65	2.89	0.64	2.78
E010	38407.00	0.1354	2	1.00	0.27	1.00	0.27	1.00	0.91	0.50	0.09	1.10	0.50	1.99
E011	32835.00	3.4149	6	2.58	1.50	1.69	0.58	0.65	0.43	0.36	0.57	2.32	0.64	2.75
E020	37611.00	7.2914	3	1.58	0.58	0.69	0.37	0.44	0.78	0.70	0.22	1.29	0.30	1.42
E021	36417.00	0.7334	2	1.00	1.00	0.26	1.00	0.26	0.50	0.91	0.50	2.00	0.09	1.09

*Total Density – sps.m-2, Total Biomass – g.m-2, Number of species per sample - N.sp, Maximum diversity index - HMAX, Index of diversity per sample for density - HD, Index of diversity per sample for biomass – HB, HD/HMAX Evennes: E=H/log(S), HB/HMAX Evennes: E=H/log(S), ED - Simpson index for density: D=sum(pi*pi), EB - Simpson index for density: D=sum(pi*pi), Simpson's index of diversity for density: 1-D, Simpson's reciprocal indexfor density: 1/D, Simpson's index of diversity for biomass: 1-B, Simpson's reciprocal indexfor biomass: 1/B

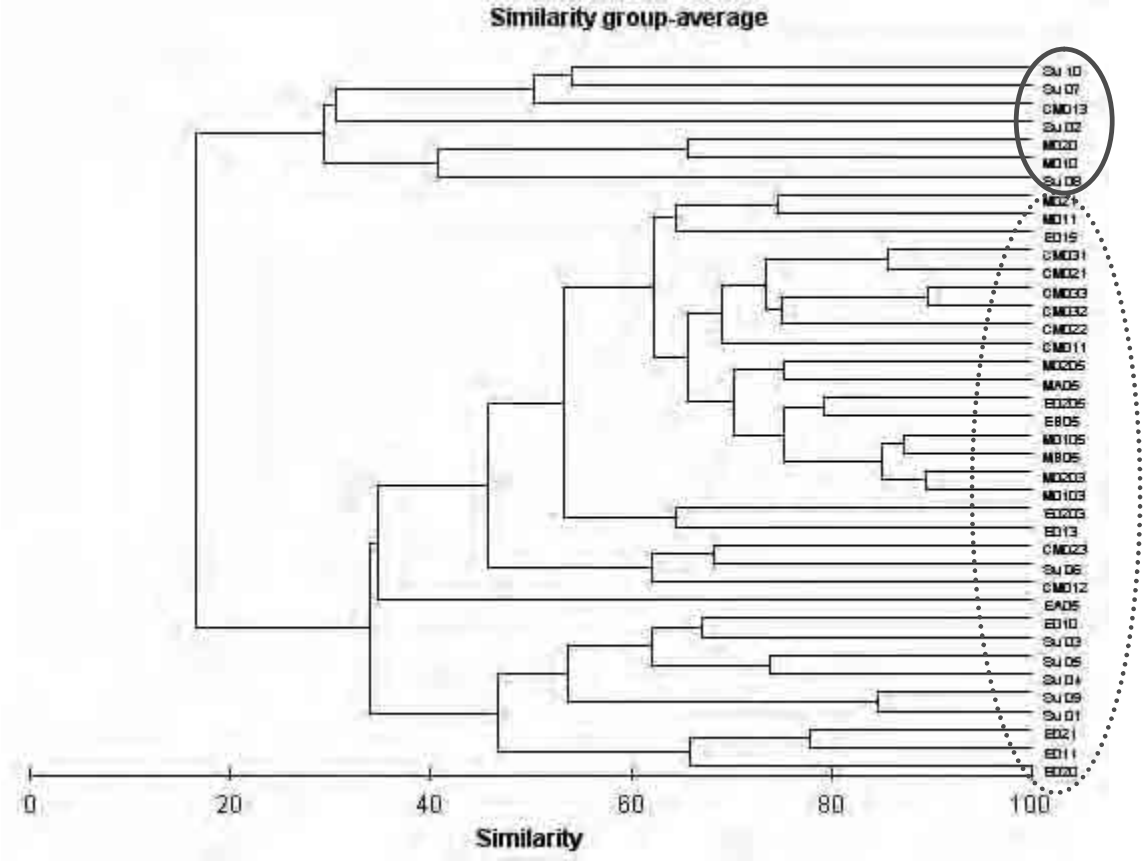

Fig. 5.4.1: Dendrograme of similarity between the stations performed in the Romanian shallow water (Sulina, Cape Midia, Mamaia and Eforie beaches) for the assessment of benthos population.

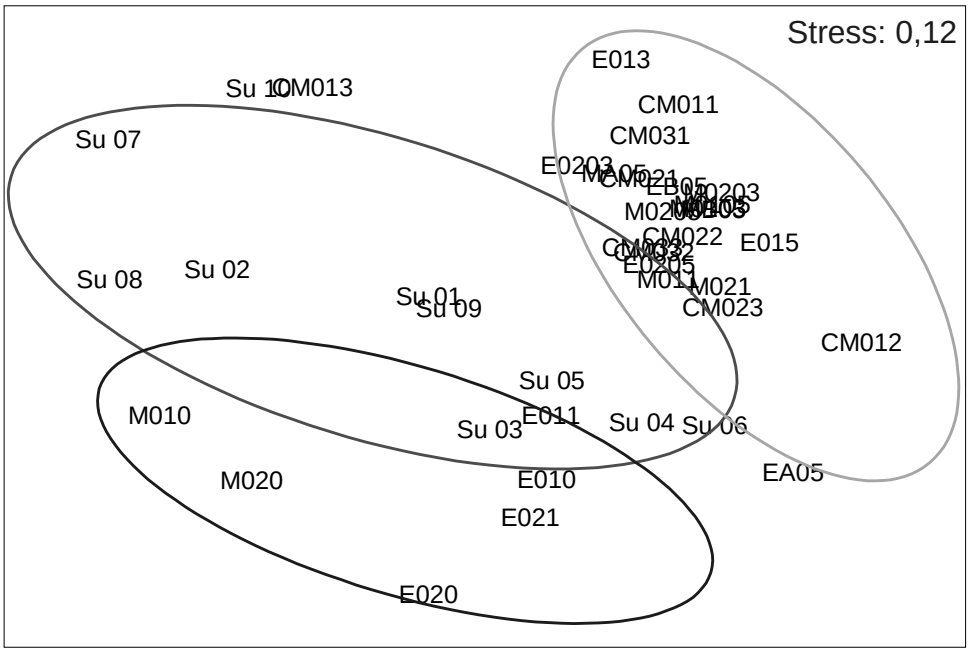

Fig. 5.4.2: MDS – ordination of all benthos stations performed at the Romanian shallow waters (Sulina, Cape Midia, Mamaia and Eforie beaches) in order to assess the ecological state of bottom populations.

(3) Biological analyses of the river water areas

The ecological state of bottom populations living on the sandy bottoms of the Romanian lower sector of the Danube River between Oltina and Cernavoda in 2006 was assessed by analyzing 25 samples; the results of sample sorting by species or taxonomic groups were processed and synthetic tables or graphics are presented in this report.

On the Danube River sector delimited by the Oltina (upstream) and Cernavoda (downstream) areas, the diversity of bottom populations living in sandy sediments was relatively low, only 10 taxa were found in the 25 stations performed in 2006. In some stations either no or one species were found; these stations are not taken into consideration in the data processing.

Comparing the qualitative and quantitative structures of bottom fauna in the 25 stations, the first emerging conclusion is the general low diversity and scarcity (Table 5.4.5), the heterogeneity of the populations distribution, the low similarity between the stations (Figure 5.4.3). The distribution of sediment types as well as their fauna is in patches.

The benthic populations have in general low densities and biomasses – on the average about 11,000 indvs/m^2 and 54 g/m^2 (Table 5.4.4). The most frequent and abundant organisms are the worms (Nematoda – 72% and Oligochaeta – 44%), followed by insect larvae (Chironomida – 28%) and bivalve (Corbicula fluminea – 16%); the other 6 forms recorded in the area of interest were found only in one station. This situation is well illustrated by the ecological significance index (WD), which gives the rank of species (RkD) according to densities. If we take into consideration the biomasses, the rank of organisms in the average population will be changed (Table 5.4.4).

As number of species the richest stations is at Cernavoda (9 taxa), followed by Oltina (4 taxa) and Cochirleni (3 taxa). We can appreciate that more or less the quantitative structure of the population from the three areas is generally similar to the qualitative one and the densities are increasing from upstream stations (Oltina) to downstream stations (Cernavoda). The pattern of biomass distribution is different, reflecting the specific weight of each population; for instance, in the Cochirleni area, the absence of mollusks causes a drastic drop of biomass.

In the three main studied areas the average pattern of species ranking is maintaining the worms populations and insect larvae being numerically on the first places. Usually, these forms are opportunistic being capable of recovering their populations after disturbances.

By using Multivariate Statistics Methods – Multidimensional Scaling (MDS), the ordination of rank similarity, between sites with different bottom communities, reflects the three areas. The coloured circles separate the clumps representing samples similar in species composition and abundance. (MDS) (Figure 5.4.4).

Taking into account the low biodiversity, the quantitative scarcity of bottom fauna and the opportunistic character of the existing populations on the sandy areas in the Romanian lower sector of the Danube River between Oltina and Cernavoda, we can consider the exploitations of the sediments for filling eroded beaches at the seaside as suitable, with low ecological costs and impact.

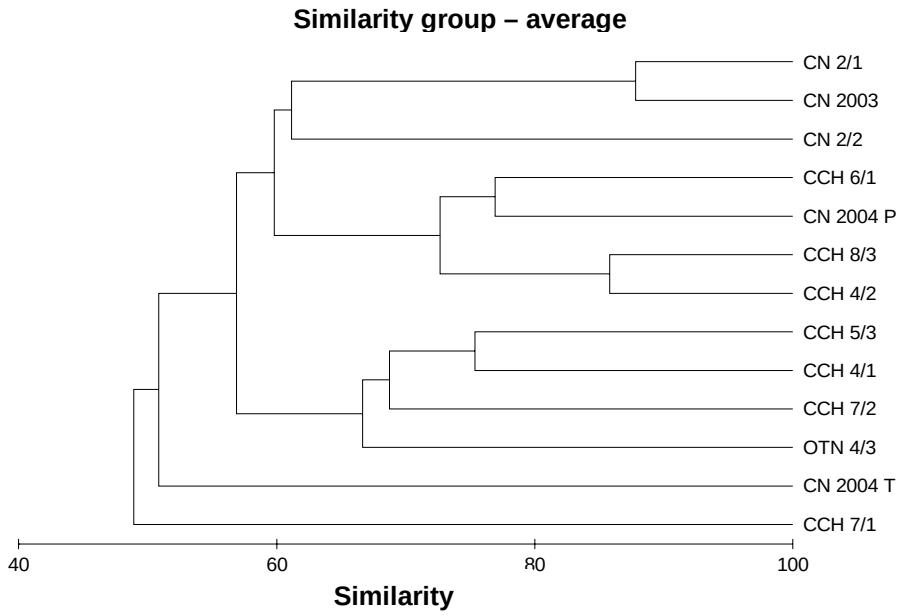

Fig. 5.4.3: Dendrograme of similarity between the stations performed in 2006 in the Danube River sector of interest (Oltina, Cochirleni and Cernavoda areas), for the assessment of benthos population

Table 5.4.4: General characterization of the Danube river benthos population in the Oltina, Cochirleni and Cernavoda (see Table 5.4.1 for explanation)

Crt. nr.	TAXA	Nooc	F%	A_D	D_{AVG}	D_{ECO}	D_D%	W_D	R_{kD}	A_B	B_{AVG}	B_{ECO}	D_B%	W_B	R_{kB}
1	**Cordylophora lacustris**	1	4	17.2	0.7	17.2	0.01	0.16	10	0.00002	0.000001	0.00002	0.000001	0.002	10
2	Nematoda	18	72	161782	6471.3	8987.9	57.92	64.58	1	0.32	0.013	0.018	0.024	1.305	6
3	Oligochaeta	11	44	103238	4129.5	9385.3	36.96	40.33	2	20.65	0.826	1.877	1.516	8.167	3
4	**Lythoglyphus naticoides**	1	4	516	20.6	516.0	0.18	0.86	5	27.52	1.101	27.520	2.021	2.843	4
5	*Corbicola fulminea*	4	16	1204	48.2	301.0	0.43	2.63	4	814.08	32.563	203.520	59.773	30.925	1
6	*Viviparus viviparus*	1	4	344	13.8	344.0	0.12	0.70	7	497.08	19.88	497.080	36.498	12.083	2
7	Copepoda	1	4	516	20.6	516.0	0.18	0.86	6	0.01	0.0004	0.010	0.0008	0.055	9
8	**Cypridopsis vidua**	1	4	344	13.8	344.0	0.12	0.70	8	0.02	0.0009	0.022	0.002	0.081	7
9	*Bezzia*	1	4	172	6.9	172.0	0.06	0.50	9	0.03	0.001	0.034	0.003	0.101	8
10	Chironomida-larve	7	28	11180	447.2	1597.1	4.00	10.59	3	2.24	0.089	0.319	0.164	2.144	5
	TOTAL			**279313.2**	**11172.5**		**100**			**1361.95**	**54.48**		**100**		

Table 5.4.5: Bottom populations parameters* from the Danube River in 2006, in the zone of interest (see Table 5.4.3 for explanation)

Stations	Nr. sp	D indvs.m^{-2}	B $g.m^{-2}$	H_{MAX}	HD	HB	HD/H_{MAX}	HB/H_{MAX}	ED	EB	1-D	1/D	1-B	1/B
CN 2003	2	39732	166.152	1.00	0.04	0.28	0.04	0.28	0.99	0.91	0.01	1.01	0.09	1.10
CN 2004 P	2	5848	0.032	1.00	0.32	0.88	0.32	0.88	0.89	0.58	0.11	1.12	0.42	1.72
CN 2004 T	8	128501	335.255	3.00	0.77	0.50	0.26	0.17	0.76	0.83	0.24	1.32	0.17	1.20
CN 2/1	3	33484	151.435	1.58	0.26	0.25	0.17	0.16	0.92	0.92	0.08	1.08	0.08	1.09
CN 2/2	2	8490	1.686	1.00	0.06	0.00	0.06	0.00	0.99	1.00	0.01	1.01	0.00	1.00
OTN 4/3	2	344	0.035	1.00	1.00	0.08	1.00	0.08	0.50	0.98	0.50	2.00	0.02	1.02
CCH 4/1	3	2924	0.449	1.58	1.26	0.65	0.80	0.41	0.49	0.74	0.51	2.05	0.26	1.36
CCH 4/2	3	24768	1.991	1.58	1.02	0.24	0.64	0.15	0.52	0.94	0.48	1.94	0.06	1.07
CCH 5/3	3	3650	0.280	1.58	1.33	1.10	0.84	0.70	0.46	0.48	0.54	2.18	0.52	2.07
CCH 6/1	2	8342	0.034	1.00	0.08	1.00	0.08	1.00	0.98	0.50	0.02	1.02	0.50	2.00
CCH 7/1	2	388	0.025	1.00	0.90	0.15	0.90	0.15	0.57	0.96	0.43	1.77	0.04	1.04
CCH 7/2	2	1720	0.037	1.00	0.47	0.41	0.47	0.41	0.82	0.85	0.18	1.22	0.15	1.18
CCH 8/3	2	16168	0.952	1.00	0.87	0.16	0.87	0.16	0.59	0.95	0.41	1.69	0.05	1.05

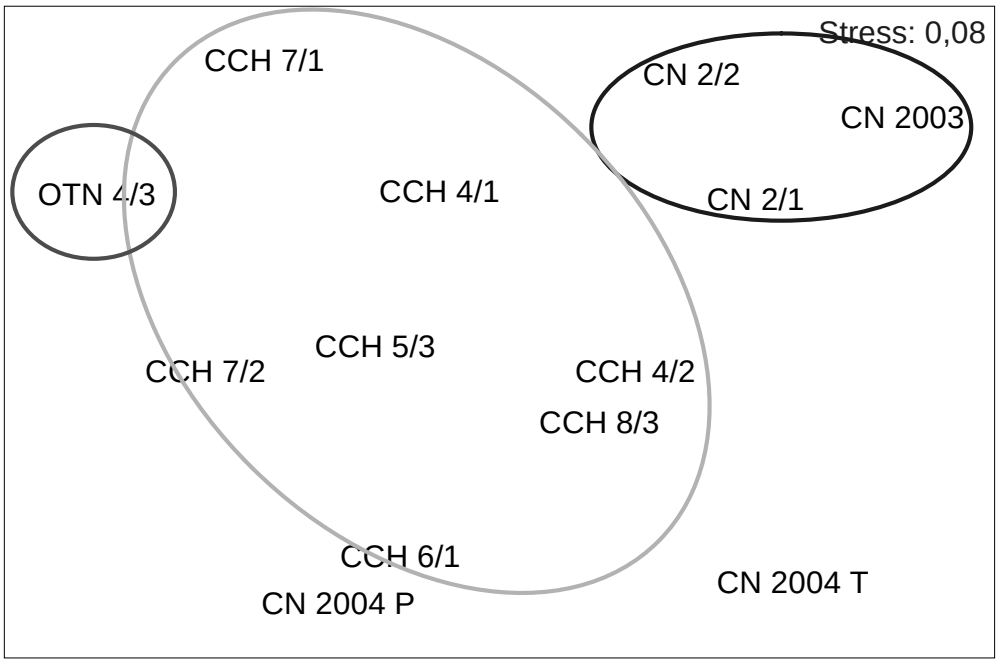

Fig. 5.4.4: – MDS – ordination of all benthos stations performed in 2006 at the Danube River sector of interest (Oltina, Cochirleni and Cernavoda areas), for the assessment of benthos population

5.4.2 Biodiversity Impact Prognosis

The sand mining takes place underwater in the Danube riverbed, and the mined sand is loaded directly in the transportation equipment. The water is not used for the sand mining.

The water level of the Danube in the area of expected sand mining fluctuates widely, with more than 8 m, between the flood and draught seasons. Fauna and flora are represented by species that can survive the harsh environment of the Danube river flow. There are some species of flora in shallow water along the riverbanks, but few flora can grow in the turbid water of several meters deep on the sand shoals. Thus no possible impact on flora will appear. As to fauna, there are fresh-water shells of common species. They may disappear temporarily from the area of sand mining, but they will soon immigrate back to the dredged site from the neighbouring areas. Thus, no impact is foreseen.

For the beach fill works in Mamaia Sud and Eforie Nord, no severe impact is expected on benthos and benthic plants and marine biodiversity, because the damage to benthos by covering of seabed with beach filling sand will be recovered soon by natural process.

On a long term, the installation of submerged breakwaters and jetties acting as new hard bottoms will have positive effects on the biodiversity, by increasing it.

Table 5.4.6lists the results of evaluation of biodiversity impact. Beach fill by sea sand causes less impact on marine organism than by river sand. Therefore, low impact is expected for beach fill with sea sand, but moderate impact is expected with river sand.

Table 5.4.6: Evaluation of biodiversity impact

No.	Description	Sand source	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	Beach fill by river sand	river	-2	0
C	Beach fill by sea sand	sea	-1	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

5.4.3 Impact Mitigation Measures

Taking into account that the sand mining activity takes place underwater in the Danube riverbed, it is subject to the internal and international rules for the navigable routes pollution. For the navigable routes pollution there are regulation with national character (the Central Committee for Rhine navigation and the Danube Committee), and the regulations of the European Economic Community (EEC). The main action directions regarding the prevention of the navigable routes are written in the EEC papers and included in the document EEC TRANS/ SC3/WP3/ R13, and ask for the following measures:

- Collecting all the polluting substances in the tank of each ship and deliver them to the collection installations from the bank where the substances are going to be treated.
- The ships must have installation for the garbage collection, treating equipment or incinerator
- It is forbidden to use the collecting tanks for hydrocarbons and fuels mixtures as ballast tanks.
- Each ship must have in the proximity of the alimentation points a chart of the filling system for the fuel and oil tanks and the necessary instructions.
- The discharging of the used water in the harbour area, shipyard area, and town area is forbidden.

Monitoring before and after operation will be carried out.

5.5 Landscape

5.5.1 Present Beach Scenery

At Mamaia Sud, there exist a series of old detached breakwaters, built from 1988 to 1990, at a distance of about 500 m from the shoreline. They have been deteriorated, with concrete blocks of Stabilopods being scattered away and the crests have subsided by more than 1 m.

According to a publicity article on the web[3], Mamaia is the European versions of Palm Beach of the United States, being situated on a littoral strip of 8 km long between the Black Sea and Lake Siutghiol, with 100 – 250 m wide beaches of extremely fine sand. Mamaia is opened from early May till late September, but most visitors are coming between June 15 and August 25 when it is the peak season and the atmosphere is brilliant. The resort has a campground, cinemas, tennis and mini-golf courts, pools, bowling, etc.

[3] http://romania.8k.com/mamaia/

To evaluate the landscape, it is important to have the viewpoint of the tourists who enjoy the most benefit of the beach.

What tourists can see from Mamaia beach is a forest of tall chimneys of petrochemical industry behind the long breakwater of Midia port to the north, which occupies one-fifth of the horizon and a small harbour to the south

At Eforie Nord, there exist a marina “Yacht Club Europa” at the southern boundary and two jetties.

According to a publicity article on the web, Eforie Nord is a small town, renowned for its sandy beaches, sunny weather and clean sea. Close by, mud on the bottom of the salted lake of Techirghiol is used for treating rheumatism. Three treatment establishments offer massage, gymnastics, physiotherapy – including mud treatment – and geriatric treatment. In town, there is a choice of restaurants, bars, discos, open-air cinema.

What tourists can see from the beach and the walking trail are the long breakwater of Constanta port to the north, which occupies one-third of the horizon, and the marina “Yacht Club Europa” to the south.

5.5.2 Landscape Impact Prognosis

(1) Impact of crest elevation on landscape

For Mamaia Sud, two choices of the crest elevation are envisioned for the rehabilitation of the existing two detached breakwaters with length of 250 m each, i.e. +2.4 m or +1.0 m. A higher crest elevation may disturb the sea view for the people visiting the beach of Mamaia Sud and have unaesthetic effects.

The main shore protection facilities for Eforie Nord will consist of three newly constructed breakwaters with lengths of 2 x 200 m and 275 m, respectively. Crest elevations of +1.0 or –0.5 m are considered. The emerged reefs with crest elevation of +1.0 m obstruct the sea view from the beach.

For both locations, the adoption of low crest breakwaters will create some impact on the landscape.

Table 5.5.1: Evaluation of landscape impact of crest elevation at Mamaia Sud

No.	Description	Crest elevation of breakwater	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	High crest, rehabilitation of breakwaters	+2.4 m	0	-2
C	Low crest, rehabilitation of breakwaters	+1.0 m	0	-1

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

Tables 5.5.1 and 5.5.2 list the results of the evaluation of landscape impact of crest elevation at Mamaia Sud and at Eforie Nord, respectively. After construction low impact is expected with low crested breakwaters. However, moderate impact is expected with high crested ones, depending on the degree of disturbance of the sea view for beach visitors at Mamaia Sud, i.e.,

the unaesthetic effects.

Table 5.5.2: Evaluation of landscape impact of crest elevation at Eforie Nord

No	Description	Crest elevation of breakwater	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	High crest, construction of breakwaters	+1.0 m	0	-1
C	Low crest, construction of breakwaters	– 0.5 m	0	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

After construction at Eforie Nord no impact is expected with submerged low crest breakwaters. However, low impact is expected with high crested breakwaters because of their interference to the sea view for beach visitors at Eforie Nord, i.e., the unaesthetic effects.

(2) Impact of river sand color on landscape

The main component of river sand is quarts made of silica dioxide, while the sea sand at Eforie beach is made of shell fragment. The river sand has gray to light brown color, while the beach sand at Eforie has brown color. People accustomed to visit Eforie beach may find it strange to feel under their feet the river sand of different color at the newly filled beach after the project implementation. Even at Mamaia Sud, the newly expanded beach with the river sand will have a darker color than the present one, which has changed its color from grey to slightly brownish one as the result of accumulation of shell sand in recent decades.

Tables 5.5.3 lists the result of the evaluation of landscape impact of river sand color at Mamaia Sud and at Eforie Nord. After construction low impact is expected with covered river sand.

Table 5.5.3: Evaluation of landscape impact of river sand color at Mamaia Sud and at Eforie Nord

No.	Description	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	0	0
B	River sand fill	0	-1

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

Such a change of beach sand color has to be accepted by beach visitors, because there is no way to obtain a sufficient amount of shell sand of brown color. Even if the sea sand around Midia Port is introduced, it has nearly the same color as the river sand because the both are terrigenous ones.

5.5.3 Impact Mitigation Measures

Impact mitigation measures are as follows:

- Design of new facilities is made with full consideration to aesthetic aspects of the beaches and sea view.
- Any construction is conducted off-season.
- Change of beach sand color will be accepted by beach visitors.

5.6 Waste

5.6.1 Solid Waste Collection/Disposal System in Constanta

The wastes produced in Constanța County are classified in the EPAC Report on the State of Environmental factors in Constanța County for 2004 into the following:

- urban wastes and similar wastes from commerce, industry and institutions
- production wastes, further separated in dangerous and non-dangerous wastes
- wastes generated by medical activities
- mud from wastewater processing and industry generated.

The total quantity of urban wastes and similar wastes from commerce, industry and institutions and mud from wastewater processing produced in 2004 arises to about 400,000 tons, reaching approximately 420,000 tons in 2005, and it is marked by a steady increase.

A part of the recyclable wastes, including paper/cardboard, plastics, metals, etc. are collected and capitalized by several economical agents from Constanța County. The total quantity of wastes capitalized in 2004 was 30,553.7[4] tons. In 2005 the quantity of capitalized wastes, excluding metals, was of about 9,000 tons.

In Constanța County there are no stations for the mechanical-biological treatment and sorting of wastes and the urban wastes are not incinerated. The non-capitalized wastes are stored in waste dumps which will be presented later.

The total of 144,932.56 tons of industrial wastes was produced in 2004 in the Constanța County. Of these, 42,371.86 tons were dangerous wastes, most of them coming from the petrochemical industry; and approximately 50% of them were capitalized. The non-dangerous industrial wastes (102,560.7 tons) were represented mostly by metallic and wood wastes, about 40% being capitalized. Despite an increase of the total industrial wastes produced in 2005 (162,496 tons), the quantity of dangerous wastes diminished to less than half (20,860 tons).

Beginning from May 2004 most of the wastes generated by the medical units of the County are incinerated by SC ECO FIR SISTEMS SRL Constanța, the quantity incinerated up to the end of the year being 34 tons.

Besides the mud from the municipal wastewater treatment units, a quantity of 12,117.4 tons of mud were produced by the industry, notably food industry and oil refinery in 2004. This quantity decreased drastically in 2005, to only 243 tons (EPAC, 2005).

The non-capitalized wastes are stored in wastes dumps. Out of the total dumps existing in the Constanța County only two are ecological. One of them is situated in the middle of the area of interest for the project – the ecological dump for domestic and industrial wastes from Costineşti, operated by SC TRACON SRL. The waste dumps provide services for 53,000 inhabitants from Agigea, Eforie, Techirghiol, Tuzla, Costineşti, and the towns along Route

[4] The detailed figures represent exact quantities of waste and come from EPAC reports on the State of the Environment in Constanta County.

No.38 - Cumpăna, Topraisar and Amzacea. Furthermore 70,000 to 100,000 tourists are seasonally added to the number of the serviced people.

The wastes from Constanța municipality are stored in the other ecological waste dump, situated at Ovidiu and operated by SC TRACON SRL.

5.6.2 Possible Source of Waste During Construction Works

Existing deteriorated groins and submerged breakwaters at Eforie Nord will be demolished and removed from the nearshore area. The quantities of materials from these structures are about 370 m^3 of concrete debris, about 5,100 m3 of stone blocks of 1 to 3 tons, and 1000 pieces of 4.5-ton stabilopods.

Total amount of household wastes to be generated from construction yard is minimal, because the main work force of the project is operators of dump trucks, bulldozers, and other construction equipments and involves few unskilled labourers working at construction site.

5.6.3 Waste Impact Prognosis

No severe impact is expected, because the project uses only inert materials such as sand, stones, concrete blocks, etc. Demolished parts of deteriorated groins etc. are recycled as the core materials of new jetties and submerged breakwaters. Construction will be carried out with every care for minimising/eliminating the production of waste materials.

Low impact is also expected concerning household wastes, because no lodging facilities for workers are built at the construction site and all the workers commute daily, i.e. sleep-out workers. Treatment of those household wastes shall be integrated into current regional disposal system as much as possible. Table 5.6.1 lists the result of evaluation of waste impact.

Table 5.6.1: Evaluation of waste impact

No.	Description	Generation of waste	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	Sleep-out workers	Small amount	-1	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

5.6.4 Impact Mitigation Measures

Collection/evacuation of the non-recyclable wastes will be made by observing the actual Romanian rules of the following:

- According to the Government Decision no. 162/2002 regarding the waste disposal, the domestic waste and the similar ones will be collected at collecting points equipped with containers. The containers will be periodically transported to a garbage platform in safe conditions established with EPA Constanta.
- According to the Government Decision no. 662/2001 regarding the used oil management, this will be collected and delivered to the collecting points. Normally, no used oil will be deposited on the beaches. The oil change will be done at the

companies owning the trucks and the other equipments.

- Metallic waste will be collected, temporarily deposited on the site precincts and will be turned to goods obligatory in the specialized units.
- The wood waste will be selected and eliminated depending on the dimensions and supporting elements in the construction works. Depending on their quality they will be turned to goods as fire wood for the local population
- The used accumulator batteries will be stocked and deposited adequately, after that they will be turned to goods by specialized units.
- Oil petroleum sludge from the fuel tank washing is in small quantities, that is why they will be collected in metallic recipients and safely deposited, and after that turned to goods by PETROM units.
- Auto tires represent one of the main problems for a construction site. They will be deposited in special places and the contractor will find a solution to eliminate them. A tire burning is forbidden.
- Paper waste and other office wastes will be collected, separately deposited and turned to goods.

The wastes generated during the construction period will be duly treated in accordance with the above regulations.

5.7 Bottom Sediment

5.7.1 Basic Data of Bottom Sediment and Sand for Beach Fill

For the coastal sediments the main inventoried contaminants are the heavy metals, total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAH) and organochlorine pesticides.

Before the sea and/or river sand can be utilized for beach fill, its grain size characteristics should be examined and a check must be made to confirm that the sand does not contain any harmful components for beach areas. To clarify these questions, a field campaign was carried out in June 2006 by the National Institute of Marine Geology and Geo-ecology (GeoEcoMar) under the subcontract with the Study Team.

Sediment sampling was executed at the project site of Mamaia Sud (10 samples), at the project site of Eforie Nord (10 samples), in the Cernavodă area (km 300 – km 301: 6 samples), in the Cochirleni area (km 305 – km 308: 18 samples), and in the Oltina area (km 338 – km 340: 12 samples). In total, 56 samples were taken and analyzed. The data of grain size distribution are listed in Appendix C of this volume.

(1) Heavy metals in sediment

Sediment samples were analyzed for the heavy metals contents to see if they contain any harmful minerals. Table 5.7.1 lists the major findings of the analysis.

Table 5.7.1: Heavy metals contents of sediment samples

Area		Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Zn (mg/kg)
Black Sea	Cape Midia	0.187 *0.072-0.501*	77 *48-119*	13.06 *2.39-64.84*	8.39 *2.62-34.22*	36.06 *15.25-104.3*
	Sulina	0.298 *0.119-0.713*	70 *40-124*	16.80 *4.22-35.47*	12.10 *7.86-18.29*	46.00 *19.55-73.7*
The Danube	Cernăvoda	0.129 *0.103-0.173*	47 *35-67*	4.56 *3.30-5.52*	9.47 *5.46-11.6*	28.07 *18.07-34.32*
	Cochirlia	0.141 *0.067-0.403*	52 *38-73*	10.21 *4.42-40.75*	8.23 *2.92-17.84*	37.35 *25.93-78.93*
	Oltina	0.124 *0.090-0.302*	57 *36–88*	6.36 *4.62-9.47*	10.60 *8.84-14.11*	30.6 *23.8–42.8*
Project site	Mamaia Sud	0.270 *0.088-0.715*	31 *5-51*	3.77 *2.19-6.8*	6.36 *4.00-8.72*	17.14 *11.90-21.59*
	Eforie Nord	0.144 *0.073-0.236*	13 *5-29*	5.06 *3.51-8.52*	3.23 *0.49-5.08*	12.28 *5.09-21.16*

Note: Each cell indicates the mean in roman letters on the upper line and the min–max range in italic letters on the lower line.

With regard to heavy metals contents, the Romanian regulation concerning sediment sets the following limit concentration:

Cadmium (Cd):	3.5 mg/kg
Chromium (Cr):	90 mg/kg
Copper (Cu):	200 mg/kg
Lead (Pb):	90 mg/kg
Zinc (Zn):	300 mg/kg

Compared with the above regulation, two samples each at the Sulina and Midia Port areas indicate the Chromium (Cr) concentration exceeding the level of 90 mg/kg slightly. However these higher concentrations are not related to pollution phenomena; they are the natural result of Cr concentration in heavy minerals accumulations. As the chromium minerals concentrating in these accumulations are highly inert, the Cr bioavailability is very low and no harmful effects are to be expected. The content of the other metals is well below the limit concentration. Only Cd show local higher concentrations, especially in Mamaia, but without exceeding the actual and even the tentative limit (0.8 mg/kg).

(2) Organic pollutants in sediment

The results of chemical analysis for organic pollutants are compiled in Table 5.7.2. The concentrations of total petroleum hydrocarbon (TPH) are below the detectable level 25 mg/kg d.w.[5] and the organoclorinate pesticides are below the detectable level 0.001 mg/kg d.w.

With regard to PAH, samples from the Midia and Mamaia areas indicate a certain level of polycyclical aromatic hydrocarbons (PAH), which seem to have the origin from pectrochemical industrial plants located in Midia Port. Some samples from Oltina also

[5] d.w.: dry weight

indicate presence of PAH, but its origin is unknown. Although no specific regulations are in force for PAH at the moment, the draft of the order modifying the provisions of the order 1146/2002 stipulates a 1 mg/kg total PAH limit. Considering this limit, the sand both from the project sites and the presumtive fill sand sources is polluted with PAHs, especially the sand from the Mamaia Sud project site and from Cap Midia. Moreover, in the Mamaia area all the analysed samples have PAHs concentrations exceeding the proposed limit.

Table 5.7.2: Concentration of organic pollutants in sediment samples

Area		Total petroleum hydrocarbon (TPH) mg/kg su	Polycyclical aromatic hydrocarbons (PAH) mg/kg su	Organoclorinate pesticides mg/kg su
Black Sea	Cape Midia	< 25	7.31 (*0.67-18.43*)	< 0.001
	Sulina	< 25	1.92 (*0.73-7.9*)	< 0.001
The Danube	Cernavodă	< 25	0.93 (*0.01-1.38*)	< 0.001
	Cochirleni	< 25	1.37 (*0.45-2.23*)	< 0.001
	Oltina	< 25	6.13 (*0.49 – 17.36*)	< 0.001
Project site	Mamaia Sud	< 25	3.90 (*1.34 – 11.45*)	< 0.001
	Eforie Nord	< 25	2.02 (*0.88 – 2.75*)	< 0.001

Note: PAH is given for the mean in roman letters and the min-max range in italic letters inside the parentheses.

5.7.2 Sediment Impact Prognosis

No severe impact is expected, because the construction materials are sand, stones, and concrete that do not contain any harmful materials to contaminate the bottom sediment (sand). Even for PAHs, which seem to be the main pollutant, most of the proposed sources for filling sand, especially the Danube locations, show the concentration level well below the acceptable limits. The same is valid for cadmium.

Table 5.7.3 lists the result of the evaluation of sediment impact. Although moderate impact is expected when sea sand is used for filling works, greater care should be taken in using the sea sand than the river sand from the safety point of view.

Table 5.7.3: Evaluation of sediment impact

No.	Description	Sand	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	Filling works	River sand	-1	-1
C	Filling works	Sea sand	-2	-1

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

5.7.3 Impact Mitigation Measures

Sediment quality analysis is involved in the monitoring plan (as a precautionary measure). Thus there will be no possibility of harmful materials introduced onto beach fill area.

5.8 Fishery

5.8.1 Fishing Activity in the Nearshore Water

The National Institute for Marine Research and Development "Grigore Antipa" provided the Study team with the information regarding the fishing activity in Constanța and Eforie.

In these two sectors (Constanța and Eforie) the industrial fishing activity practiced by the professional fishermen is developing on two categories;

- Fishing with fixed Italian type tools (April-October) butt "setca", "paragate", "ohane" and beach fishing nets at 3 – 11 m depth and even 80 m for butt fishing;
- Fishing with active tools (March-October) executed by coastal trawler ships with pelagic trawlers at 20-60 m depth

Small scale hand fishing is practiced by the local piscatorial communities with fishing rods (March-October), on the dikes and with the boats till 30 m depth. Although potentially the fish fauna contains 140 species and sub species, in the analyzed area there are only 20 species of fish, five species being dominant (sprat, "bacaliar", anchovy, surmullet, and frog fish); the remaining 120 species appear only occasionally, as isolated exemplars. The valuable species have a low percentage (sturgeons, butt, shark, saurel, grey mullet). From the total captures in the entire Romanian marine sector, Constanța and Eforie contribute only 10%.

Table 5.8.1 lists the species-wise captures (tones) at the Romanian marine sector within 2000-2005.

The Red List made in 2003 mentions 136 species with different vulnerability degrees: 1% are in "threaten" category, 1% in "Vulnerable" category, 20% in "Almost threaten" category, 22% "Never alarming" and 56% "Insufficient data" category".

The distribution, according to the vulnerability degree, of the 17 fish species frequently appearing in the captures between 2000-2005 is as follows:

- 5 "vulnerable" species: 3 pelagic and 2 benthonic
- 7 "never alarming species": 5 pelagic and 2 benthonic
- 5 "almost threaten" species: 3 pelagic and 2 benthonic

The 28 species appearing occasionally, as isolated specimens, are recorded within the category "other species". Their distribution according to the vulnerability degree is as follows:

- 10 vulnerable: 1 pelagic and 9 benthonic
- 15 threaten: 4 pelagic and 11 benthonic
- 1 insufficient data: benthonic
- 1 never alarming: benthonic
- 1 almost threaten: benthonic

Table 5.8.1: Species captures (tones) at the Romanian marine sector within 2000-2005

Year	2000	2001	2002	2003	2004	2005
Total capture	2476	2431	2116	1612	1831	1940
Sturgeons	1	1	0.4	1	1	1
Alosa sp.	76	25	4.1	4	6	4
Sprat	1803	1792	1617.5	1218	1350	1487
Anchovy	204	186	295.7	160	135	154
Saurel	8	17	21.2	10	14	12
“Bacaliar”	274	306	85	113	117	92
Mackerel	5	-	-	1	16	5
Sole	6	-	-	13	13	9
“Lufar”	4	1.3	2.5	2	3	1
Butt	2	12.5	16.6	24	42	36
Surmullet	2	2.5	1.6	2	40	30
Frog fish	42	24	45.9	47	74	95
“Gingirica”	5	11	4.4	3	5	2
“Aterina”	42	41	8.4	7	6	6
Shark	-	-	-	-	-	-
Grey mullet	-	0.4	1.7	1	3	1
Other species	1	10	9	3	6	5

Source: INCDM study 2000-2005

5.8.2 Fishery Impact Prognosis

The impact of the project on fishery will be low, because the total fish capture reduction due to the works in a very small beach area will be fairly small. Littoral fishing for the entire Romanian littoral represents only 25% of the total capture and the construction area is in water depth of less than –5 m. If a part of fishing harbors is used for the construction site, it may cause some inconvenience to fishermen and cause some negative impact on fishing activities.

The excavation works can have a major but spatially limited impact on the benthonic species due to increased water turbidity caused by the fine sedimentary material. Although these particles contain not only minerals but also some harmful substances, the main negative effect will be the clogging of the bottom. The clogging will affect the filtering organism activity, the sessile benthic organisms and also the spawn and some benthonic fish species. However, most motile organisms will soon leave and/or avoid the areas during the rehabilitation works. These are applied to the Sulina and Midia areas, because their sea beds are covered with fine sand and silt.

The noise during the excavation works will induce the departure of some fish shoal.

During the execution period of some construction works at the project sites, there may be some impact on the fish population. However, the impact on the pelagic species that make great movement is very low.

Table 5.8.2 lists the result of evaluation of impact on fishing activity. Low impact is expected by land transport of sand for beach fill because the construction area is limited to the depth of

less than – 5m. However, moderate impact is expected by sea transport of sand for beach fill because of offshore operation which may cause inconvenience to fishing activities.

Table 5.8.2: Evaluation of impact on fishing activity

No.	Description	Filling work	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	0	0
B	Land transport	River sand	-1	0
C	Sea transport	Sea sand	-2	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

5.8.3 Impact Mitigation Measures

Impact mitigation measures are as follows:

- Adoption of turbid water prevention method.
- Construction works are to be executed off the tourist season.

5.9 Social and Economical Environment Inclusive of Tourism

5.9.1 Overview of the Present Conditions

The average net nominal monthly earnings in Constanța County were 5,279,069 lei (US$159) and 6,249,970 lei (US$188) in 2003 and 2004, respectively. They were 9% and 5% higher than the national average. The unemployment rate of Constanța County in 2004 was 5.9 %, which was lower than the national average of 6.3%. The population of Constanța County was 713,825 on 1 July 2004. It decreased by 258 persons in two years. Within the county, Municipality of Constanța has the population of 307 thousands and Eforie has 9.5 thousands.

Seaside tourism is an important lucrative activity of Constanța County. As discussed in Appendix **B.3** of this volume, the tourism expressed in term of the hotel and restaurant sector is estimated to have yielded the gross domestic regional product (GDRP) of US$112 million or 6.8% share of the GDRP of Constanța County. The hotel and restaurant sector hired the employees in average numbers of 7,600 in 2002 and 8,100 in 2004 (Romanian Statistical Yearbook 2004 and 2005 editions).

The project sites of Mamaia Sud and Eforie Nord are situated amidst the summer resort beaches of South Dobrogea. According to the tourism statistics in 2005, Mamaia attracts more than 300,000 tourists who stay in hotels and other accommodations, while Eforie Nord attracts more than 80,000. During the off-season, however, the beaches are almost deserted. There are no permanent inhabitants in the coastal zone of the project sites, within a 100 m distance from the shoreline. A number of hotels and other buildings for tourist accommodations exist there, but they are opened for only two to three months in the summer.

5.9.2 Impact Prognosis on Social and Economic Environment

The project implementation will have as a main result an increase of tourists and day visitors to the beach areas enlarged by the beach fill operations. Accommodation facilities will be crowded with many tourists, and restaurants and bars at beaches will thrive with many

customers. New construction of hotels and other accommodation will follow. The construction sector will also benefit.

Such a gain in the revenue may bring forth some misdistribution of people's earnings. An increase in the number of tourists and day visitors may cause traffic congestions and raise the noise level during the touristic season. These are the conceivable negative impacts on social and economic environment.

Table 5.9.1 lists the result of the evaluation of impact on social and economic environment. In the case of zero-option impact on social and economic environment will be low to moderate and worse as time passes. However, the project implementation doesn't cause negative impacts because of creation of employment of construction workers during construction and increase of tourists followed by new accommodations, more employment, etc. after construction.

Table 5.9.1: Evaluation of impact on social and economic environment

No.	Description	Project	(During Construction) Evaluation	(After construction) Evaluation
A	Zero-option	–	-1	-2
B	Beach fill	Implementation	0	0

Rating; 0: No impact, -1: Low impact, -2: Moderate impact, -3: Severe impact

5.9.3 Impact Mitigation Measures

The conceivable negative impacts mentioned above should be mitigated through taxation and other civil means. The benefit of the positive impacts will far exceed the negative impacts on social and economic condition.

5.10 Impact Prognosis of Other Environment Factors

5.10.1 Soil and Subsoil

The project has no sources of pollutants for soil and subsoil such as herbicides, dust discharging facilities, etc. The construction is carried out on a flat land without forest cover. Therefore, the project causes neither soil erosion such as topsoil erosion by rainfall after reclamation and/or by deforestation, or soil contamination in the area concerned owing to dust from stockpiles of construction materials, spreading of herbicides, etc.

5.10.2 Human Settlement

Distance to the human settlements is several km away from the sand mining place on the Danube, and residential areas exist a few hundred meters away from the project sites in both Mamaia Sud and Eforie Nord. Therefore, this project causes no negative impact on those human settlements.

5.10.3 Cultural Heritage

There are no submerged sites of historical and/or cultural importance, which are known in the work areas. If such sites will be identified during construction, they will be preserved and

investigated in compliance with the related law.

5.10.4 Local Conflict of Interests and Misdistribution of Benefits

The local conflict of interest may arise from the misdistribution of benefits. Main direct beneficiaries will be the hotel owners, but increased profits will be distributed indirectly to the entire community through taxation and other civil means. Interview survey after construction is recommended in the monitoring plan as a precautionary measure.

5.11 Evaluation of Impact of River and Sea Sand Nourishment

Table 5.11.1 and Table 5.11.2 show the evaluation of expected impacts of using the river and sea sand for beach fill, respectively.

Table 5.11.1: Evaluation of expected impacts of using river sand for beach fill

Activity		River Sand Nourishment	
No.	Impact item	Rating	Reason
Social Environment: *Regarding the impacts on “Gender” and “Children’s Right”, might be related to all criteria of Social Environment.			
1	Involuntary Resettlement	D	No impact is expected.
2	Local economy such as employment and livelihood, etc.	D	No negative impact is expected.
3	Land use and utilization of local resources	B’	Occupation of the existing land during the construction.
4	Social institutions such as social infrastructure and local decision-making institutions	D	No impact is expected.
5	Existing social infrastructures and services	D	No impact is expected.
6	The poor, indigenous and ethnic people	D	No affection is expected.
7	Misdistribution of benefit and damage	D	No negative impact is expected.
8	Cultural heritage	D	No submerged sites of cultural heritage.
9	Local conflict of interests	D	No negative impact is expected.
10	Water Usage or Water Rights and Rights of Common	B’	The impact on fishing activities will be low.
11	Sanitation	D	No deterioration in public health and sanitary conditions.
12	Hazards (Risk) Infectious diseases such as HIV/AIDS	D	This project neither produces nor treats hazardous substances. Infectious diseases such as HIV/AIDS will not be introduced because all the workers commute daily.
Natural Environment			
13	Topography and Geographical features	D	No valuable topographical and geological features
14	Soil Erosion	D	No negative impact is expected.
15	Groundwater	D	No impact is expected.
16	Hydrological Situation	B	A certain impact of dredging on the river course is expected.
17	Coastal Zone (Mangroves, Coral reefs, Tidal flats, etc.)	D	No negative impact is expected.
18	Flora, Fauna and Biodiversity	B’	Moderate impact is expected on organisms during construction
19	Meteorology	D	No impact is expected.
20	Landscape	B’	Low impact is expected with covered river

Activity		River Sand Nourishment	
No.	Impact item	Rating	Reason
			sand.
21	Global Warming	D	No impact is expected.
Pollution			
22	Air Pollution	B	Air pollution will be caused mainly during transport by dump trucks.
23	Water Pollution	B'	Turbidity will not increase by dredging and filling operation.
24	Soil Contamination	D	No impact is expected.
25	Waste	B'	Liquid and solid waste may be generated.
26	Noise and Vibration	B	Transport of sand by dump trucks causes enhancement of noise and vibration.
27	Ground Subsidence	D	No impact is expected.
28	Offensive Odor	D	No impact is expected.
29	Bottom sediment	B'	Low impact of river sand fill is expected.
30	Accidents	B'	No impact is expected.

Rating:
A: Serious impact is expected.
B: Moderate impact is expected.
B': Low impact is expected
C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.)
D: No impact is expected. IEE/EIA is not necessary.

Table 5.11.2: Evaluation of expected impacts of using sea sand for beach fill

Activity		Sea Sand Nourishment	
No.	Impact item	Rating	Reason
Social Environment: *Regarding the impacts on "Gender" and "Children's Right", might be related to all criteria of Social Environment.			
1	Involuntary Resettlement	D	No impact is expected.
2	Local economy such as employment and livelihood, etc.	D	No negative impact is expected.
3	Land use and utilization of local resources	D	No occupation of the existing land.
4	Social institutions such as social infrastructure and local decision-making institutions	D	No impact is expected.
5	Existing social infrastructures and services	D	No impact is expected.
6	The poor, indigenous and ethnic people	D	No affection is expected.
7	Misdistribution of benefit and damage	D	No negative impact is expected.
8	Cultural heritage	D	No submerged sites of cultural heritage.
9	Local conflict of interests	D	No negative impact is expected.
10	Water Usage or Water Rights and Rights of Common	B	The impact on fishing activities will be low.
11	Sanitation	D	No deterioration in public health and sanitary conditions.
12	Hazards (Risk) Infectious diseases such as HIV/AIDS	D	This project neither produces nor treats hazardous substances. Infectious diseases such as HIV/AIDS will not be introduced because all the workers commute daily.
Natural Environment			
13	Topography and Geographical features	D	No valuable topographical and geological features
14	Soil Erosion	D	No negative impact is expected.

Activity		Sea Sand Nourishment	
No.	Impact item	Rating	Reason
15	Groundwater	D	No impact is expected.
16	Hydrological Situation	B	The impact of dredging is estimated to affect wave-induced currents.
17	Coastal Zone (Mangroves, Coral reefs, Tidal flats, etc.)	D	No negative impact is expected.
18	Flora, Fauna and Biodiversity	B	Low impact is expected on organisms.
19	Meteorology	D	No impact is expected.
20	Landscape	B'	Low impact is expected with covered sea sand.
21	Global Warming	D	No impact is expected.
Pollution			
22	Air Pollution	B'	Air pollution will be caused mainly during transport by boats.
23	Water Pollution	B	Turbidity will be increased by dredging and filling operation.
24	Soil Contamination	D	No impact is expected.
25	Waste	B'	Liquid and solid waste may be generated.
26	Noise and Vibration	D	Low impact is expected.
27	Ground Subsidence	D	No impact is expected.
28	Offensive Odor	D	No impact is expected.
29	Bottom sediment	B	Moderate impact of sea sand fill is expected.
30	Accidents	D	There may be no risks of accidents.

Rating:
A: Serious impact is expected.
B: Moderate impact is expected.
B': Low impact is expected
C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.)
D: No impact is expected. IEE/EIA is not necessary.

A few comments are necessary to explain the reason of assigning the rating in each item in Table 5.11.1 and 5.11.2. The comments for river and sea sand nourishments are the same unless otherwise noted as well as those for Mamaia Sud and Eforie Nord.

The item No.1 (Involuntary Resettlement):
No requirement of the inhabitants of the area concerned to move out of their dwelling and to resettle at other places.

The item No.2 (Local economy such as employment and livelihood, etc.):
No negative impact is expected because of creation of employment of construction workers during construction.

The item No.3 (Land use and utilization of local resources):
Some expansion of quay and apron area is required when the river sand is transported to Ovidiu Port.

The item No.4 (Social institutions such as social infrastructure and local decision-making institutions):
No impact on accessibility to social institutions such as social infrastructure and local decision-making institutions due to increase of traffic congestion and accidents on highways of the area concerned.

The item No.5 (Existing social infrastructures and services):
No impact on some residents inconvenience to access to existing social infrastructures and

services due to split of communities.

The item No.6 (The poor, indigenous and ethnic people):
No affection of the living conditions and lifestyle of the poor, indigenous and ethnic people.

The item No.7 (Misdistribution of benefit and damage):
The project does not cause misdistribution of benefit and damage associated with the priority project sites among residents, fishermen, hotel owners, shop owners etc., because of creation of employment of construction workers during construction.

The item No.8 (Cultural heritage):
There are no submerged sites of historical and/or cultural importance, which are known in the work areas.

The item No.9 (Local conflict of interests):
The project does not cause local conflict of interests associated with the priority project sites among fishermen, hotel owners, shop owners etc., because of creation of employment of construction workers during construction.

The item No.10 (Water Usage or Water Rights and Rights of Common):
The impact on fishing activities both in the Danube and Midia Port will be low. The littoral fishing with stationary tools represents only 25% of the total capture and most of the tools are located north of the study area while most fishing grounds for recreational boat fishing are situated outside the workplace.

The item No.11 (Sanitation):
No deterioration in public health and sanitary conditions of the area concerned because treatment of household wastes shall be integrated into current regional disposal system as much as possible.

The item No.12 (Hazards (Risk), Infectious diseases such as HIV/AIDS):
This project neither produces nor treats hazardous substances. Infectious diseases such as HIV/AIDS will not be introduced because all the workers commute daily.

The item No.13 (Topography and Geographical features):
There are no valuable topographical and geological features in the area concerned.

The item No.14 (Soil Erosion):
Sand fill prevents soil erosion behind the beach.

The item No.15 (Groundwater):
The project does not cause a lowering of the groundwater table because sand dredging is done on the sedimentary sand.

The item No.16 (Hydrological Situation):
A certain impact of river sand dredging on the river course of the Danube is expected because there is a possibility that the transformation of the river course will be caused. The impact of sea sand dredging is estimated to affect wave-induced currents around the Midia Port due to the change of the bottom topography by dredging.

The item No.17 (Coastal Zone (Mangroves, Coral reefs, Tidal flats, etc.)):
The project prevents coastal erosion onto neighboring beaches and/or changes in marine conditions owing to construction of structures and beach fill.

The item No.18 (Flora, Fauna and Biodiversity):
Beach fill by river sand causes less impact on marine organism than by sea sand because of roughness of river sand. Therefore, low impact is expected for beach fill with river sand, but moderate impact is expected with sea sand.

The item No.19 (Meteorology):
The project does not change meteorological conditions such as temperature, precipitation, winds, etc. because neither large-scale sand fill nor land reclamation is carried out.

The item No.20 (Landscape):
The river sand has gray to light brown color, while the beach sand at Eforie has brown color. People accustomed to visit Eforie beach may find it strange to feel under their feet the river sand of different color at the newly filled beach after the project implementation. Even at Mamaia Sud, the newly expanded beach with the river sand will have a darker color than the present one, which has changed its color from grey to slightly brownish one. Even if the sea sand around Midia Port is introduced, it has nearly the same color as the river sand because the both are terrigenous ones.

The item No.21 (Global Warming):
The project does not include factors that may cause the problem of global warming.

The item No.22 (Air Pollution):
Transport of dredged river sand by dump trucks causes enhancement of air pollution and dust along the road side area in Constanța. However, transport of dredged sea sand by boats causes little enhancement of air pollution along the sea side area in Constanța.

The item No.23 (Water Pollution):
Turbidity will not increase by dredging in the Danube and filling operation, because of coarseness of the river sand. However, turbidity will be increased by dredging off Midia and filling operation, because of fineness of the sea sand.

The item No.24 (Soil Contamination):
The project does not cause soil contamination in the area concerned owing to dust from stockpiles of construction materials, etc.

The item No.25 (Waste):
There is a possibility of leakage of oil from dredging boats and barges. Small amount of solid waste from the boats and offices is generated because the workers commute daily.

The item No.26 (Noise and Vibration):
Transport of dredged river sand by dump trucks causes enhancement of noise and vibration along the road side area in Constanța. However, transport of dredged sea sand by boats doesn’t cause any enhancement of noise and vibration along the sea side area in Constanța.

The item No.27 (Ground Subsidence):
The project does not cause land deformation and/or subsidence in the area concerned owing to the lowering of groundwater table.

The item No.28 (Offensive Odor):
The project does not yield offensive odor materials such as exhaust gas, dredged sludge, etc.

The item No.29 (Bottom sediment):
Most of the proposed sources for filling sand, especially the Danube locations, show the

concentration level well below the acceptable limits, even for PAHs, which seem to be the main pollutant. The same is valid for cadmium. Although moderate impact is expected when sea sand is used for filling works, greater care should be taken in using the sea sand than the river sand from the safety point of view.

The item No.30 (Accidents):
There may be risks of traffic accidents during construction when river sand is transported by trucks even though the risk is not more than the cases of ordinary traffic.

Summing up the results of environmental impact evaluation for the use of the river and sea sand for beach fill in the priority project, the overall impact is slightly larger in the case of using the river sand. However, the degree of expected impact is moderate to low. The environmental impact assessment of the priority project should be carried out by including the expected impacts by using the river and/or sea sand for beach fill.
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CHAPTER 6:

RISK MANAGEMENT AND MONITORING PLAN

Chapter 6 Risk Management and Monitoring Plan

6.1 Risks of Accidents and Mitigation Measures

6.1.1 Risks of Accidents

(1) Seismic risk

A part of the territory of Romania is located amid the seismic active zone of the world. It is the area of the mountain range of Carpați (Transilvania Alps) where the seismic coefficient for structural design is assigned the value of 0.32. As the location of interest moves away from the Carpați, the seismic activity is lessened. The seismic coefficient applicable for Bucharest, for example, is 0.20. Macroseismically, the Romanian Black Sea Coast belongs, according to STAS 11100/1-77, to a mildest seismic activity zone (zone "7" of seismic intensity, while according to the norm P100/92 the area belongs to the seismic zone "E", with a seismic coefficient of 0.12. Considering the type of the works, their location and the seismic classification of the area, no serious damage is expected, even in the event of a major earthquake.

(2) Erosion risk

Romania has a territorial coastline extending about 240 km along the northwestern side of the Black Sea. In the past several decades the Romanian Black Sea shore has been suffering from serious beach erosion problems. The coastal erosion not only threatens the tourism industry in summer season through the loss of beach area but also endangers the safety of housing and public welfare. The severest erosion is taking place in the southern part of Mamaia, where the shoreline will retreat more than 40 m in the coming twenty years if no countermeasures are undertaken. The project for the protection and rehabilitation of the southern Romanian Black Sea shore aims at stopping the coastal erosion and increasing the asset value of coastal zone with new beach areas.

(3) Pollution risk

The turbidity associated with sand mining and beach filling operations is expected to be the main manifestation of water pollution. The intensity and duration of the turbidity increase will depend on the finer fractions (silt and clay) content of the sand. River sand from the Danube usually has no such fractions, while the sand mined off Midia Port or from Sulina Bar usually contains at least some silt and clay.

Accidental spills of fuel and other oil products from the equipment for construction works may need to be accounted for but no heavy metal and/or significant organic pollution is to be expected.

(4) Radioactivity

The project works do not imply the use of any technical radioactive sources. The main materials used for the project realization are different forms of concrete and sand, either from the Black Sea or the Danube River; the only material with a possible radioactive potential might be the sand.

The existing data do not show the presence of any natural radioactive anomalies or significant

radioactive contaminations along the Danube River.

Since 1962, EPA Constanta monitors on a regular basis the global and artificial radioactivity in several environmental components, including water, soil, plants etc. Having in view the potential risk of a nuclear accident at the Nuclear Power Plant from Cernavoda, beginning from 1990 the monitoring program gives a special attention to the surrounding zone, which includes two of the potential sand source areas. Although no specific data for sediments are collected within the program, the results for all the investigated environmental components were always within the limits of the natural variation ranges.

The most frequently identified radionuclide, indicating clearly man-made radioactive contamination was ^{137}Cs, always attributed to the Chernobyl fallout. These data are sustained by the extended survey of the Danube state, performed by *Equipe Cousteau* (1993)[1], which demonstrated that the Danube radioactivity is low relative to other rivers. The artificial radioactivity is very low, dominated by trace residues of Chernobyl fallout.

The situation is the same for the Black Sea: no specific data for sediment radioactivity existing data from other environmental components indicating normal variation ranges.

Taking into account the existing data it may be considered that the execution of the project does not imply any radioactivity related risks.

(5) Risk situations during the construction period

The accidents might be caused by the non-observance of the exploitation regulation and the environment protection rules. During the construction period the risks for an accident can be classified as follows:

- Human risks, are the most important and are due to: insufficient qualification, non observation of the technology, working rules and work protection, physical dysfunctions during the work, alcohol or drugs consumption, diseases etc.
- Technical risks due to the equipment and transport vehicles because of accidental mechanical breakdowns.
- Natural risks – seismic and risk due to climatic conditions: rain, fog, storm, thunder that can hinder the equipment and vehicles functioning
- Combined risks due to some different and minor causes, whose effects, sometime cumulative, can lead to serious accidents. They are usually numerous and unpredictable.

6.1.2 Mitigation Measures

Table 6.1.1 lists the environmental issues that are to be subjected to the mitigation measures as proposed in the Chapter 5.

Apele Romane will be in charge of implementing the mitigation measures. A special attention will be given to the measures for warning and intervention in case of emergency and accidental pollution.

[1] Equipe Cousteau - 1993 - The Danube... For whom and for what - Equipe Cousteau and European Bank for Reconstruction and Development, 186 pp.

Table 6.1.1: Mitigation plan

Phase	Activities and impacts	Mitigating Measure
Construction	● Fishing rights might be respected by custom, although they are not guaranteed by law. ● Impacts on the fishery through the restriction of fishing rights by occupancy of the fishing grounds.	● Adoption of turbid water prevention method. ● Occupation of fishing grounds will be very limited and temporary.
	● Possibility of impact of dredging work on benthos and benthic plant.	● Monitoring before and after operation will be carried out. ● The sand mining effects on benthic fauna are expected to be temporary because the fauna will soon return to the dredged area from the neighboring area after the completion of construction as proved in many experiences. ● In the work areas the negative impact of benthos burial during works will be limited to the working area. Part of the normal habitat will be permanently lost but the protective works will provide new habitats, soon populated after the end of works.
	● Aquatic life might be affected by polluted water when the waste flows into the sea.	● No waste will be thrown away into the sea.
	● Possibility of dust from dump trucks.	● Watering work on the unpaved urban roads regularly to reduce dust generation. ● The dump trucks are covered with tarps to stop sands from slipping.
	● Air pollutants emitted from various sources, such as construction machines and vehicle traffic will affect ambient air quality.	● Proper maintenance of construction equipment such as dump trucks. ● All the trucks make a detour to avoid the urban area. ● The transportation is made only during the day. ● When the dump trucks cross the localities, the maximum speed is kept at 20 km/h.
	● Possibility of turbidity when dredging sand from the seabed for beach nourishment and installing jetties and breakwater.	● Adoption of turbid water prevention method if the Romanian regulations so requires because the effect is temporary.
	● Generation of construction waste and debris.	● The intended construction plan makes use of demolished parts of deteriorated groins etc. of existing facilities to be recycled into materials of new facilities such as core materials of new jetties and submerged breakwaters. ● The quantities of demolished parts at Eforie Nord are about 370 m3 of concrete debris, about 5,100 m3 of stone blocks of 1 to 3 tons, and 1000 pieces of 4.5-ton stabilopods. ● Construction will be carried out with every care for minimizing/eliminating the production of waste materials.
	● Possibility of noise and vibration caused by operation of construction equipment and traffics of dump trucks.	● No construction activities during the nighttime ● All the trucks make a detour to avoid the urban area. ● Adequate instructions for truck drivers for safe and noise-free traffics ● When the dump trucks cross the localities, the maximum speed is kept at 20 km/h. ● Proper maintenance of the equipments

Phase	Activities and impacts	Mitigating Measure
	● Possibility of impact on traffic according to transportation method of sand and rocks. ● There may be at increased risks of traffic accidents which could cause injury or death along sand transport routes.	● Proper signal control and information dissemination ● Rearrangement of the transport system- a detour to avoid the urban area. ● Adequate instructions for truck drivers for safe traffics ● When the dump trucks cross the localities, the maximum speed is kept at 20 km/h.
Operation	● A certain misdistribution is inevitable at the priority project site(s) among residents, fishermen, hotel owners, shop owners etc.	● The misdistribution should be mitigated through taxation and other civil means, e.g., promotion of social welfare and improvement of infrastructure. ● Interview survey after construction is recommended in the monitoring plan as a precautionary measure.
	● Change of the coastlines due to coastal erosion or sedimentation.	● Beach profile and shoreline map survey will be carried out twice a year and once in 5 years respectively after construction of new facilities.
	● Possibility of deterioration of aesthetic harmony by the appearance of new jetties and offshore breakwaters.	● Although new jetties and offshore breakwaters do not create an impressive look because of their gray color and lowness, design of such new facilities will be made with full consideration to aesthetic aspects of the beaches seen from the shore.

6.2 Environmental Monitoring during Construction Works

6.2.1 General

The environmental monitoring plan will be presented with description of the items of impacts to be monitored, specification of the timing and locations of the monitoring activities, and recommendation for the agency responsible for execution of the monitoring. The cost for the environmental management and monitoring will also be described. Table 6.2.1 lists the content of the environmental monitoring plan during construction works. Among various parameters, the survey of benthos and benthic plant is needed to check any change induced by construction works and to confirm their recovery after the project. Table 6.2.2 shows the cost estimate of monitoring per project site per year. The cost for each parameter is a preliminary estimate, which should be re-examined when the project is undertaken.

6.2.2 Sampling Survey of Benthos and Benthic Plant

Biological analyses are to be made for the selected sand source area and the two nearshore rehabilitation areas at Mamaia Sud and Eforie Nord. The analyses will include the following:

– identification of macrofauna species

– identification of meiofauna groups

– evaluation of population size: density and biomass

– assessment of size classes structure of filtrating epibiotic species

Number of sampling points are 10 for each area (total 30) and the points location should be decided considering the progress of construction of breakwaters, jetties, and beach fill.

6.2.3 Aquatic Life

Visual inspection with recordings of species of aquatic life will be made monthly on the beaches of Mamaia Sud and Eforie Nord by experts of aquatic life.

6.2.4 Water Quality Measurement

Water analyses for the nearshore water areas of Mamaia Sud and Eforie Nord are to be made for nutrients (NO_2, NO_3, PO_4, SiO_2 dissolved), dissolved oxygen, pH, Eh, turbidity, and TPH. The number of sampling points is ten (10) for each area (total of 20) and the points location should be decided in consideration of the progress of construction of breakwaters, jetties, and beach fill.

6.2.5 Sediment Quality Measurement

Sediment sampling and laboratory analyses are to be performed on the sand from the selected sand source area and the two nearshore water areas of Mamaia Sud and Eforie Nord. The geochemical analyses will be done for heavy metals, TPH, PAH, organochlorine pesticides. The number of sampling points is ten (10) for each area (total of 30) and the points location will be decided in consideration of the progress of construction of breakwaters and beach fill.

6.2.6 Noise and Vibration Measurement

During construction works the noise and vibration, together with traffic volume, will be monitored at three locations along the sand transport route to Mamaia Sud and Eforie Nord. Background noise and vibration level are to be measured before the construction commencement. Parameters to be monitored for the noise and vibration are Leq (dBA) and L10 (dB), respectively. The duration of the survey are twelve (12) hours per location from 7:00 a.m. to 7:00 p.m. on either day of Tuesday, Wednesday, or Thursday excluding a special day such as holiday.

The monitoring of the noise and vibration with the traffic volume is to be carried out three times a year by the contractor.

6.2.7 Others

Besides the above monitoring works conducted by survey companies and biologists, Apele Romane will work together with the contractor for the parameters as shown in Table 6.2.1. DADL will be responsible for implementing environmental monitoring with the involvement of related organizations.

Table 6.2.1: Environmental monitoring plan during construction works

Phase	Parameter	Monitoring	Locations	Timing	Implementation Agency	Yearly cost (Euro)
Construction	Fishing grounds	- Follow turbid water prevention	Project sites	Monthly	Apele Romane	-
	Benthos and benthic plant	- Sampling survey and identification test	Project and dredging sites	Twice a year	Biologist	14,000
	Aquatic life	- Visual inspection	Project sites	Monthly	Biologist	2,500
	Dust from dump trucks	- Visual inspection	Transport route	Weekly	Contractor	-
	Air pollutants	- Check of machine maintenance record	Project sites and camp	Weekly	Apele Romane	-
	Turbidity of sea water	- Visual inspection	Project and dredging sites	Weekly	Contractor	-
	Water quality (Turbidity, DO, pH)	- Using measuring instrument	Project and dredging sites	Bi-monthly	Survey company	5,000
	Sediment quality (Heavy metals, Organochlorines, PAHs and Total hydrocarbons)	- Sampling and analysis	Dredged sand for beach nourishment	Twice a year	Survey company	8,000
	Waste and debris	- Visual inspection	Project sites and camp	Weekly	Apele Romane	-
	Noise and vibration	- Noise and vibration measurement	Transport route	Three times a year	Survey company	8,000
	Traffic accidents	- Check of driving diary and traffic safety education	Driver post	Weekly	Apele Romane	-
	Sub-total					37,500

Table 6.2.2: Cost estimate of monitoring during construction works per project site per year.

Item	Location	Quantity	Unit Price	Times/Year	Total Price
Sediment Sampling at the Potential Sand Sources	- RD	10	100	2	2,000
Sampling at Mamaia Sud (or Eforie Nord)	- MS (or –EF)	10	37.5	6	2,250
Biological Analysis	- RD - MS (or –EF)	20	50	2	2,000
Aquatic life Visual inspection by Biologist	- MS (or –EF)	1	150	12	1,800
Water Analysis	- MS (or –EF)	10	50	6	3,000
Sediment analysis - Chemistry	- RD - MS (or –EF)	20	200	2	8,000
Noise and Vibration	Transport route	2	1,000	3	6,000
Sub total					25,050
Reporting and Other expenses					6,800
Overhead 20%					5,010
Total					Euro 36,860

RD: River Danube MS: Mamaia Sud EF: Eforie Nord

6.3 Environmental Monitoring after Project Implementation

6.3.1 General

The environmental monitoring plan for the operation period and its cost will also be described. Table 6.3.1 lists the content of the environmental monitoring plan. Among various parameters, the survey of benthos and benthic plant is needed to confirm their recovery after the project. Table 6.3.2 shows the cost estimate of monitoring per project site per year. The cost for each parameter is a preliminary estimate, which should be re-examined when the project is undertaken.

6.3.2 Sampling Survey of Benthos and Benthic Plant

Biological analyses are to be made for the dredged sand source area and the two nearshore water areas of Mamaia Sud and Eforie Nord. The analyses include the following:

– identification of macrofauna species

– identification of meiofauna groups

– evaluation of population size: density and biomass

– assessment of size classes structure of filtrating epibiotic species

The number of sampling points is ten (10) for each area (total of 30) and the points are to be decided in consideration of the layout of shore protection facilities installed at the project sites.

Table 6.3.1: Environmental monitoring plan after Project Implementation

Phase	Parameter	Monitoring	Locations	Timing	Responsible Agency	Yearly cost (Euro)
Operation	Misdistribution of benefit and damage	- Interview survey	Project sites	Once a year	Survey company	800
	Local conflict of interests	- Interview survey	Project sites	Once a year	Survey company	800
	Benthos and benthic plant	- Sampling survey and identification test	Project and dredged sites	Twice a year	Biologist	6,800
	Sub-total					8,400

Table 6.3.2: Cost estimate of monitoring after project implementation per project site per year.

Item	Location	Quantity	Unit Price	Times/ Year	Total Price
Interview survey	- MS (or –EF)	50	20	1	1,000
Sediment Sampling at the Potential Sand Sources	- RD	10	100	2	2,000
Sampling at Mamaia Sud (or Eforie Nord)	- MS (or –EF)	10	37.5	2	750
Biological Analysis	- RD - MS (or –EF)	20	50	2	2,000
Sub total					5,750
Reporting and Other expenses					1,500
Overhead 20%					1,150
Total					Euro 8,400

RD: River Danube MS: Mamaia Sud EF: Eforie Nord

Table 6.3.3 lists the yearly costs of the Environmental monitoring from 2007 to 2013. After 2013 the cost of the monitoring program remains approximately the same.

Table 6.3.3: Environmental monitoring cost from 2007 to 2013.

Year	Mamaia Sud	Eforie Nord	Total (Euro)
2007	39,220	0	39,220
2008	39,220	0	39,220
2009	8,400	39,220	47,620
2010	8,400	39,220	47,620
2011	8,400	8,400	16,800
2012	8,400	8,400	16,800
2013	8,400	8,400	16,800

6.3.3 Monitoring of Social Environment

The monitoring of the social environment will be done basically with the help of a wide range of indicators such as revenues for ANAR and Constanta City, Per-capita Income Index, Poverty Index, GDRP, etc.

6.4 Geophysical Monitoring during and after Project Implementation

6.4.1 General

Geophysical monitoring hereby refers to the beach and inshore surveys, wave measurements and water level measurements. They have been carried out by the National Institute for Marine Development and Research “Grigore Antipa” (NIMRD) and the Water Department Dobrogea – Litoral (DADL). It is absolutely necessary to continue the surveys and measurements with the expanded scale for assuring the successful implementation of the project and good care of the project after implementation.

As discussed in the Coastal Protection Plan for the Southern Romanian Black Sea Shore presented in Volume 1, the present project at Mamaia Sud and Eforie Nord represents the first phase of the above plan. Successful planning of the projects envisaged in the second, third, and later phases will much owe to the information and data to be obtained through the

meticulous continuation of the surveys and measurements.

The beach and inshore surveys as well as the wave and water level measurements discussed in this section are not limited to those directly related to the present project but does cover the physical monitoring over the whole coastal area of the Southern Romanian Black Sea. It is intended to provide a perspective and long-lasting view for the integrated coastal zone management.

6.4.2 Beach and Inshore Survey

As discussed in Appendix **F.3** of this volume, the beach and inshore survey for beach monitoring includes the items listed in Table 6.4.1.

Table 6.4.1: Items of beach monitoring program with cost estimate

No.	Item	Frequency or Installation date	Cost estimate (Euro)	Remarks
1	New benchmark setup	Start of project	2,500	16 new benchmarks
2	Beach profile survey	Twice a year	16,000	50 profiles from Năvodari to Vama Veche
3	Shoreline map survey	Once in 5 years	4,000	From Năvodari to Vama Veche (60 km)
4	Purchase of side-scanning sonar	Start of project	500,000	Sea Bat 8125
5	Bathymetric survey	Once a year	40,000	4 areas of Mamaia and 1 area of Eforie Nord
6	Wave measurement	Replacement in every 3 months	4,000	Wave and current recorder donated by JICA
7	Water level measurement	Continuous	3,900	Continuation of NIMRD's work

The beach profile survey with addition of 16 new benchmarks is to monitor the change of beach profile above the shoreline. It should be carried out twice a year in the same months such as May and November for the whole coast of the Southern Romanian Black Sea.

Locations of new benchmarks as well as existing benchmarks for beach profile survey are shown in Figs. F.4.1 and F.4.2 of Appendix **F** of this volume. The methodology of beach profile survey, shoreline map survey, and bathymetric survey is discussed in **F.4** to **F.6**, respectively.

The shoreline map survey is to enrich the database of the Romanian shoreline. Without this database, no work can be carried out for reliable planning of the future coastal protection and rehabilitation projects in the second, third, and later phases of the coastal protection plan introduced in Volume 1.

The bathymetric survey of the project areas at Mamaia and Eforie is to monitor the evolution of the filled beach areas and neighboring beaches.

The side-scanning sonar "Sea Bat 8125" is expensive equipment, but its purchase is indispensable for reliable and efficient operation of bathymetric survey.

6.4.3 Wave Measurement

Wave measurement by means of the multi-purpose marine recorder (DL-2) purchased by JICA has begun at the offshore of Mamaia North in water of 10 m deep (N44º15'42.3'' and E28º39'29.2'') from 1st December of 2005. The records of waves up to 30 rd April of 2006 have been analyzed and will be presented in Appendix H of this volume.

The multi-purpose marine recorder is set at the sea bottom and measures the elevation of the instantaneous water level and the bi-directional currents in every 0.5 s for 20 minutes at an interval of two hours. The measured water level and current speeds are stored in a memory within the watertight recorder for the duration of three months or longer. The recorder is lifted every three months and the record of the memory is transferred to a personal computer. The heights, periods, and directions of individual waves as well as those of significant wave and other representative waves are calculated automatically with custom-made computer software.

The wave measurement data is the most basic information for any coastal protection works and maritime structural designs. The measurement must be continued without stop for a minimum of three years before any meaningful information of wave characteristics will be obtained for applications. Many wave observation stations in the world have been operating for more than 10 years and intend to continue for ever.

The cost of wave measurement is about 4,000 Euro per year as listed in Table 6.4.1. It includes the cost for mobilization of a marine observation ship for recovery of the memory record and hiring of divers for lifting and resetting the multi-purpose marine recorder in every three months.

6.4.4 Water Level Measurement

The water level measurement in Constanța Port has a long history beginning from 1935. Currently NIMRD is taking charge of the measurements at the ports of Constanța and Mangalia. The measurement records have been submitted to the Study Team under a subcontract, and the results of analysis have been presented in **3.3** of Volume 1 and **D.3** of Annex D of Volume 3. The analysis of the records clarified the rising rate of the mean sea level at 2.2 mm per year. It also revealed the low frequency fluctuation of the mean water level with the period up to several weeks and the amplitude of a few decimeters.

The water level measured at the tide gage station in Constanța Port is the reference level for every marine works. Contractors, surveyors, and marine personnel always seek for the information of water level at any given hour. The cost of continuing the water level measurement is 3,900 Euro according to NIMRD. The budget for this operational cost should be assured for ever.

CHAPTER 7:

PROJECT EVALUATION

Chapter 7 Project Evaluation

7.1 Environmental Sectoral Operational Program (ESOP)

7.1.1 Outline View

The major policy issue as a keynote for the environment sector in Romania is the sustainable use of natural resources. Asset value emanating from the country's natural portfolio could only be counted on by integrating environmental protection and nature conservation into sectoral policies. Specifically, the issues of land utilization, rural development, sustainable use of waters, waste management and environmental safety, as well as regional and settlement development and physical planning, among others, call for policy and administrative integration in due course of policy implementation. *The Environmental Sectoral Operational Program* (*ESOP*) is a country's conceptual and operational framework over the period of 2007–2013, in line with the *Acquis Communautaire* that lays down the general provisions on Community fund management, and the Chapter 22 (Environmental Protection-*Angajamente Capitolul 22*[1]) of *the Position Paper of Romania* defining policy decisions and public interventions as envisaged by the Government of Romania for external collaboration with the World Bank, the European Council, and other partnership institutions. The finalization of *the Romanian National Development Plan* (*NDP*) *2007-2013*, the country's overall development strategy paper inclusive ESOP, is in progress, while discussions within the government and between external funding institutions expeditiously taking place.

The overall objective of the Environmental Sectoral Operational Program (ESOP) is to improve the living standards and environment, while focusing on meeting its achievement *acquis*.[2] With this, ESOP comprises the five specific objectives, one of which is "the reduction and improvement of natural disaster affecting the population by implementing preventive measures in most vulnerable areas by 2015" inclusive of coastal protection on the Black Sea shore. Other fours include (i) improvement of access to water infrastructure by providing water supply and wastewater services in most of the urban areas by 2015, (ii) improvement of soil quality by improving waste management services and reduction of ecological burdens in minimum 30 counties, (iii) reduction of negative environmental impact caused by old municipal thermal plants in most polluted localities by 2015, and (iv) reduction and improvement of biodiversity and natural heritage by supporting the protected area management. To note that the beneficiaries affected by the implementation of the Sectoral Operational Program (SOP) measures must have one common performance indicator for monitoring and evaluation purpose.

7.1.2 Priority Areas including Coastal Protection

In pursuance of the policy objectives as provided immediately above, the following activity areas are identified;

(1) Priority Axis 1: Extension and modernization of water and wastewater systems
(2) Priority Axis 2: Development of integrated solid waste management systems and

[1] Conference on Accession , Brussels, 30 October 2001 (CONF-RO 37/01)
[2] References: The Ministry of Environment and Water Management (MoEWM), *The Sectoral Operational Program* (draft), April 2006, p1, MOEWM, *Programul Operational Sectorial Mediu*,

rehabilitation of old ecological burdens

(3) Priority Axis 3: Improving municipal heating system in selected priority areas
(4) Priority Axis 4: Implementation of adequate management system for natural protection
(5) Priority Axis 5: Implementation of adequate infrastructure of natural risk prevention in most vulnerable areas
(6) Priority Axis 6: Technical Assistance

As previously noted, the key areas of the Priority Axis 5 (Natural Risk Prevention in Vulnerable Areas) include (i) protection against floods and (ii) reduction of coastal erosion. The specific objectives of this priority axis include (i) contributing to a sustainable flood management in most vulnerable areas, and (ii) the Black Sea shore protection and rehabilitation[3], under the auspices of the EU Cohesion Fund.

Since last decades, serious coastal erosion has taken place over the 240 km-long Romanian Black Sea shore. In particular, the loss of around 2,400 ha is found in the northern part of the Black Sea, Danube Delta Biosphere Reservation over the past 35 years according to the National Research Institute for Marine Research and Development, "*Grigore Antipa*"[4]. Besides, the southern part of the Black Sea shore is at a stake, with the onshore region's robust tourism sector and others in the economy being prone to natural disaster. Damage by coastal erosion will also endanger the safety of housing and public services. The government, with the collaborative actions taken by external funding and assistance institutions, will proceed with undertaking major preventive measures for economic, ecological, social security in the hot vulnerable areas.

With regard to flood management, the priority measures will focus on the implementation of the Water Framework Directive (2000/60/EC) that aims at surface, underground, and coastal water protection. In this light, construction works for flood prevention and reduction of destructive consequences of floods will take place. Besides, flood risk management plans and risk maps will be prepared in collaboration with EU Member States, while targeting each of the hydrographic basins and coastal areas where vital administrative, cultural, social, and economic activities are in place.

7.1.3 Coastal Protection and Rehabilitation of the Southern Black Sea Shore

ESOP states the protection and rehabilitation of the Southern Black Sea shore, aiming at bringing about geographical conservation and enlargement of the beaches, with the protection and safety of fixed assets of housing, land property, and other public facilities thereof in view. Under the auspices of the Japan International Cooperation Agency (JICA), Coastal Protection Plan of the said project was submitted in February, 2006 with the scope of long-term public intervention measures up to 2020. A feasibility study on the priority project within the Coastal Protection Plan has sequentially been in place as reported in this volume. Beneficiary of the project will be the National Administration of Romanian Waters (*Apele Romane*)[5].

[3] MoEWM, *op. cit.*, p.52
[4] Average coastal erosion that took place during this 35 years is figured out to be around 80 ha/year), while sand accumulations having only been around 7 ha par year to 200 ha. The sea shoreline has declined inward 180 – 300 metres, with around 400 metres in some areas.
[5] MoEWM, *op. cit.*, p.54

7.1.4 Financing Plan

In association with the *Romanian National Reference Strategic Framework 2007-2013*, the Environmental SOP's total budget over the six-year programming period is assumed to be EUR 4.9 billion, while accounting for 23.4% of the financial sources of the NSRF ("Develop Basic Infrastructure to European Standards") allocation. Of this, a large chunk of finance source emanates from the EU funds totalling EUR 3.96 billion, while disaggregated to the Cohesion Fund (CF) and the European Regional Development Fund (ERDF) with each of these amount to EUR 2.9 billion and EUR 1.1 billion, respectively[6]. Likewise, the balance of EUR 0.94 billion is to be from the national coffer, either from government revenue or external borrowings under the name of the Ministry of Public Finance[7]. EU fund contribution to investments in each of the priority axes is assumed to be at maximum 85 percent and 80 percent for CF and ERDF, respectively. Coastal protection sub-sector, together with flood control, will receive EUR279.2 million over seven (7) years of time, while accounting for 7.0 percent of the gross fund of avail.

Annual allocation of funds to ESOP by EU fund over the period of 2007-2013 is listed by priority axis in Table 7.1.1 and shown in Fig. 7.1.1 by category. It is provided as under the schematic framework for SOP illustrated in Fig. 7.1.2.

Table 7.1.1: Annual allocation of funds to ESOP (2007-13) by EU fund by Axis (EUR million)

	Fund	EU Allocation	Gov. Romania	Total	Share of EU
AXIS 1	CF	2,440.0	430.6	2,870.6	85 %
AXIS 2	ERDF	773.0	193.3	966.2	80 %
AXIS 3	CF	200.0	200.0	400.0	50 %
AXIS 4	ERDF	150.0	37.5	187.5	80 %
AXIS 5	CF	237.0	42.1	279.2	85 %
AXIS 6	ERDF	160.0	40.0	200.0	80 %
Total		3,960.0	943.5	4,903.5	80.75 %

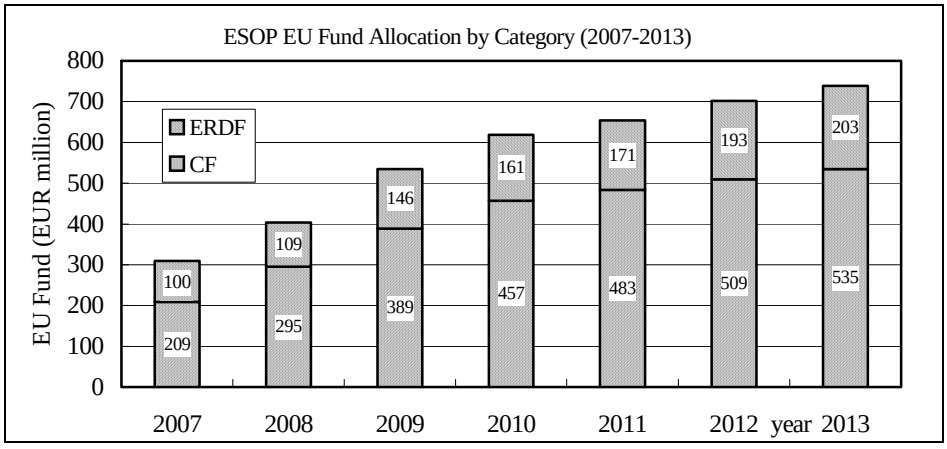

Fig. 7.1.1: Annual allocation of funds to ESOP by EU fund by category

[6] The financing shares of ERDF and Cohesion Fund are respective of 80 percent and 85 percent of the total project cost.

[7] To note that the issue of repartition of financial burden between the state, local governments, and/or final beneficiaries still needs urgent clarification and division of functions and authority devolved amongst the game players.

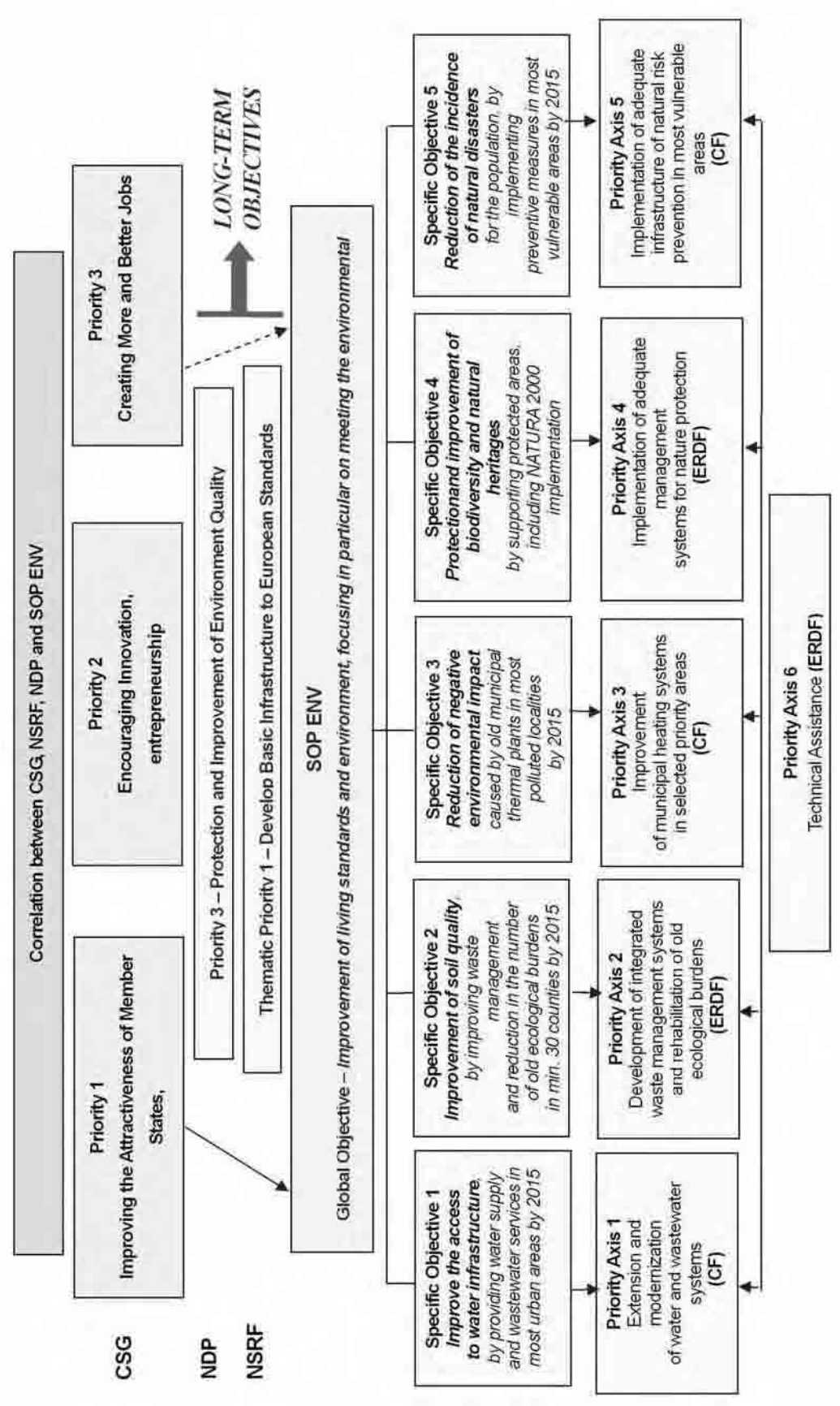

Fig. 7.1.2: Outline view of sectoral operational program – ENV

7.2 Financial Affordability Analysis and Financing Plan

7.2.1 Initiating Remarks

Eliciting costs and benefits in economic analysis may differ from that for financial analysis depending on the viewpoint from which the project in concern is appraised on the efficiency front of national resource use. As may well be aware, the economic costs accrued and benefits attributable to development projects reflect the scarcity of resources thus being estimated in real (social) terms, whereas financial costs and benefits measured in terms of market price. In many cases, project alternatives themselves may not be clearly defined, and as such the comparison would relate to hypothetically set-up marginal projects which might be undertaken in lieu of the project under evaluation. This is the purpose of applying what is known as "Social Discount Rate (SDR)", a minimum social return to represent what invested capital might earn in alternative marginal use. Provided that the economic return of the proposed project exceeds SDR in the country at the time of project appraisal, the concerned project would likely to be the best investment opportunity at a margin.

Viewed in this light, economic analysis of the prospective Priority Project with the two components of the coastal protection and rehabilitation project at Mamaia Sud and Eforie Nord on the Southern Romanian Black Sea shore will quantitatively take place in a systematic and globally accepted framework for analysis and methodology in due course of the final stage of the study[8]. The analytical framework, model configuration and variables with assumptive parameters being applied in evaluation processing are set forth herewith in a bid to delineate the underlying assumptions for economic analysis of the proposed project.

It is stressed that the financial viability (profitability) analysis by way of estimating Financial Internal Rate of return (FIRR) is not undertaken under the current study due to a lack of the opportunity of income generation coherent to the project characteristic. Alternatively, affordability analysis of the project has been given in the succeeding section of **7.2.2**.

7.2.2 Affordability Analysis

(1) Macroeconomic background for project affordability

On the macroeconomic front, the country has since 2000 been on the right track with upward real GDP growth and downsizing inflationary trend largely due to the government policy, under the auspices of the World Bank (WB), the International Monetary Fund (IMF), the European Union (EU), which was conducive to the smoother transition of the economy to the market-oriented and the sector-led macroeconomic management. A disciplined fiscal policy, complemented by tight monetary policy and augmented by robust advances in structural reform, led to improved public financial position in the enterprise sector thereby placing public finance and the financial system on a much firmer footing. Macroeconomic and debt positions of the country are depicted and given in Fig. 7.2.1.[9]

[8] Discounted cash flow (DCF) method for the estimation of economic returns may need no detailed justification to date as long as this approach has since the 1960s been generally accepted and applied most competently in many other analyses. (Reference: for example, The World Bank, *The Economic Choice Between Hydroelectric and Thermal Power Development*, 1966, p.4, and many others more)

[9] Despite robust economic performance to date, it is still pointed out that poverty persists in the country with 25.5 percent of the population living below the poverty line.

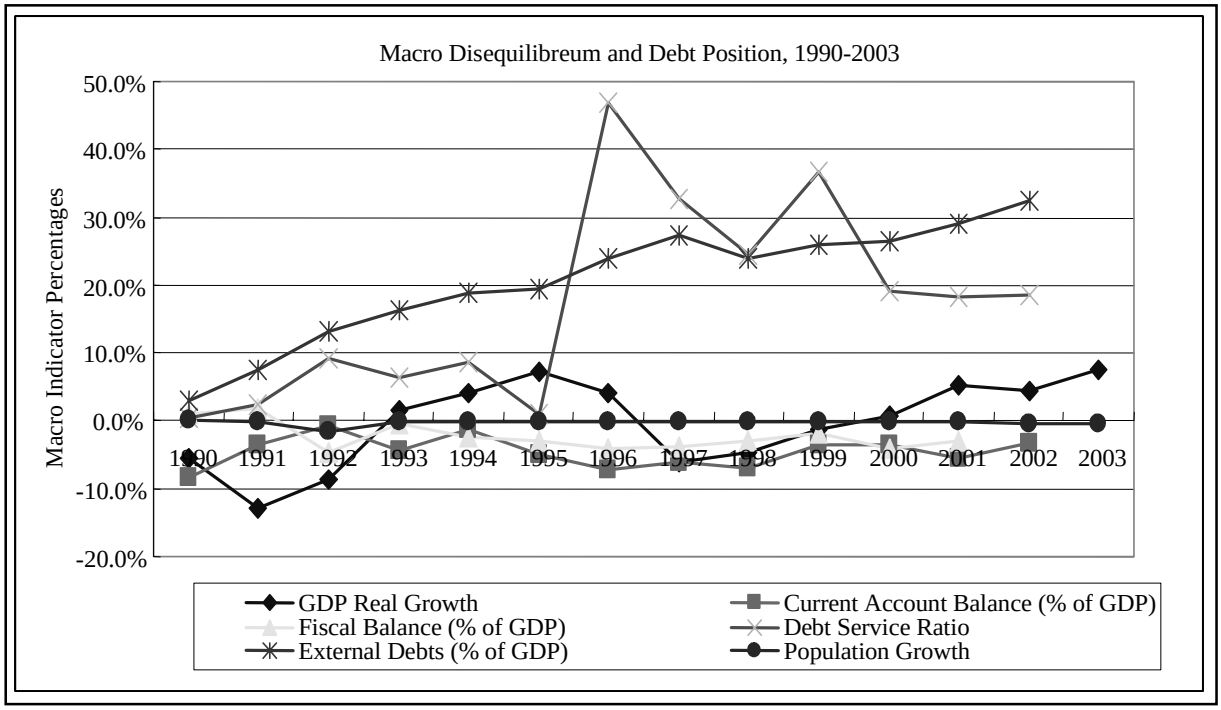

Fig. 7.2.1: Macroeconomic and debt positions of Romania 1990-2003

Real GDP growth were positive 0.6 percent, 5.3 percent, 4.3 percent, 7.6 percent, and 8.3 percent in the order of 2000 through 2004, while inflation curbed down over the same period from 45.7 percent to 15.3 percent (2003). It went downsized a little in 2005 to 4.1 percent in 2005 due largely to a lower agricultural output and a slower industrial production on account of flood damages and the appreciation of the currency (RON) against the Euro and the US dollar[10]. Interest rate declined sharply, and the fiscal deficit was brought under control. Financial position of the central government in the light of public debts was held to comfortable levels, with the percentage share of total debt outstanding to GDP[11] from 26.6 percent to 32.4 percent during 2000-2002 and the Debt Service Ratio[12] standing at 36.7 percent down to 18.6 percent over the period of 1999 through 2002.

(2) MoEWM budgeting to the sector and coastal protection (1996-2010)

State budget appropriated to the Ministry of Agriculture and Environment had since 1996 increased by 42.9 percent per annum till the year 2002 right before the ministerial realignment took place. In nominal term, budget appropriation hit the peak at US$56.7 million equivalent in 2002 arising steadily from US$4.7 millions equivalent in 1997. Subsequent budget allocation to the Ministry of Environment and Water Management (MoEWM) has since its establishment in 2003 moderately been downsized to US$48.9 million, with the annual decrease of 4.8 percent on average[13].

Faced with the urgent need to comply with the Water Framework Directive of EU and to pursue

[10] Reference: The World Bank, *Country Partnership Strateguy for Romaniafor the period FY06-09*, June 2006, p.3

[11] By Heavily Indebted and Poor Countries (HIPCs) Debt Sustainability Analysis, it is defined that a country is debt-prone when total debt outstanding exceeds 150 percent of GDP. GDP was US$73.2 billion equivalent in 2005.

[12] Index of financial soundness of a country, and a rule of thumb, DSR more than 25 percent would be the sign of crisis in public finance.

[13] Source: The Ministry of Environment and Water Management, Office of the Secretary General.

the government's firm decision to commit to environment protection inclusive of coastal protection down on the Black Sea shore along the Romanian eastern border, the government now sets, in a draft Budget Law, the earmarked expenditure of around US$ 300 million each year for the sector over the period of 2007 through 2010[14]. The three-year rolling-budget plan for coastal protection at the Ministry was set at 157.8 million in total over the period of 2007-2009, of which US$58.1 million are to be allocated in 2007 and 2008 respectively, with the balance of 41.6 million in 2009.[15] For reference, chronological shift in the earmarked sector budget during 2007-2010 is listed in Table 7.2.1 and the change of the state budget for MoEWM (1996-2005) is shown in Fig. 7.2.2.

Table 7.2.1: State budget for coastal protection 2007-2009 (US$ mil)

	2007	2008	2009	2010
Total Sector Finance	445.6	754.3	706.7	620.0
Of which State Budget	314.3	312.2	320.3	322.2
Coastal Protection	58.1	58.1	41.6	

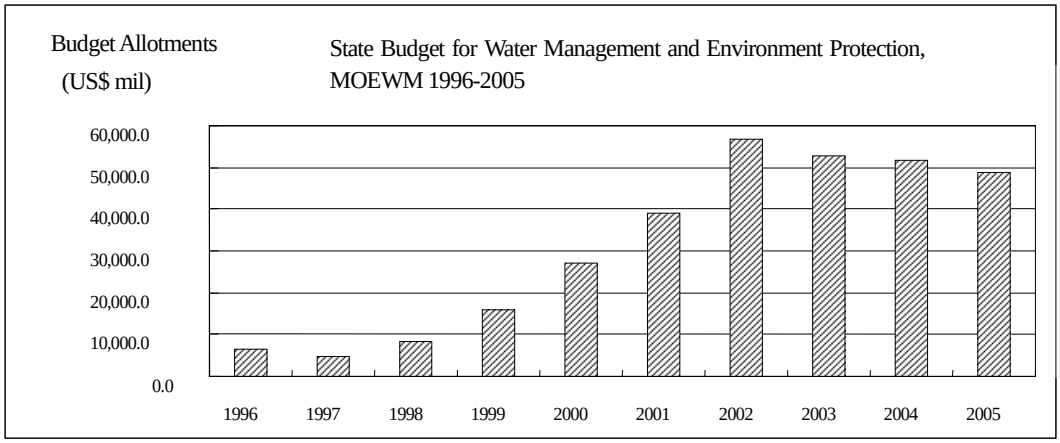

Fig. 7.2.2: State budget for MoEWM, 1996-2005

Table 7.2.2: MoEWM-ANAR budget proposal on coastal protection 2006-2008

No	Project	Cost (Est. US$ mil)
1	Reinforcement and protection works of the Black Sea Coast, sector Sacalin Island and Portita, Constanta County	60
2	Consolidation and protection works of the Black Sea Coast, sector between Portia-Edighiol-Vadu, Constanta County	40
3	Consolidation and protection works of the Black Sea Coast, Midia Navodari-Constanta Casino, Constanta County	50
4	Consolidation and protection works of the Black Sea Coast, between Agigea Sud Dike- Tuzla Cape, Constanta County	25
5	Consolidation and protection works of the Black Sea Coast, between Tuzla Cape-Tatlageac Lake, Constanta County	30
6	Consolidation and protection works of the Black Sea Coast, between Tatlageac Lake-Mangalia Lake, Constanta County	30
7	Consolidation and protection works of the Black Sea Coast, between -Mangalia Lake-Vama Veche, Constanta County	15
8	Increasing the Siutghiol lake water quality, Constanta County	28

[14] Source: The Ministry of Environment and Water Management, June 2006
[15] Source: The Ministry of Environment and Water Management, *Budgetul pe Anul*, December 2005

In the meantime, MoEWM and ANAR submitted the budget proposal on March 2005 to the Ministry of Public Finance (MoPF) for the inclusion of coastal protection to the three-year-rolling budget plan (medium-term expenditure framework, MTEF). The total amount of the eight projects specified in the Proposal was US$278.0 million. The detail of the proposal is given in Table 7.2.2. Judging from the drawings attached to the budget proposal, the projects are mostly comprised of laying a series of submerged, detached breakwaters in the offshore for wave attenuation and the cost estimate is crude without engineering analysis.

(3) Financial position of DADL – accounting analysis

The Water Directorate at Dobrogea Litoral (DADL) is administratively responsible for the southern Romanian Black Sea shore region and the Hydrographical basin of the Danube, and hence *a beneficiary* of the proposed coastal protection and rehabilitation project at Mamaia Sud and Eforie Nord. With this in view, a close look at the financial statements of DADL can draw a number of numerical information and insights in the light of financial position of the entity for analytical works. For example on the "stock" side, large parts of the Assets (US$49.6 million in 2004) and Owner's Equity (US$46.5 million) emanate from respective of corporal fixed assets (US$47.6 million, 95.9 percent) and public patrimony (US$35.5 million, 71.6 percent) as shown in the Balance Sheet and Profit-Loss Statement in respective of Tables 7.2.3 and 7.2.4 and Fig. 7.2.3. A small portion of liability (short- and long-term borrowings) reveals financial soundness in management. On the other side on the "flow" side, gross revenue of US$3.2 million obtained from its activity represents approximately 0.6% of the total capital, such that evidently revealing an under-employment of productive capacity as represented by the size of assets. In the previous years it can be observed that the value of corporal fixed assets has increased significantly and it can also be observed an increase in revenues to a bit modest extent. Revenue sources of DADL by category are given in Fig. 7.2.4.

In the meantime, DADL posted serious loses in the last three years of 2002 through 2004, with the deficits having been carried over as an accumulated loss to the following year. The accumulated loss could lead the entity to a limited investment capacity to develop certain projects by its own funds. Against this, the Marketing Department of the entity took a step to embark on financial restructuring by amending the cascading tariff structure for large-scale customers, while reflecting the new legislation (Ministerial Order) and the law that confers DADL a part of financial autonomy in the light of pricing. Viewed in this light, DADL introduced the new contracting method in 2006 that laid down a pavement for surplus revenue in the year and on. The new system of the beach use from Năvodari down to Vama Veche awards wholesale and 10-year-long-term contracts to bidders, most of which are commercial entities outside of Constanta. Of the beach areas of 166 ha over the said coastline, the right of beach use for around 132 ha has been tendered and contract awarded for about US$ 2.5 million (RON 6.9 million equivalent)[16].

With this, revenue forecast for 2006 is in favor of the Water Directorate with net surplus of around US$ 0.5 million[17]. Financial position of DADL in the past and 2006 is depicted in Fig. 7.2.5.

[16] Source: DADL, Finance Department, June 2006. Average unit price of beach use in 2006 was around RON 6.5 (US$2.3)/$m^2$, arising slightly from US$1.5-1.8/$m^2$ in the preceding years.

[17] DADL, *Bugetul de Venturi si Chektuiel, Ventuli Proprii Anul 2006i*

Table 7.2.3: Financial Statement-Balance Sheet, DADL 2002-2004

Rate of exchange (RON/US$)	3.30						
Year	2002 US$ '000	2003 US$ '000	2004 US$ '000	Year	2002 US$ '000	2003 US$ '000	2004 US$ '000
Assets				**Liability**			
Current assets							
Cash and deposits	36.7	-59.2	156.3	**Current liabilities**			
Securities							
Trade receivables				Trade payables			
Notes							
Accounts	838.0	1,486.6	875.9	Accounts	847.1	1,703.6	978.4
Provision for doubtful trade receivable	-2.2	-2.2	-2.2	Advance on contract in progress	0.0	1.0	1.9
inventories	56.0	89.1	870.0	Taxes payable and other fiscal liabiliti	100.1	110.5	572.2
Total current assets	**928.6**	**1,514.3**	**1,900.1**	**Total short term liabilities**	**947.2**	**1,815.1**	**1,552.5**
Investments and non-current assets				Long term liabilities			
Account receivables	7.3		1.1	Differed payment	0.9	20.1	806.2
Total investments and non-current assets	**7.3**		**1.1**	Accounts payable*			663.8
				Total long term liabilities	**0.9**	**20.1**	**1,470.0**
Fixed assets				**Owner's equity**			
Land	0.9	0.9	3.0				
Buildings and structure	55,565.8	55,815.0	56,675.5	Capital (patrimony)	396.7	396.7	396.7
Machinery, equipment and vehicles	713.0	1,588.5	2,633.8	Capital reserves			
Construction in progress	7,401.8	10,242.9	12,004.1	Revaluation of tangible fixed assets	10,311.3	10,616.7	10,598.4
Total property, plant and equipment	63,681.5	67,647.4	71,316.4	Reserved from profit			
Less accumulated depreciation	-23,101.7	-23,411.3	-23,665.0	Other reserves	23.8	12.6	12.6
Total fixed assets	**40,579.8**	**44,236.1**	**47,651.5**	Retained earnings	-67.3		
Intangible assets	10.6	11.5	16.1	**Total equity**	**10,664.5**	**11,026.0**	**11,007.7**
Accumulated amortization	-2.5	-6.1	-10.0	**Public patrimony**	**29,911.2**	**32,894.7**	**35,528.5**
Total intangible assets	**8.1**	**5.5**	**6.1**				
Total assets	**41,523.8**	**45,755.9**	**49,558.8**	**Total equity and reserves**	**41,523.8**	**45,755.9**	**49,558.8**

Table 7.2.4: Financial statement of DADL – profit-loss statement, 2002-2004

Rate of exchange	33000		
	2002	2003	2004
Based activity			
Net sales	**2,354.4**	**2,731.3**	**3,210.7**
Cost of sales			
salary	865.4	1,015.0	1,100.5
social security	313.8	359.1	361.6
materials	197.9	240.3	547.8
other expenses	654.9	1,059.6	1,682.9
depreciation	125.6	107.2	256.7
Tax	32.3	36.3	39.3
total cost	**2,190.0**	**2,817.6**	**3,988.8**
Gross profit (loss)	**164.4**	**(86.2)**	**(778.1)**
Revenues from goods for resales	51.0	46.7	28.3
Cost of resales	51.0	46.6	28.3
Gross profit	**0.0**	**0.2**	**0.0**
Total net sales	2,405.5	2,778.1	3,239.0
Total cost of sales	51.0	46.6	28.3
Total gross profit	**2,354.4**	**2,731.5**	**3,210.7**
Other income			
Financial revenues	2.2	0.4	9.1
Financial expenses	1.2	13.9	26.1
Financial result	**1.1**	**(13.5)**	**(17.1)**
profit tax	0.0	0.0	0.0
Total revenues	2,407.7	2,778.5	3,248.0
Total expenses	2,242.2	2,878.0	4,043.2
Profit/Loss	165.5	(99.5)	(795.2)

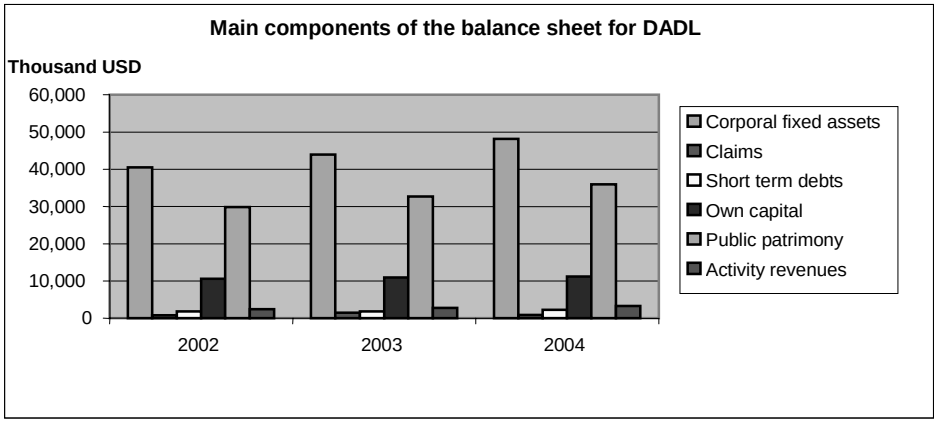

Fig. 7.2.3: Main components in balance sheet of DADL in 2002-2004

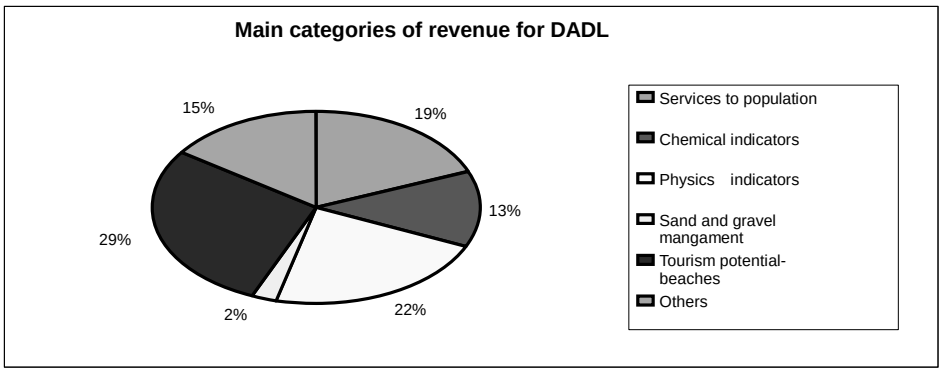

Fig. 7.2.4: Main category of revenue for DADL

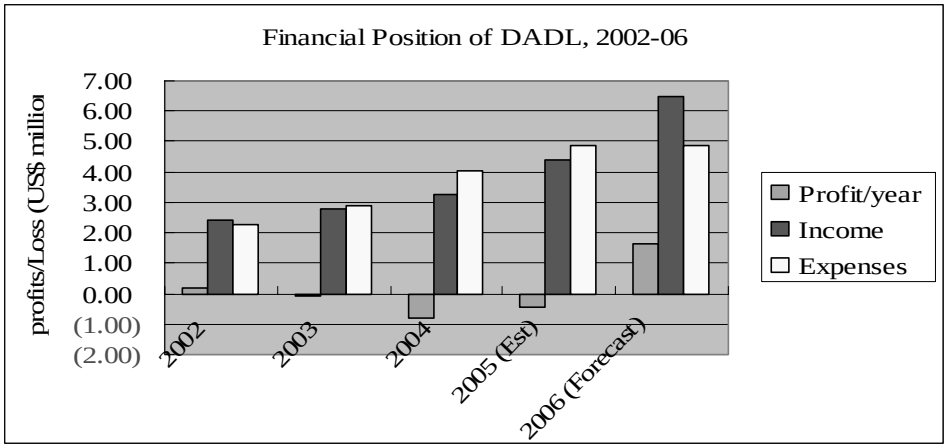

Fig. 7.2.5: Profit-loss statement of DADL, 2002-2006

(4) Financial position and investment budget of ANAR

(a) *Financial position of ANAR*

The financial analysis for ANAR takes place here based on the ANAR budget proposals, while covering the fiscal years of 2001- 2005. As visualized in Figs. 7.2.6 and 7.2.7[18], financial position was remedied in 2005 while the activity in 2004 was at a lower level than in the previous years. The financial situation of the ANAR needs to be improved in 2005 as for the last 5 months of the year. ANAR expects that the revenues will be 3 times higher compared with the same period of the year 2004 and the contributions for the exploitation of sands and gravel will almost double. The most important role in this increase is being played by the administration of Danube which will increase by 12 times. Although in each budget ANAR proposed to obtain a profit for the respective year, it seems this was not the case, or it is not very significant, as the revenues from exploitation are almost equal with the expenditures from this category.

The main category of expenditures is the one with personnel, being at around 50% of total expenditures. Also the personnel of the company remained at an almost constant level, around 9350 employees. The next important categories of expenditures are the ones with materials and other expenditures inclusive of protocol advertising, sponsorship, and others.

[18] The graph was elaborated using data from the approved budget for the years 2001, 2002, 2003, actual economic results for 2004 and proposed budget for 2005.

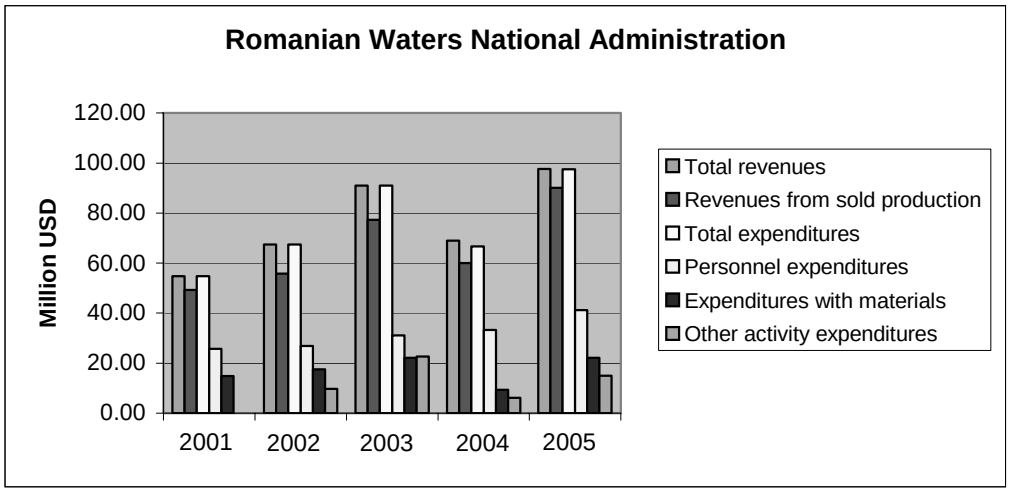

Fig. 7.2.6: ANAR revenues and expenses, 2001-2005

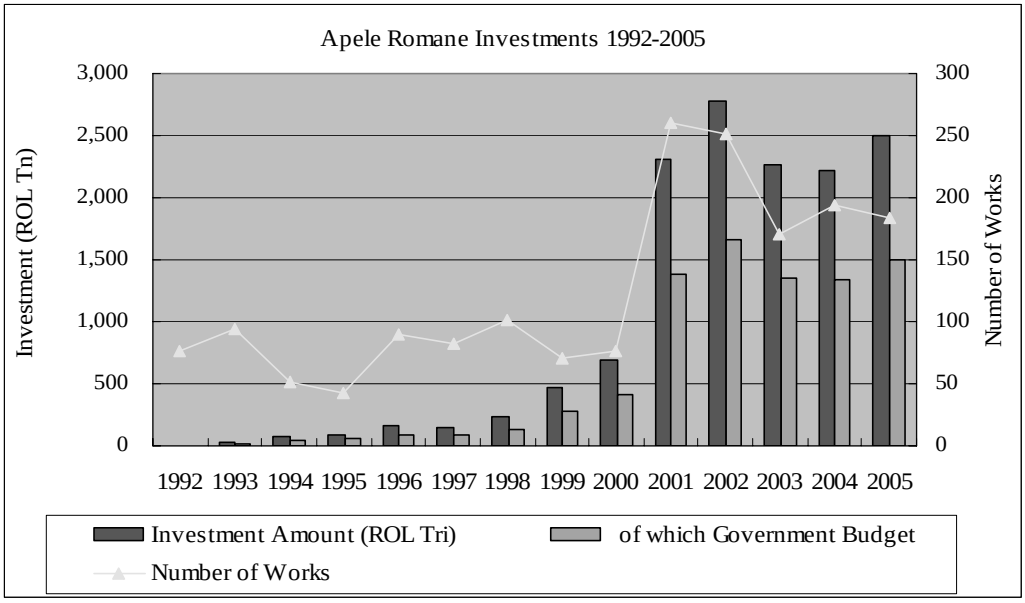

Fig. 7.2.7: Development budget of ANAR, 1992-2005

(b) *Investment budget*

The aggregate investment budgets approved for the fiscal year of 2001 through 2004 and that proposed for 2005 are posted at US$77.1 million, US$92.5 million, US$75.3 million, US$74.0 million, and US$83.2 million as per 2005 foreign exchange quotation equivalent, respectively in that descending order. Prior to 2001 when the Government and the European Bank for Reconstruction and Development (EBRD) commenced a concerted effort in financing the comprehensive management of water resources in the country, investment had moderately been placed with the state funds of US$ 0.2 million equivalent to US$23.0 million equivalent in respective of 1992 and 2000. With this and number of works implemented by ANAR, the simple average of investment costs stood somewhere around US$0.3 million (2001) to US$ 0.45 million equivalent (2004). Of the aggregate investment activities by ANAR, investments in Dobrogea Litoral (DADL) remained somewhat moderate, while accounting for 3.1%, 3.6%, 5.2%, and 4.6% in 2001 through 2004, in that order.

Of the investment activities in water resource management, the largest chunk emanates from those for flood mitigation, followed by conservation of water resources, and environment protection, while each of these accounting for 86.9 percent, 10.9 percent, and 2.2 percent, in that order. Transitional change in ANAR investments by category is depicted in Figure 7.2.8.

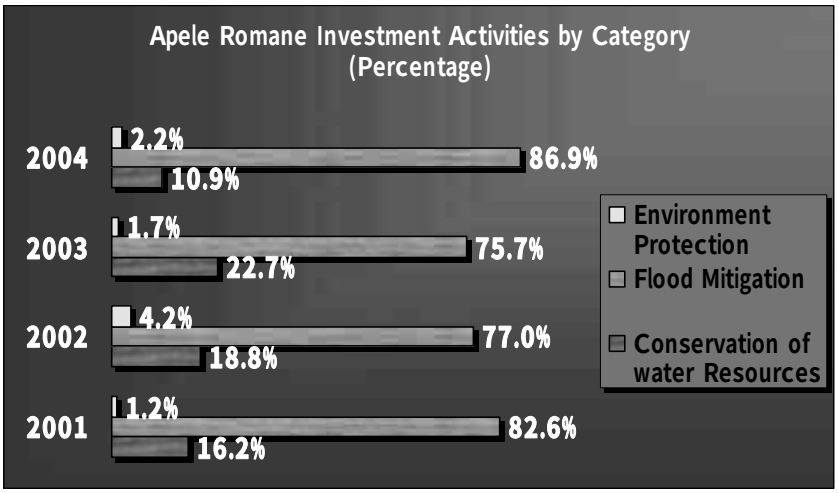

Fig. 7.2.8: Investment budget by category 2001-2004

In the mean time, recurrent budgets of the entity have almost as par the aggregate budgets for development works, with US$ 53.3 million, US$ 74.3 million, US$ 72.5 million, and US$ 96.6 million (proposed) foreign exchange quotation equivalent over the same period of 2001 through 2005. To note that funding sources of recurrent budgets of the ANAR headquarters (HQ) and each of the eleven regional offices come from contracted companies who pay taxes and duties for water delivery and management services supplied by ANAR. Revenue of the headquarters covers recurrent budgets of themselves and those of some regional offices that are currently running deficits. In principle, each of the regional offices is autonomously to cover their recurrent budget while raising enough funds from their own public services.

Of the aggregate, personnel expenditure has been moderate out of the current budget and has little fluctuated in the past five years, with 46.9 percent in 2001 to 49.8 percent in 2004. This expense is to be curbed down to 42.2 percent in 2005. Average salary with social security and other items of fringe benefits stood at US$323.4 equivalent (RON 970) per person per month in 2004.

(5) Revenue by administrative unit in Constanța County

(a) *Quota of income tax for local governments*

According to the Emergency Ordinance No. 45/2003 Article 5, income for local budget comprises:

a) Own incomes from: taxes, fees, contributions, other payments, other incomes and deducted quotas from the income tax;
b) Deducted amounts from certain income of the state budget;
c) Subsidies received from the state budget and from other budgets; and
d) Donations and sponsoring.

In compliance with the Article 28 of GO No. 45/2003, modified by EGO No. 9/2005, income tax collected by the state at the level of the local administrative unit is distributed amongst the central and local governments by a quota of:

- 47% shall be allocated monthly to the local budgets of the communes, towns and municipalities, on the territory of which tax payers are carrying on their activities;
- 13% to the own budget of the county; and
- 22% to a distinct account, opened on account of the county council for the balancing of the local budgets of the communes, towns, municipalities and county.

Local governments prepare development programs annually, under the authority of coordination and decision by Governor (*Prefectura*), for the rectification or approval as given by local/county councils. Development programs as an annex to annual budget include the project details as under:

a) Objective of and rationale for the proposed project,
b) Estimated project cost by category (foreign exchange and local portions),
c) Indicative financing plan with specific financing sources in view,
d) Budgetary allocation envisaged,
e) Project life and implementation schedule,
f) Implementing body,.
g) Annual operation and maintenance costs estimated, and.
h) Technical documents including maps and engineering designs.

In the implementation of development projects with external funds covering part of the total costs, state budget is transferred on a grant basis, as stipulated by the article 30 (OG no. 45/2003).

(b) *Financial position of Constanța County currently in place*

Seeking for the ways and means to complement aggregate financial needs for the public intervention at the local level, it would be imperative to take financial involvement of the county council (Prefectura's Office) as well as the local council (Municipality of Constanța) in view. As stipulated in the Public Administration Law, the County Council is to develop County Territorial Development Plan, while coordinating local councils in the county. Further, the county council may finance infrastructure projects[19]. In this context, a brief look at the financial position of the Constanța County to date is made, with the finding in the following:

The total revenue of the county was US$60 million equivalent in 2004. Of this, the largest chunk emanated from the Municipality of Constanța accounting for around 47.0 percent, followed by the aggregate villages in the county, the County Council, the aggregate towns in the county, and two other municipalities, with each of these accounting for 16.4 percent, 15.1 percent, 12.2 percent, and 9.3 percent, in that order. Revenue by administrative unit in the County in 2004 is depicted in Fig.7.2.9.

As of 31 March 2005, the aggregate debt outstanding of the county stood at RON 20.6 million[20] (equivalent to around US$5.8million as per 2005 foreign exchange quotation), of

[19] Source: Royal Haskoning, *Institutional Arrangement for ICZM in Romania*, 2004, p.15, To note that the report of Royal Haskoning also describes somewhat contradictory in the function of investment financing by Prefecture, as quoted by " The Prefecture can not finance the project" on the same page 15. This point may be clarified in the forthcoming field study by the JICA team.
[20] Precisely ROL205,517.966 million (Source: Prefectura Office, Constanta County, 2005)

which those accrued to current and development budgets account for 85.1 percent (US$4.9 million) and 14.9 percent (US$0.9 million), respectively.

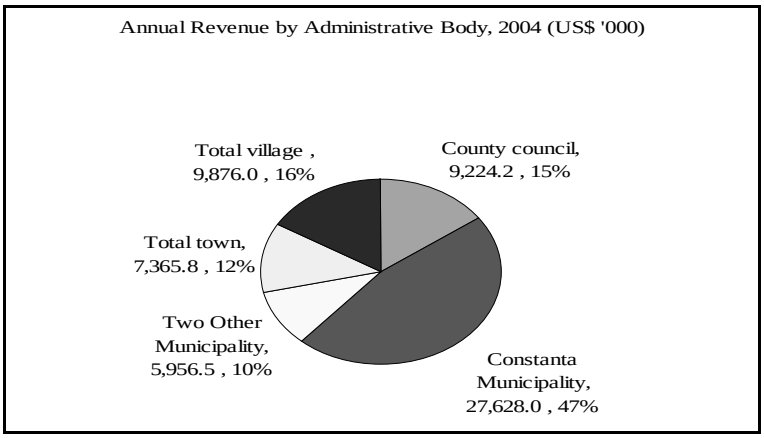

Fig. 7.2.9: Revenue by Administrative Unit in Constanta County, 2004

(6) Conclusive remarks

Affordability of public investments (development projects) is a double-folded analysis, as reflected in the previous sections, which includes (i) affordability at the sector level, and (ii) affordability at the project level. With regard to the macro-front of the former element (the coastal protection and rehabilitation scheme in the Romanian economy), the issue will be addressed in favor of the sub-sector in concern. As previously noted in **7.1.1** and Table 7.1.1 of this volume, external public funds for collaborative effort for the country's socio-economic development, with the EU post-accession fund (European Regional Development Fund and Cohesion Fund) as a forerunner in particular, are readily available. Besides, the World Bank newly approved the Municipal Services Project to MoEWM for the development of environment protection-related infrastructure in pilot 11 counties, in line with the newly coming *Country Partnership Strategy 2007-2009*,[21] following the Environment Management Project of US$150 million in 2005 as the possible financing sources. Further, financing from the Council of European Development Bank (CDB) would readily be of avail, while considering the Bank's preferential support extended thus far to Romania as described in **8.4.1 (8)** of Volume 1. Likewise, the state government has a medium-term rolling budget program for coastal protection over the forthcoming three years of 2007-2009, with US$157.8 million in aggregate as an indicative fund package for the sector as listed in Table 7.2.1. Political commitments of the government of Romania together with the international partnership society in pursuance of the sound and sustainable management of the country's environment assets inclusive of the eastern coastal areas seem profoundly firm.

On the micro-side of coastal protection and rehabilitation scheme in the country, the proposed public intervention measures for the protection and rehabilitation of the two pilot seashore areas of Mamaia Sud and Eforie Nord constitute a part of the pipeline projects for EU

[21] *CPS 2007-2009* was approved by the Bank Board on 16 June 2006, with other five (5) specific projects inclusive of the one as named in the main context above. Other four (4) projects include the Social Inclusion Project supporting the vulnerable sector people in the society for US$60 million, the Revenue Administration Mobilization Project to MOPF (US$70 million) to strengthen the administration to raise government revenue (now revenue accounts for 29% of GDP and VAT collection rate at 55%), the Transportation Improvement Project to MoLIT for road maintenance in outside cities, and the Avian Flu Control Project to MOH and MOA

post-accession financing within the operational framework for ESOP[22]. While the decision of the government and EU in Brussels regarding the selection of specific projects for aid-financing is to be made by the end of 2006, the proposed project is most likely to take a lead for financing from EU-post accession Cohesion Fund, provided that technical details and environment issues are delineated and get ready for application to Brussels, on a *ceteris paribus* basis. Further, the uprising revenue and associated financial position of the project beneficiary – DADL, as reflected in **7.2.2 (3)** of this volume, is favorable for implementing operation and maintenance works on their own financial basis.

Central to the smooth and well-oriented initiation of the project preparation for the concerned measures in Constatnța is the government's firm policy commitment to the sector in, not only a short-, but the medium- and long-term coastal protection in the country. With this, it would be likely that the project and the long-term coastal protection plan up to the forthcoming 14th year be sustainable under the auspices of the government in collaboration with the international society, while being provided a sequential budget to initial investment, part or all of operation and maintenance costs, and planning and implementation of projects that follow in the years that come. In tandem, policy measures would come in place providing revenues retained at DADL, with the further delegation of financial and managerial autonomy to the Water Directorate in Constanța[23].

7.2.3 Financing Plan with EU Funding in Sight

The aggregate financial cost of the project over the project period for four years (fully three and half years for construction works) is currently estimated at EUR46.27 million inclusive of taxes and duties, and physical and price contingencies, of which the sub-component projects at Mamaia Sud and Eforie Nord cost respective of EUR 12.50 million (27.0%) and EUR 33.77 million (73.0%)[24].

In line with what has been advised by the EU official in Bucharest on the preparatory works by the Government of Romania for EU financing, the following tables are prepared while highlighting the indicative project costs as disaggregated to the cost component by financing eligibility for the respective of "project as a whole" (one-package project) as well as the sub-projects at Mamaia Sud (Component "A") and Eforie Nord (Component "B")[25]. In summary, costs eligible for EU funding are EUR 12.24 million, EUR 33.03 million, and EUR 45.27 million inclusive of physical and price contingencies for the Component "A", Component "B" and the Aggregate (A+B), in that order.

Tables 7.2.5, 7.2.6, and 7.2.7 list the breakdown of costs eligible for EU funding for the Components "A," "B," and the aggregate "A+B," respectively, while Table 7.2.8 lists the

[22] The Study team was advised at the time of discussions with Mr. Silviu Stoica, General Director, Directorate of Implementation of European Funds, MoEWM and others of close relevance. In the meantime, decision making of investment and project financing is an administrative matter solely incurred to EC Headquarters in Brussels, the Study team was not yet in a position to confirm the said advise at the time of June-July 2006 field mission.

[23] By the time the draft Final Report was being prepared, this issue of financial autonomy and delegation of managerial power and authority from ANAR Headquarters to DADL was left unspecified. In this connection, further observation and discussions, as necessary, would closely be relevant to financial autonomy and associated sound capacity of investment financing by DADL as a project beneficiary.

[24] Current estimates assume the use of river sand from the Danube.

[25] In this connection, a lot of thanks are due to Mr. Cesar Niculescu (then EC Delegation official and now the World Bank professional staff) and Ms. Adriana Micu (EC Delegation official) for their kind advises and information extended to the study mission.

breakdown of costs eligible for EU funding for respective components. The engineering cost tables for Components "A" and "B" exclusive of price contingencies are provided in Table 3.3.1 of **3.3** and Tables 4.5.1 of **4.5.**

Table 7.2.5: Indicative financial cost by eligibility for EU funding Component "A"

No.	Item	Eligible Cost (Euro mil.)	Non-Eligible Cost (Euro mil.)	Total Cost (Euro mil.)
1	Material	2.01	0.00	2.01
2	Equipment	5.34	0.00	5.34
3	Labor Cost	1.91	0.00	1.91
	Skilled	1.62	0.00	1.62
	Unskilled	0.29	0.00	0.29
4	Management (MIU) and monitoring cost	0.84	0.00	0.84
5	Engineering Service	0.65	0.00	0.65
6	Taxes and Duties	0.00	0.23	0.23
7	Base Cost	10.75	0.23	10.98
8	Physical Contingency (Base Cost ×5%)	0.54	0.01	0.55
	Base Cost + Physical Contingency	11.29	0.24	11.53
	Price Contingency	0.95	0.02	0.97
9	TOTAL	12.24	0.26	12.50

Table 7.2.6: Indicative financial cost by eligibility for EU funding Component "B"

No.	Item	Eligible Costs (Euro mil.)	Non-Eligible Cost (Euro mil.)	Total Cost (Euro mil.)
1	Material	6.14	0.00	6.14
2	Equipment	11.96	0.00	11.96
3	Labor Cost	6.12	0.00	6.12
	Skilled	4.93	0.00	4.93
	Unskilled	1.19	0.00	1.19
4	Management (MIU) and monitoring cost	0.82	0.00	0.82
5	Engineering Service	1.70	0.00	1.70
6	Taxes and Duties	0.00	0.61	0.61
7	Base Cost	26.74	0.61	27.35
8	Physical Contingency (Base Cost ×5%)	1.34	0.03	1.37
	Base Cost + Physical Contingency	28.08	0.64	28.72
	Price Contingency	4.95	0.10	5.05
9	TOTAL	33.03	0.74	33.77

Table 7.2.7: Indicative financial cost by eligibility for EU funding Components "A" and "B"

No.	Item	Eligible cost (Euro mil.)	Non-eligible cost (Euro mil.)	Total cost (Euro mil.)
1	Material	8.15	0.00	8.15
2	Equipment	17.30	0.00	17.30
3	Labor Cost	8.03	0.00	8.03
	Skilled	6.55	0.00	6.56
	Unskilled	1.48	0.00	1.48
4	Management (MIU) and monitoring cost	1.66	0.00	1.66
5	Engineering Service	2.35	0.00	2.35
6	Taxes and Duties	0.00	0.84	0.84
7	Base Cost	37.49	0.84	38.33
8	Physical Contingency (Base Cost ×5%)	1.88	0.04	1.92
	Base Cost + Physical Contingency	39.37	0.88	40.25
	Price Contingency	5.90	0.12	6.02
9	TOTAL	45.27	1.00	46.27

Table 7.2.8: Indicative eligible costs for EU financing by components

No.	Item	Component A Mamaia Sud	Component B Eforie Nord	Total cost
1	Material	2.02	6.14	8.16
2	Equipment	5.34	11.96	17.30
3	Labor Cost	1.91	6.12	8.03
	Skilled	1.62	4.93	6.55
	Unskilled	0.29	1.19	1.48
4	Management (MIU) and monitoring cost	0.84	0.82	1.66
5	Engineering Service	0.65	1.70	2.35
6	Taxes and Duties	0.00	0.00	0.00
7	Base Cost	10.75	26.74	37.49
8	Physical Contingency (Base Cost ×5%)	0.54	1.34	1.88
	Base Cost + Physical Contingency	11.29	28.08	39.37
	Price Contingency	0.95	4.95	5.90
9	TOTAL	12.24	33.03	45.27

7.3 Economic Analysis of the Project

7.3.1 Intorduction

The economic internal rate of return (EIRR)[26] analysis takes place herein where economic viability of the Project is quantitatively measured by EIRR, with the economic net present value (ENPV), based on the estimated economic cost and benefit streams laid down over the project period. Financial costs are converted to economic cost in real term to reflect the true

[26] IRR, by definition, is a discount rate that equalizes discounted net benefits (benefit-cost) over the project life, and mathematically expression as follows.

$$\text{IRR} \equiv r : \text{that makes } \sum_{t=1}^{n}\{(B-C)_t \times (1+r)^{-t}\} = 0$$

where $(B-C)_t$ represents net benefit in the year t (t = 1, 2,…, n). The above equation is numerically solved by repeated calculation.

value of goods and services employed during the project period. The analytical framework and methodologies, the variables and assumptive parameters applied, and the outcomes are delineated and sequentially provided in the following section.

Meanwhile, it would be stressed that quantitative analysis of economic feasibility attributable to environment sector projects like the project in concern has been carried out under the JICA study, applying the Contingency Valuation Method (CVM) in measuring people's Willingness to Pay (WTP) for coastal protection as part of the project benefits (incremental benefits) [27]. During the Study, field survey has duly been conducted by making interviews to nearly five hundred Constanța county residents and beach visitors[28]. The detailed methodology and results of the survey are presented in **I.3** of Annex I of Volume 3.

7.3.2 Analytical Framework and Methodology

(1) Analytical framework

In the light of EIRR analysis to be undertaken for the concerned project, the economic cost stream as par constant 2006 price level includes (i) capital cost of investment, and (ii) associated operating and maintenance (OM) costs for the life of constructed facilities (project life)[29]. On the other hand side, the benefit stream pertains to (i) people's revealed preference as measured by Willingness to Pay (*WTP*) for the upgraded coast environment in terms of quality (ambiency[30]) and quantity (enlarges beach areas), (ii) foreign exchange earned by enlarged beach areas (*Incremental Benefits*), (iii) foreign exchange as a recovery of foregone benefit that takes place due to a beach fill of eroded beach areas (*Cost-saved*), and (iv) avoidable damage (social loss) owing to the project (*Cost-saved*).

In the estimation of the last benefit component (avoidable damage), social costs accrued to construction and rehabilitation works for the facilities in place and geological condition, *vis-à-vis*, the promenade and cliff revetment on the seashore line of Eforie Nord, are taken up. To note that no damage estimate is made for residential housings, industrial units and facilities, and public institutions with regard to economic loss which people and the government would have to bear in the case of further progress of coastal erosion and associated cliff collapse in future[31]. In a bid to avoid arbitrariness in and unnecessarily futile arguments during analysis, indirect benefits of such social costs possibly attributable to the project have been excluded, thus resulting in somewhat lower and conservative benefits.

The economic benefits in the framework of "with" and "without" project as elucidated in the above is depicted and given in Fig. 7.3.1.

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[27] Where no interview survey is undertaken, *WTP* is treated as a mark-up expenditure level for beneficiaries that induces people's normative value-judgment as to whether the proposed technical scheme could shift their welfare level upwards under the binding financial constraint.

[28] In this connection, the Study team is so grateful to Prof. Dr. Virgil Breaban and his young talented colleagues/ students at the "Ovidius"University of Constanța who devotedly supported field study and research work in Constanța during a hot month of August and the following period.

[29] Costs associated with the relocation of the housing units/business entities is assumed to be the sunk costs, thereby leading no addition of economic cost accrued to this project. Likewise, land use enhancement that may include land loss prevention and land use restoration is not imputed on the project because nearly non-existence of agricultural lands within the concerned area.

[30] The term "ambiency" is used in the context of "people's happiness perceived by the cozy atmosphere of Mamaia Sud and Eforie Nord beaches in environmentally and scenically sound condition.

[31] While this portion of "would-be social costs" had been considered at the time of Interim Report preparation, the detailed engineering study has indicated little possibility of the occurrence of this type of damage within the time framework of the concerned study.

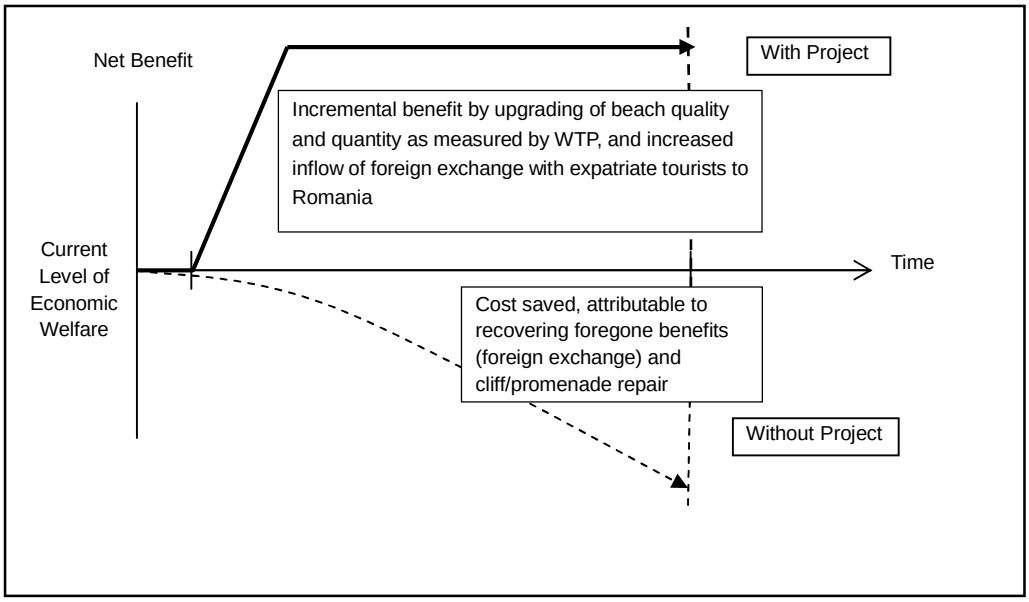

Fig. 7.3.1: Economic benefits in the framework of "with" and "without" the project

In addition to the methodology as given above, a Long-run Marginal Cost (LRMC) pricing method for the measurement of economic impact due to the proposed project will be applied in the study, as appropriate. Underlying assumption of this method is that economic benefit of investment measures is maximized when the price (benefit) is identical to estimated marginal cost under the assumption of perfect competitive market. Microeconomics background of LRMC pricing is given in **H.2.3** of Annex H of Volume 3. In the light of economic analysis of development projects, it would be noteworthy to address the issues of the following:

(i) indirect benefits incurred and arbitrariness in analysis,
(ii) land value as economic benefit,
(iii) economic pricing, and
(iv) transfer payment.

This would provide a conceptual and operational framework for analytical procedure commonly in place amongst the international financing institutions and others of close relevance.

(a) *Indirect benefits attributable to coastal protection*

In general, indirect damage comprises a number of components inclusive of loss of retail and industrial outputs, losses stemming from downgraded environment-induced interruptions in utility services, and cost of emergency operations due to possible damage to fixed assets on the coastal zone. While there would be discussions under the current study to incorporate indirect costs accrued to coastal erosion, this issue tends to be arbitrary to a great extent, as such the JICA study in place does not take any point to discuss the issue[32].

[32] Not for sure, but there would have been little number of papers /documents that investigated indirect costs of costal erosion thus far. Meanwhile, there are some papers regarding the quantification of indirect costs accrued to environment sector development projects. For instance, the Canadian International Development Agency (CIDA) *Flood Control Manual* of 1993 specifies, as summarized by the Asian Development Bank, a set of values for indirect damage as a portion of direct damage, notably, 15 percent for residential areas, 37 percent for commercial activities, 45 percent for industrial activities, and 10 percents for agriculture.

In the meantime, indirect benefit attributable to flood control projects would, in general, include land use enhancement that pertains to land loss prevention and land use restoration. While this would be considered acceptable to quantify benefits and incorporate in the analysis where agricultural land had been part of project component, the concerned project is not such a case, thus leading no attempt to include this segment of project benefits.

(b) *Land value*

In line with the economics concept of "opportunity cost of scarce resources" employed in development projects, the economic value of land is normally accepted to be assessed in terms of land productivity, *inter alia*, crops gained or grass used for horticulture. In this light, it is important to note that "market price of land" does not represent its economic value because the financial cost of land has only been set in terms of demand and supply in the market, as such no consumption of scarce resources accrued to the specific project in sight. Alternatively saying, the economic value of land is not generated by public investment measures unless there has been some production of "value" incrementally accrued. Furthermore, land prices in urban area are tend to be distorted by speculation in future price escalation expected, and also by social prestige psychologically attached to the specific land lot. Closely keeping this in view, it is reiterated that the escalation of market value of land in the study area is not included as project benefit in the current analysis.

(c) *Economic pricing*

With the incremental supply of physical infrastructure for coastal protection and rehabilitation on the southern Romanian Black Sea shore, with Mamaia Sud and Eforie Nord in particular, the proposed project is the least-cost and environmentally sound solution to mitigate coastal erosions as gradually but steadily experienced in the area thus far. The project is also to enhance the region's tourism industry that is conducive to an increased growth of regional products and people's welfare by way of inflow of foreign exchange and other socio-economic resources. In this light, economic analysis of the prospective seashore protection and rehabilitation project is hereby undertaken while quantifying benefits and costs as measured in terms of the opportunity costs of resource scarcity and allocative efficiency in the national economy as a whole. As a rule of thumb in generally accepted principles and guidelines for cost-benefit analysis (C/B Analysis) of public investment measures, economic analysis places financial costs as a basis on which the modification procedure is undertaken while converting market value of goods and services to border prices.

As for the foreign cost portion of the project, this procedure is reflected by way of valuating goods and services in, *notably*, CIF (Cost of Insurance and Fleet) and FOB (Fare on Board) prices, respectively. Likewise, the local cost portion of the project, Conversion Factors are applied to convert market value of financial costs to its value in shadow prices as expressed in terms of border currency units (specifically in US$ term). In so doing, a Standard Conversion Factor (SCF) is applied to all of the non-tradable goods and services employed (local cost components). In line with what has generally been accepted in economic analysis of development projects, specific conversion factors for some of the construction materials, machinery and equipment, wherever applicable, and skilled and unskilled labor had duly been considered in due course of analysis. With this, the conversion factor for unskilled labor is being applied in the current study, while referring to the projects under the auspices of the World Bank (WB), the European Bank for Reconstruction and Development (EBRD) and others of close relevance, as appropriate.

While SCF requires, in estimation, information on the ratios of border prices to market prices for a variety of commodities, it can be approximated by the use of data on foreign trade and net border taxes of general commodities. The approximation is provided by the border value formula as follows.

$$SCF = (M+X) / \{(M+t_m)*(X+t_x)\} \quad (7.3.1)$$

where M and X denote the values of imports and exports in border prices, respectively, where t_m is import duties net of subsidies and t_x is export duties net of subsidies.

(d) *Transfer payments*

Transfer payment means a shift of claims on real resources from one member or sector of society to another without causing any depletion of scarce resources in the society. This includes interest payments, domestic taxes and duties, and subsidies such as the government compensation to re-settlers. With this in view and as commonly applied in economic analysis of development projects, transfer payments are excluded from financial costs in due course of the estimation of economic costs.

7.3.3 Economic Costs

(1) Guiding principle

The cost stream comprises (i) capital investment for new and rehabilitated coastal protection facilities, (ii) capital investment for beach fill, and (iii) new and incremental operation and maintenance (OM) costs accrued to the management of these facilities and beaches for land preservation and environment conservation at a required level over the period of 2007 through 2047. To note that the estimation excluded the costs incurred prior to the afore-mentioned years as *sunk costs*. As reflected immediately above in 7.3.2 (1) (iii), the economic costs of the local cost portion is estimated based on the financial costs, while applying the conversion factors (SCF: 0.95, and unskilled labor: 0.85).

(2) Results

Based on the financial costs as duly estimated by the Study team and revealed in **7.2** of this chapter, the economic costs of the project components "A" (Mamaia Sud) and "B" (Eforie Nord), and the aggregate ("A + B") have been estimated, while excluding non-eligible items (land acquisition), transfer payments (taxes and duties), and price contingency. The outcomes are summarized in Table 7.3.1, together with the estimate for the case of Mamaia Sud using sea sand. Financial costs inclusive of price contingency for the cases of using river sand are also listed in Table 7.3.1 for reference. The difference is due to price contingency and conversion of local costs to economic costs.

Table 7.3.1: Economic and Financial Costs by project component [units: EURO mil. (US$ mil.)]

Component	River Sand	Sea Sand	Financial Costs
Component "A" at Mamaia Sud	10.67 (13.67)	18.39 (23.36)	12.50 (15.84)[33]
Component "B" at Eforie Nord	26.87 (33.91)	NA	33.77 (42.78)
Aggregate ("A + B")	37.54 (47.57)	NA	46.27 (58.62)

The detailed economic cost tables for the components "A" and "B" and the aggregate "A + B" are given as Tables 7.3.2, 7.3.3, and 7.3.4, respectively.

[33] Cost estimates for the case of using river sand for the both components "A" and "B"

Table 7.3.2: Economic cost of aggregate "A+B"
(EUR mil.)

Cost Items	FC	LC	Total
Materials	1.01	6.77	7.78
Equipment	0.0	16.43	16.43
Labor	3.25	4.50	7.75
Skilled	3.25	3.13	6.38
Unskilled	0.0	1.37	1.37
Land Acquisition	0.0	0.0	0.0
MIU and Monitoring Cost	0.50	1.04	1.54
Engineering Fee	1.41	0.86	2.27
Taxes and Duties	0.00	0.00	0.00
Base Cost	6.17	29.60	35.77
Physical Contingency	0.30	1.47	1.77
BC+PhC	*6.47*	*31.07*	***37.54***
Price Contingency	*0.00*	*0.00*	*0.00*
Aggregate costs	**6.47**	**31.07**	**37.54**

Table 7.3.3: Economic cost of component "A"
(EUR mil.)

Cost Items	FC	LC	Total
Materials	0.37	1.55	1.92
Equipment	0.00	5.07	5.07
Labor	0.85	0.97	1.82
Skilled	0.85	0.73	1.58
Unskilled	0.00	0.24	0.24
Land Acquisition	0.00	0.00	0.00
MIU and Monitoring Cost	0.25	0.50	0.75
Engineering Fee	0.39	0.22	0.61
Taxes and Duties	0.00	0.00	0.00
Base Cost	1.86	8.31	10.17
Physical Contingency	0.09	0.49	0.50
BC+PhC	*1.95*	*8.72*	*10.67*
Price Contingency	*0.00*	*0.00*	*0.00*
Aggregate costs	**1.95**	**8.72**	**10.67**

Table 7.3.4: Economic cost of component "B"
(EUR mil.)

Cost Items	FC	LC	Total
Materials	0.64	5.22	5.86
Equipment	0.0	11.36	11.36
Labor	2.40	3.53	5.93
Skilled	2.40	2.40	4.80
Unskilled	0.0	1.13	1.13
Land Acquisition	0.00	0.00	0.00
MIU and Monitoring Cost	0.25	0.54	0.79
Engineering Fee	1.02	0.64	1.66
Taxes and Duties	0.00	0.00	0.00
Base Cost	4.31	21.29	25.60
Physical Contingency	0.21	1.06	1.27
BC+PhC	*4.52*	*22.35*	*26.87*
Price Contingency	*.00*	*0.00*	*0.00*
Aggregate costs	**4.52**	**22.35**	**26.87**

7.3.4 Economic Benefits

(1) Guiding principle

The economic value attributable to the project is estimated by way of quantifying the following items:

(i) People's welfare as perceived by the presence of beaches on a sound basis (use- and non-use value) – Willingness to Pay (*WTP*),
(ii) Foreign exchange (FX) earned in association in with the incremental beach areas and expatriate tourists to the region,
(iii) Foreign exchange saved due to the prevention of downsizing expatriate tourism to the region associated with beach preservation, and
(iv) Social costs saved, attributable to the prevention of the erosion of promenade and cliff revetment on the beach.

Although there is an opinion that cliff collapse due to scouring at its foot by wave actions may lead to the damage to buildings and housings on top of coastal cliff in the Eforie Nord project site and that it should be calculated as part of the social cost saved, it is not included in the economic value estimate in this Study because of the uncertainty of time and scale of damage occurrence.

Alternatively, the Long-Run Marginal Cost (*LRMC*) pricing method is applied for the measurement of project benefit incurred to the Component B at Eforie Nord. To simplify discussions on the preceding economic benefits, the benefits by project component and factor are delineated and listed in Table 7.3.5.

Table 7.3.5: Economic benefits by project components and items

Component	WTP	Incremental FX	FX Saved	Social Cost Saved
Mamaia Sud	O	O	O	–
Eforie Nord	O	O	O	O

(2) Methodology

In valuation of economic benefits of incremental supply of wastewater management in a bid to assess the viability of the project more accurately, the current analysis applies two major approaches, vis-à-vis, (i) Willingness to Pay (*WTP*) for the use- and non-use value of coastal protection and rehabilitation, and (ii) Long-Run Marginal Cost (*LRMC*). *WTP* is coherently defined as people's perceptive "*bid prices*" at the highest level for the service to be rendered, or "*proxy measurement*" of economic value.

(a) *Willingness to Pay* (*WTP*)

As a preposition of the numerical analysis of economic benefits attributable to each of the priority projects, an interview survey for the estimation of people's willingness to pay for environment protection took place in August 2005 in Constanța. The study population of the 10 coastal cities and communities on the Black Sea shore area in Constanța County has presumably been set at around 421,000 out of the total 715,000 residents in the county. Random sampling took place in the preparation of interview survey, with 249 interviewees having the same probability of being selected. In addition, 150 interviewees were randomly picked up at beaches, and 70 from business entities. In total, the analysis was made on the

answers of 449 interviewees, which yielded an estimate of US$2.3 (1,8 Euro) per month per household. Details of the interview study are described in **I.3** of Annex I of Volume 3 with questionnaire forms which contained 24 questions in 14 sheets.

In carrying out the survey, *Contingent Valuation Method (CVM)* with specifically a "Double-bound Dichotomous Choice Method" was taken up as an analytical tool to elicit *WTP*. In the meantime, *WTP* for healthy condition was in tandem incorporated in the questionnaire in a bid for interviewees, particularly non-users of beaches, to understand the effects of "intangible benefits" inclusive of "environment protection" and "health", as such helping people's bid on those values in monetary terms. While few number of the study experiences on people's willingness to pay for environment protection has taken place thus far either in this region or in the country, this study as an experimental forerunner would help to understand people's general perception and behaviors in association with environment protection in Romania. Details of CVM survey, procedures and the results are described in **I.3** of Annex I of Volume 3.

(b) *Long-Run Marginal Cost* (*LRMC*) *Pricing*

One alternative measurement of the benefit is the "*price of the concerned public service"* and it is set forth in line with Long-run Marginal Cost (*LRMC*) of project output. *LRMC* pricing, by mathematical definition, ensures the most efficient allocation of scare resources (leaving no "dead-weight-loss" as referred to in the Pricing theory of Microeconomics), thus making the whole economy better-off. In estimation of *LRMC*-based price, the most commonly used variant of the theoretical concept in welfare economics and investment-decision theory is a levelized annuity cost coupled with recurrent cost incurred every year. In a bid to further estimate the annualized cost of investment, capital recovery factor (*CRF*), which is a function of (social) discount rate of capital (denoted by *i*) and economic life (*n*), will be applied in most of the places.[34]

Numerical expression of *LRMC* pricing comes in the following:

Annutized economic cost of capital investment accrued (Marginal Cost)

= TC (total cost) * *CRF* (*i*, *n*) + annual economic O/M cost (7.3.2)

where TC denotes the total capital investment cost, while *CRF* is depicted as:

$$CRF^{35} \equiv \frac{i(1+i)^n}{(1+i)^n - 1} \tag{7.3.3}$$

With the underlying theory and practices in view, model configuration and the resulting in the current analysis is given below.

[34]Another variant of MC widely used is the Long Run Average Incremental Cost (LRAIC) with its short accessibility to the relevant information and data. In theoretical terms it may not be correct nonetheless it is useful as an approximation. Mathematically it is expressed as LRAIC = $\left\{\sum\left(It\times(1+r)^{-t}\right)\right\}/\left\{\sum\left(Q_t\times(1+r)^{-t}\right)\right\}$ where *t* is a year in a project period (*t* = 1,2,...., *n*), whereas *i*, I and Q denote a discount rate, an incremental investment and an incremental supply, respectively.

[35]CRF is defined as a summation of depreciation (represented by a sinking fund factor) and opportunity cost of capital (or inflation rate), which is mathematically depicted as follows:

$$\frac{i(1+i)^n}{(1+i)^n-1} = \frac{i(1+i)^n+i-i}{(1+i)^n-1} = \frac{i\{(1+i)^n-1\}+i}{(1+i)^n-1} = \frac{i}{(1+i)^n-1} + i$$

7.3.5 Model Configuration and Assumptive Parameters

(1) Analytical procedure

In carrying out the study, step-by step procedure for economic analysis of the project has been followed. That includes the following:

a) Taking a bird's eye view of public finance at the local administrative authority, inclusive of income/profit/property tax collections
b) Collecting financial and engineering data/information for the conversion of costs and benefits valued at market price to those assessed in economic terms,
c) Undertaking economic analysis by WTP method and Marginal Cost Pricing method to investigate economic feasibility of the project, with the measurement index of Economic Internal Rate of Return (EIRR), and
d) Sensitivity analysis for variation in relevant parameters, *vis-à-vis*, (i) lower benefit by 10 percent, (ii) capital cost over-run by 10 percent, and (iii) one year delay in project completion (delay in benefit generation).

(2) Model configuration and assumptive parameters

Subject to technical and other most relevant and best available data/information, model configured and numerical assumptions are set forth with a number of variables and assumptive parameters as specified to each of the categories. They are given in the following:

a) Project life,
b) Foreign exchange quotation,
c) Conversion factors,
d) Economic benefit (1): incremental beach areas,
e) Economic benefit (2): foregone beach areas,
f) Economic benefit (3): foregone promenade and cliff revetment due to coast erosion,
g) Economic benefit (4): Willingness to Pay (*WTP*) per household per year
h) Economic benefit (5): check-in tourists and day-visitors,
i) Economic benefit (6): WTP population for the analysis
j) Economic benefit (7): Beach occupancy rates and incremental visits by expatriate tourists,
k) Economic benefit (8): foreign exchange inflow to Romania per expatriate tourist,
l) Physical contingency and price contingency,
m) Estimated financial cost of the project,
n) Operation and maintenance (recurrent) costs,
o) Salvage value,
p) Capital Investment and O/M Costs for *LRMC* pricing method, and
q) Capital Recovery Factor (*CRF*) and Indicative *LRMC* price

(a) *Project life*

Project period is normally set in accordance with the prospective economic life of the proposed investment and anticipated construction/commissioning schedules. In the analysis accrued to this investment program, the total project life has been set at 40 years after the provision of the project fund, with the first year to commence and the 3-year construction works up to the fourth year in line with the EU 3+*n* rule, and the subsequent 37-year-service period from the fourth year on to the forty-first year.

(b) *Foreign exchange quotation*

This rate well represents the maximum values that Romania currency (RON) could be worth under the market conditions to come. In the analysis, the mid-2006 market value of the Romanian Lei (RON) of 3.5 per EUR (RON 2.8 per US dollar equivalent) is applied for goods and services from now on, while taking in view the year-average exchange rate of RON 3.6 per EUR (RON 3.3 per US dollar equivalent) in 2005 is applied for the past expenditure.

(c) *Conversion factors and shadow exchange rate*

As previously noted, financial costs and benefits are revalued in economic term while excluding built-in market failures due to non-competitive pricing, externality of the economy, political preference for lower incomers by way of the minimum wage law and fiscal distortions such as taxes and duties levied on goods and services in the markets. In so doing, conversion factors are estimated while considering the prevailing import duties, value added tax (VAT) and others of relevance. Specifically, the standard conversion factor (SCF) and that for unskilled labor stand at respectively of 0.95 and 0.85 in the analysis. Should the quantification of economic costs and benefits take place in terms of the local currency, shadow exchange rate stands at 1.05 (an inverse of SCF, 0.95).

(d) *Economic benefit (1): Incremental beach areas*

By beach fill operations that take place in and Mamaia Sud and Eforie Nord over the three-year-construction period (the first to fourth years), the areas to be enlarged are estimated at around 156,000 m^2 in aggregate, with 49,700 m^2 and 106,719 m^2 at maximum, in that order. In the wake of the completion of the works in Mamaia Sud in December of the second year and Eforie Nord in June of the fourth year, in the meantime, the filled beach areas are to be diminished eventually to around 12,700 m^2 and 100,000 m^2 in 20 years, in that order. Incremental beach areas at Mamaia Sud and Eforie Nord are depicted in Fig. 7.3.2.

(e) *Economic benefit (2): Foregone beach areas*

Without the project in concern, beach areas in Mamaia Sud and Eforie Nord are assumed to be downsized in the order of around 82,000 m^2 and 10,000 m^2 in 18 years. Foregone beach areas estimated over a long-term period as specified above are depicted and given in Figure 7.3.2. The calendar years listed in this figure are based on the assumption that the fund for the priority project would have been available within the year 2007. However, the prospect as of February 2007 is such that the fund will be not available until at a much later date. The calendar years in this figure should be postponed to later dates by the difference between the assumed and actual years of fund acquirement.

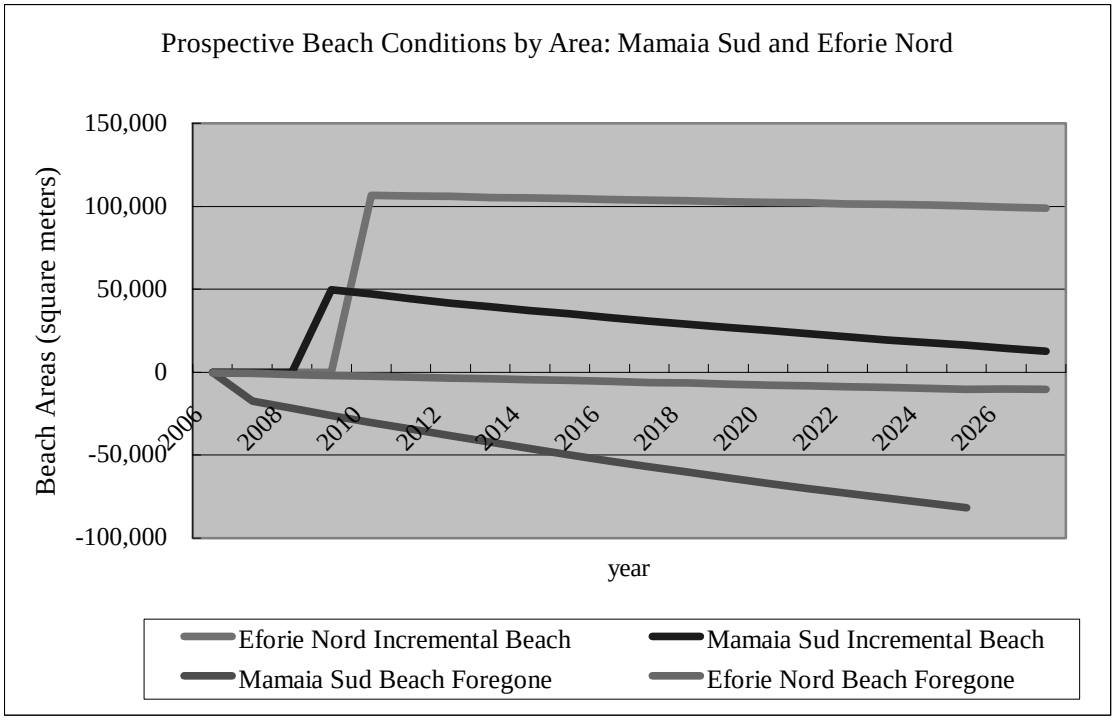

Fig. 7.3.2: Prospective Beach Conditions in Mamaia Sud and Eforie Nord

(f) *Economic benefit* (*3*)*: Foregone promenade and cliff revetment due to coast erosion*

Expected annual damage, or levelized damage avoidable by the prospective shore protection works in Mamaia Sud and Eforie Nord, is estimated from the past trend of coastal erosion in the area, while assessing the recurrence frequencies of such damage in the said areas. In the analysis, the economic cost of the protection and maintenance of cliff revetment. And the promenade immediately facing the Black Sea in Eforie Nord is taken up and incorporated as part of the economic benefits (avoidable damages and the cost-saved for the society). Specifically, the unit prices of EUR 1,200/m and EUR 300/m of the revetment at the foot of shore cliff and promenade, respectively, for the length of 440 m are assumed as the social cost; i.e. unless otherwise, the society has to bear the cost for proper maintenance.

(g) *Economic benefit* (*4*)*: Willingness to Pay (WTP) per household per year*

Willingness to pay (WTP) as a stated (revealed) preference of the people for the use- and non-use-values has been elicited and presumably set at RON 6.4 (median value of 50 percent acceptance schedule, US$ 2.3, EUR 1.8) per month per household, based on the interview survey and subsequent analytical works (one household has 2.8 persons on average). Brief description of the background theory of welfare economics (consumer surplus and simplified method of the estimation) in the light of the analysis currently has been given in I.2 of Annex I of Volume 3.

(h) *Economic benefit* (*5*)*, check-in tourists and day-visitors*

Check-in tourists in Constanța County were counted at 845,478 in 2005, of which expatriate tourists accounted for 11.7 percent[36]. As for Mamaia and Eforie Nord, the aggregate number of tourists were about 0.38 million (385,331), with those of around 0.3 million (302,604) and 0.08 million (82,727) for respective of Mamaia and Eforie Nord in the same year. These

[36] Source: Constanța County Prefectura (Governor's) office, 2005

account for 35.8 percent and 9.8 percent of the aggregate. Of this, the share of expatriate tourists at each of the beaches reached 15.8 percent and 6.3 percent for Mamaia Sud and Eforie Nord, in that order. As for the Mamaia Sud area, a simple rule of one-third of the whole Mamaia area is assumed in the situation without any separate statistics for Mamaia North, Center and South; this leads to about 0.101 million (100,868) for Mamaia Sud. According to the estimate listed in Table A.3.1 of Appendix A of this volume, daily beach visitors at the whole Mamaia area and Eforie Nord have the share of 24% and 12%, respectively.

The number of "day-visitors" who are assumed to be "commuting" to and stay all day long on beaches is presumably set forth at 47,000 a day on all of the beaches along with the southern Black Sea shore area[37]. Provided that the seasonal days for beach resort and tourism activities are 89 days per annum, the aggregate number of day-visitors to all of the Southern Black Sea beaches is estimated at around 4.2 million per annum. Of this, those who come to Mamaia Sud and Eforie Nord are supposedly counted at about 1.0 million and 0.5 million, respectively, in proportion to the numbers of people at each of these two beaches (24 percent and 12 percent for Mamaia Sud and Eforie Nord, respectively, and see Table A.3.1 of this volume). In the meantime, the check-in tourists stay 6 nights on average, and so the day-visitors would to come to beaches six (6) times a year on average. This leads to the estimated number of persons coming to the beaches in concern presumably being set at around 0.167 million and 0.083 million for Mamaia Sud and Eforie Nord, respectively. Conclusively, the aggregate number of day-visitors to the two beaches in concern reaches 0.25 million per annum.

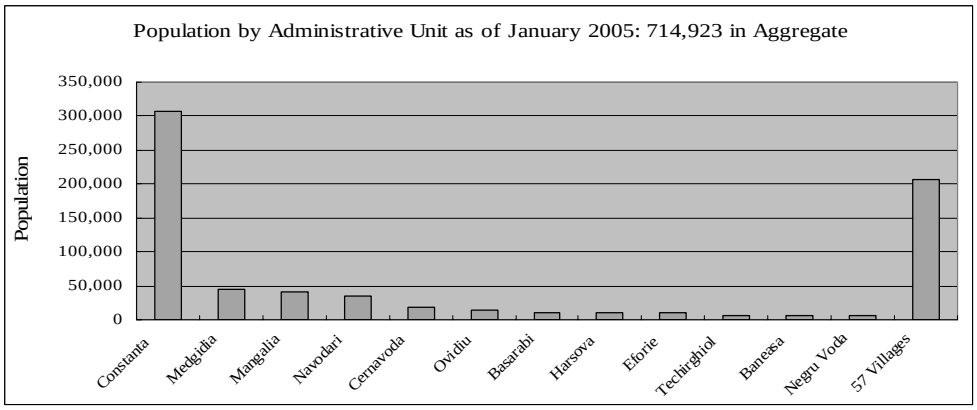

Fig. 7.3.3: Population distribution of Constanța County

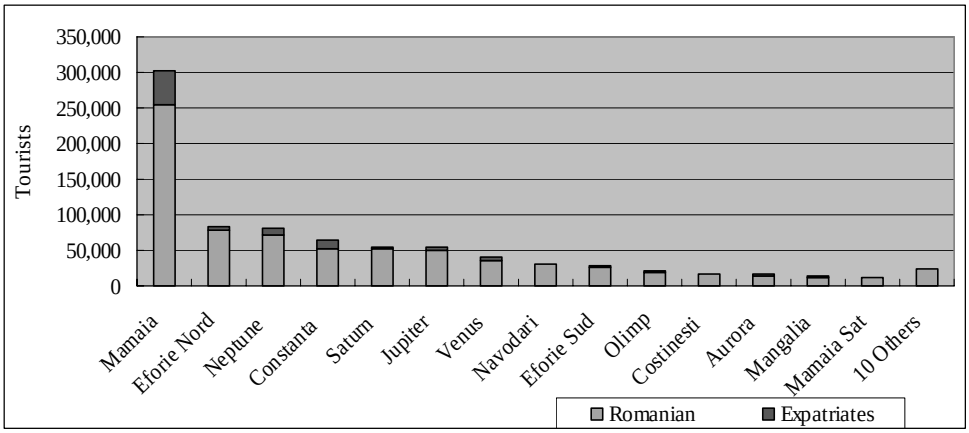

Fig. 7.3.4: Check-in tourists to Constanta by origin and location

[37] Regarding the detailed analytical methodology to elicit the number of day-visitors, refer to Appendix A "Statistics of seaside tourists" of this volume.

The number of check-in tourists to Constanța County by beach (2005) is depicted in Fig. 7.3.4. Further, a methodological diagram for the estimation of the numbers in the immediate above is given in Fig. 7.3.5.

(i) *Economic benefit* (*6*): *WTP population for the analysis*

The population against which the estimated people's revealed preference for coastal protection (willingness to pay) is to be applied in the elicitation of the quantified benefit specifically attributable to the present project at Mamaia Sud and Eforie Nord is presumably set at around 435,000 in compliance with the numbers of check-in tourists and day-visitors to the concerned beaches as given immediately above.

(j) *Economic benefit* (*7*): *Beach occupancy rates and incremental visits by expatriate tourists*

Based field inspections undertaken by the Study team, the beach occupancy rates for Mamaia Sud and Eforie Nord beaches are intuitively set at 0.5 (person) and 0.3 (person) per square meters (m^2). (See **A.3** of Appendix A of this volume.)

With the beach occupancy rates above and the enlarged beach areas of about 150,000 m^2 (Mamaia Sud and Eforie Nord of respective of around 50,000 m^2 and 100,000 m^2), incremental tourists to these beaches are assumed to be by and large 25,000 and 33,000 in Mamaia Sud and Eforie Nord, respectively. Of this, expatriate tourists are supposed to increase to around 3,950 and 2,075 at maximum in this order, while applying the proportional rates of the share of expatriate check-in tourists of 15.8 percent (Mamaia) and 6.8 percent (Eforie Nord). Further, "marginal propensity of supply of expatriate tourists"[38] is introduced such that the proportion of incremental visits of foreigners in terms of one unit of beach area increase is to be estimated at the margin. With the past statistical data of expatriate tourists to the seaside of Constanța County (1999-2004), the rate is estimated at 0.26, while assuming the constant beach areas in Mamaia Sud and Eforie Nord and applying medium-term "incremental average value" as proxy for marginal values.

With the above in view, the aggregate numbers of incremental foreign tourists prospective increase in expatriate tourists to Mamaia Sud and Eforie Nord are assumed to be around 1,530 at maximum in both of the beaches, with 980 and 550 per annum for Mamaia Sud and Eforie Nord, respectively.

(k) *Economic benefit* (*8*): *foreign exchange inflow to Romania per expatriate tourist*

The total number of expatriate visitors to Romania in 2004 was 1.4 million with the foreign exchange earning of US$ 450.8 million (EUR406.0 million equivalents) in the same year[39]. With this, the foreign exchange generated due to expatriates to Romania is estimated at US$ 315.5 per head.

For reference, the study on the Socio-Economic Impact of Black Sea Coastal Erosion on Tourism, currently in place under the auspices of the United States Agency for International

[38] Alternatively, the concept and terminology of "supply elasticity of foreign tourists in terms of land areas of avail at the margin" would be replaced for "marginal propensity" defined as the ratio of change in the number of foreign tourists to the change in beach areas over a certain period of time. Mathematically "elasticity" is expressed as follows. ε = partial derivative of (number of foreign tourists / beach areas)

[39] The Romania National Institute for Statistics, *Statistic Yearbook 2005*, p.732 and p.747

Development (USAID), implied the foreign exchange bestowed to Constanța by foreign visitors was coincidently at the same order of somewhere around US$ 281.9 per head[40].

(l) *Physical contingency and price contingency*

Reflecting expected increases in the base cost estimates of the Project due to changes in quantities, technical specification, and/or engineering design and methods of implementation, physical contingency allowances is set at 5.0 percent of the base cost, while depending on technical uncertainty attributed at the time of basic designing.

In anticipation of increases in base cost of the project that might arise from inflation, price contingency is considered in association with the estimation of aggregate financial costs of the project in concern. With the inflation rates in the past three years in view, price contingencies are assumed to be 2.0 percent and 5.0 percent for the foreign and local cost components, respectively. Meanwhile, it would profoundly be noted that price contingency is considered only for financial cost estimation, and not incorporated into EIRR estimation.

(m) Estimated financial costs of the project and indicative investment schedule

While the precise estimates applied in the analyses duly depend on engineering study and discussions with officials involved, the base cost of the project as a whole in financial terms was estimated at EUR 38.33 million (US$ 48.54 million equivalent) as par the mid-2006 price level. Adding the physical and price contingencies under the assumptions as given immediately above, the total financial cost is envisaged at EUR 46.27 million (US$ 58.62 million equivalent). Disaggregating the total cost, a large chunk of financial cost emanates from the component "B" at Eforie Nord of EUR 33.77 million (US$ 42.78 million equivalent), with the balance of EUR 12.50 million (US$ 15.84 million equivalent) being accrued to the component "A" at Mamaia Sud. The detailed cost estimates exclusive of price contingencies are given in Tables 3.3.1 and 3.3.2 in **3.3** for Mamaia Sud and in Tables 4.5.1 and 4.5.2 in **4.5** of this volume, whereas those with price contingencies in Tables 7.2.5, 7.2.6, 7.2.7, and 7.2.8 in **7.2.**

Of this, 9 percent, 20 percent, 50 percent, and 21 percent of the total project cost (comprising the said two-components) will consecutively be disbursed annually in the first four years (mid-first through mid-fourth years) strictly in line with the *EU n+3 rule* (duration of up to full-three years) for construction period. Specifically, the project will be commenced in the middle of the first year with the initial investment in Mamaia Sud, followed by that in Eforie Nord. One and a half year physical intervention is to take place for each of the sub-projects. While no real cost increase in any specific commodities/services associated with the Project is presumably in sight, the possible hike of any project inputs in the forthcoming years is postulated to be absorbed in a possible devaluation of the domestic currency against either the dollar or the Euro. Indicative investment schedule for the sub-component projects in a sequential time series is listed in Table 7.3.6.

[40] The study is currently ongoing (as of June 2006), with the draft final report envisaged for the submission in September/October 2006. The conclusive remarks regarding the quantified economic impact on the Constanța tourism sector and Cost-Benefit Analysis is yet to come in the draft final report. Data source: USAID, *The Socio-Economic Impact of Black Sea Coastal Erosion on Tourism* (draft in Romanian), April 2006, p.42

Table 7.3.6: Indicative investment schedule by sub-component of the project

Component / Year	first year	second year	third year	fourth year	Total
Aggregate	9 %	20 %	50 %	21 %	100 %
Mamaia Sud	30 %	70 %			100 %
Eforie Nord			70 %	30 %	100 %

(n) *Operation and maintenance* (*recurrent*) *costs*

Being subject to the guidance from and discussions with the engineering experts, annual O/M cost is assumed to be 1.0 percent of the aggregate capital investment disbursed during the initial three years. From the fifth year onward, the environmental and physical monitoring cost of EUR 0.082 million as listed in **4.5 (2)** of this volume is shared by the Project Components "A" and "B" as the annual O/M cost, even though this cost should partly be born as the operational cost of DADL for good maintenance of beach areas of the Southern Romanian Black Sea.

While the present project does not technically foresee any significant maintenance work for breakwaters, jetties, groins, and beach fill as discussed in **3.3.4 (3)** of this volume, economic cost estimation in place included some financial margin to cover additional operation and maintenance works that would be incurred to future needs for re-supply of fill sand or alike owing to unexpected severe storms or any other natural calamity. With this in view, the operation and maintenance (OM) estimates are figured out at EUR 0.3 in aggregate of subcomponents of "A" and "B".

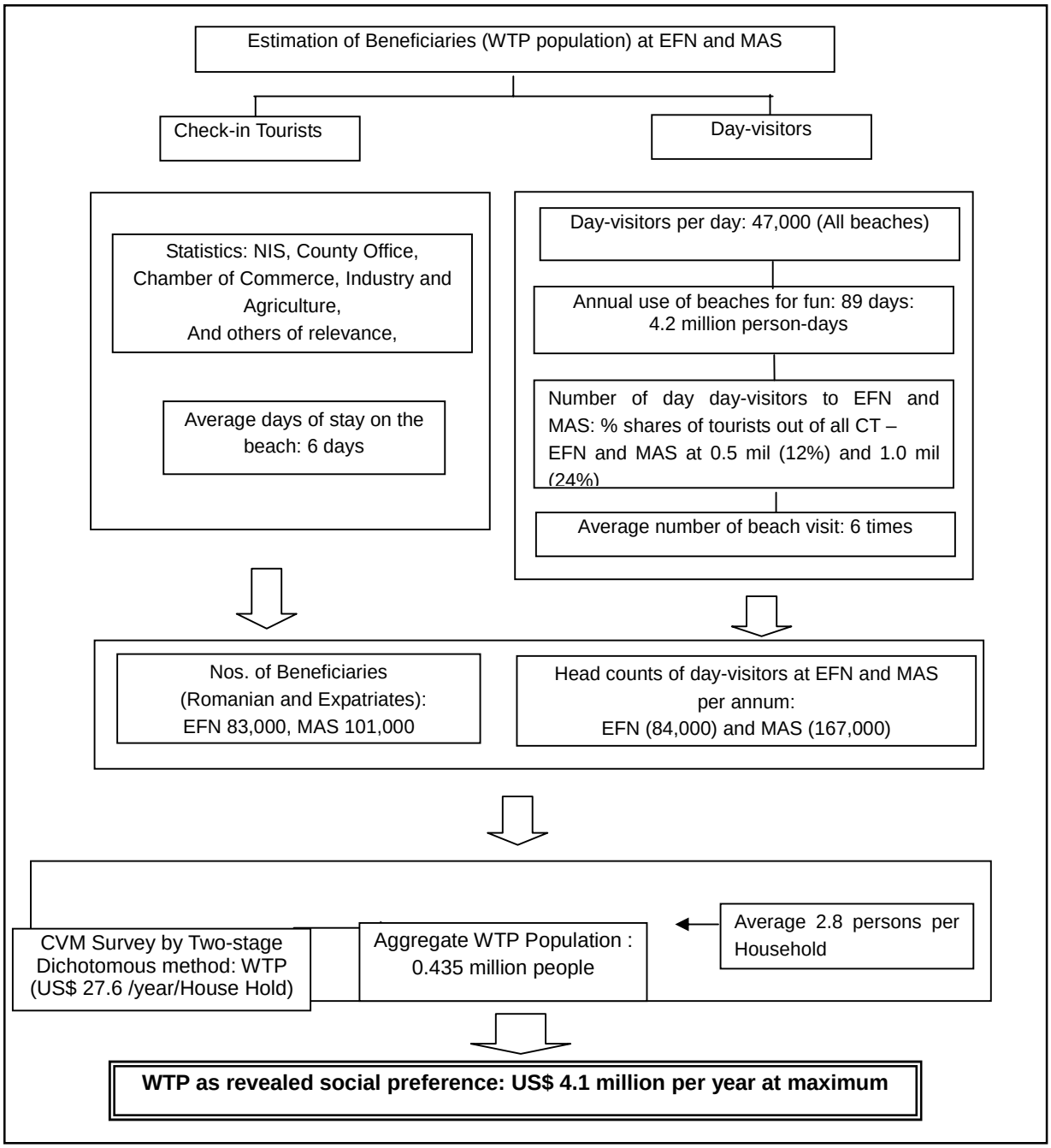

Fig. 7.3.5: Sequential flow of analysis in estimation of WTP by CVM
(EFN for Eforie Nord and MAS for Mamaia Sud)

(o) *Salvage value*

It is assumed that in the wake of project termination in the forty-first year, there will be no economic value withheld with or opportunity of reuse of the facilities constructed and utilized during the project life. As such there is no salvage value of the fixed assets due to the project in concern is assumed in the estimation of EIRR.

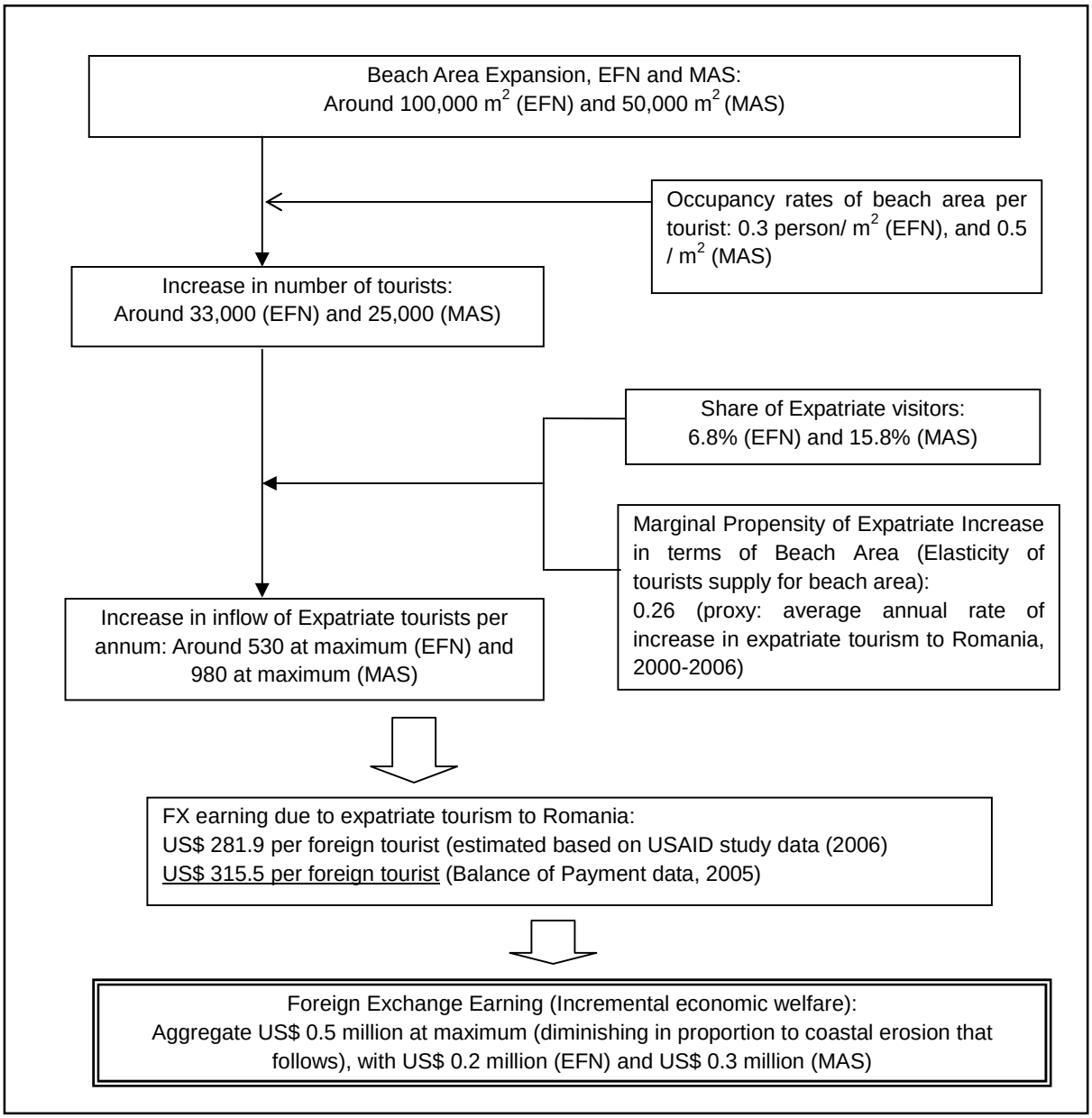

Fig. 7.3.6: Sequential flow of analysis in estimation of incremental foreign exchange (EFN for Eforie Nord and MAS for Mamaia Sud)

(p) *Capital Investment and OM Costs for LRMC pricing method*

The economic cost of Component B is estimated at EUR 26.87 million (US$ 33.90 million equivalent), whereas annual O/M expenses that follow in the investment outlay of EUR 0.27 million (US$ 0.34 million)

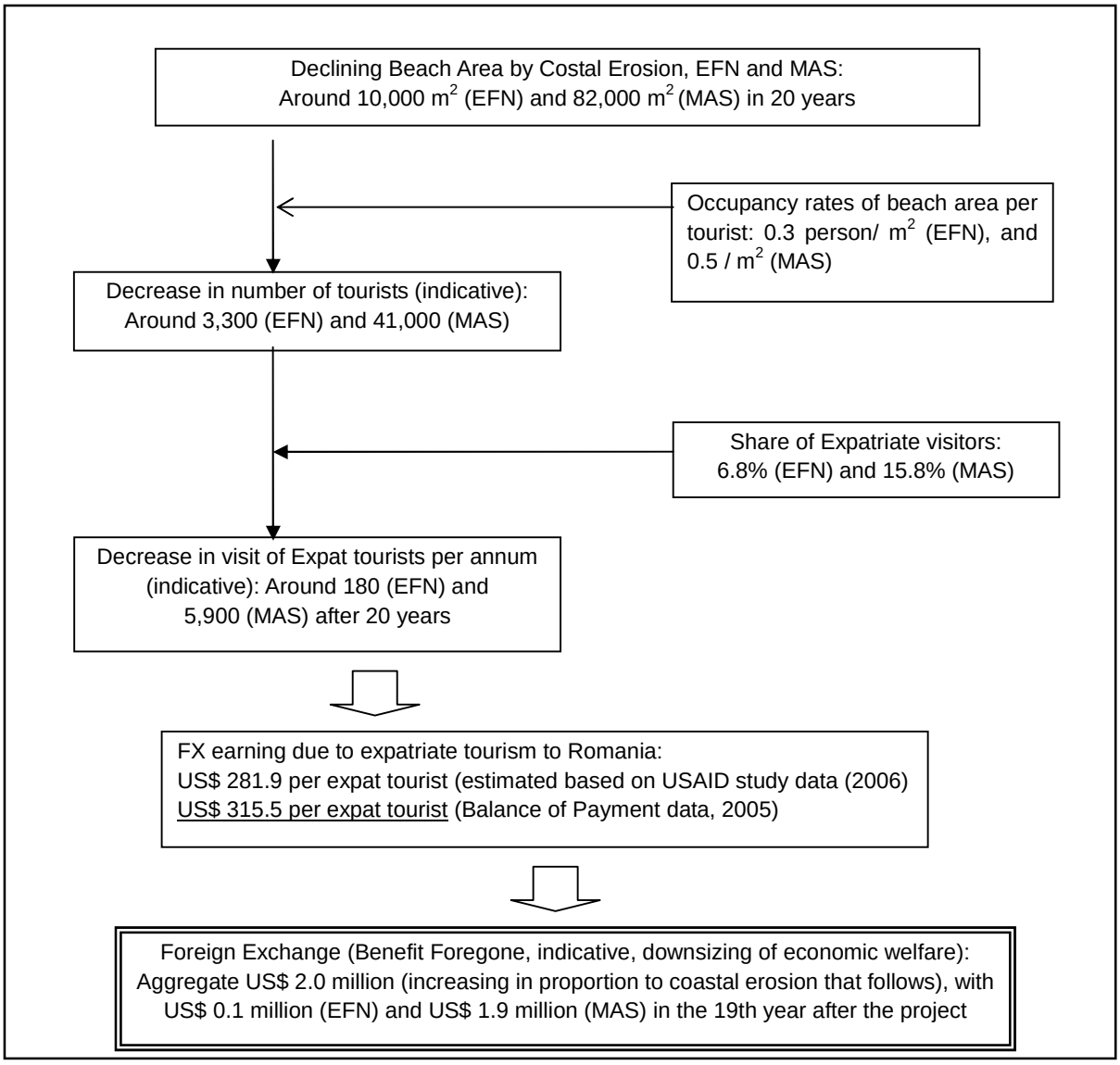

Fig. 7.3.7: Sequential flow of analysis in estimation of foreign exchange saved
(EFN for Eforie Nord and MAS for Mamaia Sud)

(q) *Capital Recovery Factor* (*CRF*) *and Indicative LRMC price*

With the discount rate of 8.0 percent over the 40 years of expected project life, *CRF* being assumed to annualize the capital investment costs was estimated at 0.08, thus leaving the annualized marginal cost of EUR 2.23 million (US$ 2.84 million). With this, associated with the annual recurrent (O/M) cost of EUR 0.27 million (US$ 0.34 million) and the Standard Conversion Factor (SCF) being applied, the economic value of the project as reflected by LRMC pricing method in gross term is estimated at EUR 2.50 million (US$ 3.18 million equivalent) per annum.

Sequential flows of analysis regarding the estimation of willingness to pay (WTP), foreign exchange earned, foreign exchange saved, and social costs saved by cliff/promenade erosion are depicted and given in Fig. 7.3.5, 7.3.6, 7.3.7, and 7.3.8, as attached.

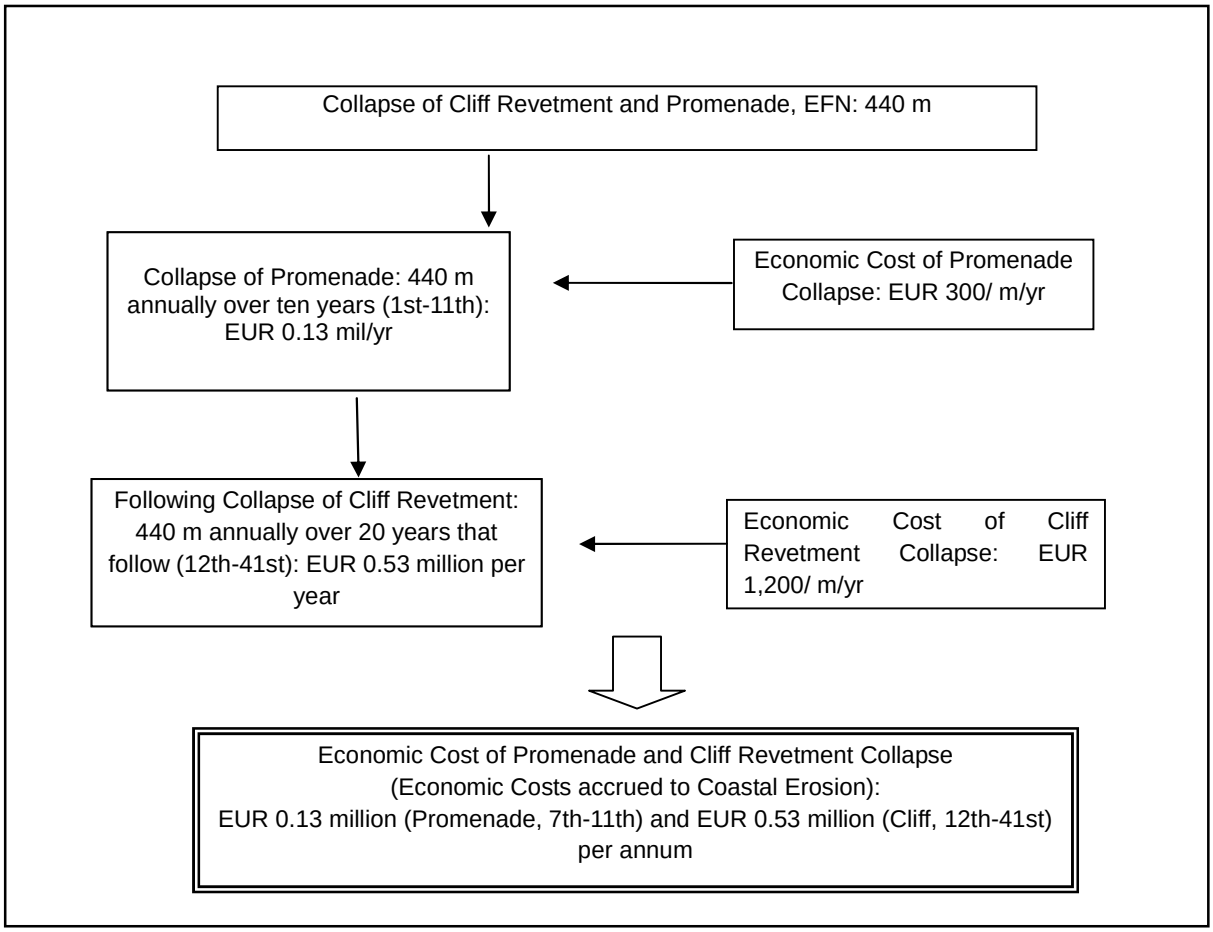

Fig. 7.3.8: Sequential flow of analysis in estimation of social costs saved (Eforie Nord)

7.3.6 EIRR Analysis of Component "A" at Mamaia Sud

The aggregate capital investment, and operation and maintenance (O/M) costs that follow till the forty-first year are estimated at, respective of, EUR 10.67 million[41] (US$ 13.67 million) and EUR 4.16 million (US$ 5.27 million), thus totaling the economic cost to EUR 14.83 million (US$18.78 million). The annual O/M cost is estimated at EUR 0.11 million (US$ 0.14 million) as par mid-2006 price. The economic benefits incurred to the component in concern turned out to be EUR 84.28 million (US$ 106.73 million) in aggregate, with diminishing return of EUR 2.60 million (US$ 3.29 million) at maximum in the third year (presumably in the third year). Subsequently, net benefit of the component stands at EUR 69.45 million (US$ 87.95 million) in total.

With the above in view, the economic feasibility as borne out by EIRR is estimated at 20.6 percent. Alternatively measured, economic net present value (ENPV) turned out to be EUR 18.62 million (US$ 23.64 million) at the social discount rate (SDR) at 6 percent.

Summarized is a net cash-flow for economic feasibility estimated, and attached as Table 7.3.8, with other cash-flows for Component "B" (Table 7.3.9) and Aggregate of A and B (Table 7.3.10).

[41] As reiterated, economic costs comprise base cost and physical contingency, excluding price contingency.

7.3.7 EIRR Analysis of Component "B" at Eforie Nord

It is estimated that the total capital investment and forthcoming O/M costs that follow over the project period of 40 years up to the forty-first year are respective of EUR 26.87 million (US$ 33.90 million) and EUR 10.21 million (US$ 12.93 million), thus totaling the economic cost to EUR 37.08 million (US$ 46.96 million). The annual O/M cost is estimated at EUR 0.27 million (US$ 0.34 million). On the benefit front, the economic worthiness incurred to the component B turned out, on the basis of the long-run marginal cost (*LRMC*) pricing method, to be EUR 91.44 million (US$ 115.81 million) in aggregate, with diminishing return of EUR 2.51 million (US$ 3.18 million) at maximum in the fourth year (assumingly in the fourth year). Sequentially, net benefit of the Component in concern stands at EUR 54.36 million (US$ 68.85 million) in total.

Eventually, the economic feasibility as borne out by EIRR is estimated at 7.8 percent based on the aforementioned methodological alternative. In the meantime, ENPV turned out to be EUR 5.47 million (US$ 6.95 million) with the social discount rate of 6 percent.

In the meantime, an explanatory note on the evaluation of EIRR figure coherently attributable to the concerned component "B" (7.8 % as a base case) is separately attached as **H.2** of Annex H of Volume 3 and Appendix J of this volume.

7.3.8 EIRR Analysis of the Aggregate ("A + B")

Likewise, the project-wise total capital investment and ensuing recurrent (O/M) costs that lie ahead till the forty-first year have worked out to, respective of, EUR 37.54 million (US$ 47.57 million) and EUR 14.37 million (US$ 18.20 million), thus totaling the economic cost in aggregate to EUR 51.91 (US$ 65.74). The annual OM cost is estimated at EUR 0.38 million (US$ 0.48 million) at maximum. On the benefit front, the aggregate value of economic benefits attributable turned out to be EUR 150.27 million (US$ 190.32 million), while aggregating the economic benefits of the components "A" and "B" by WTP method. Subsequently, net benefit of the two subprojects stands at EUR 98.36 million (US$ 124.58 million) in total; it is not an arithmetic summation of the benefits of the two components.[42].

In view of the foregoing, the economic feasibility as borne out by EIRR is estimated at 9.7 percent. Likewise, ENPVs turned out to be EUR 14.50 million (US$ 18.42 million) at the discount rate of 6 percent. Summary table of costs and benefits attributable to the components as well as a package (A+B) is given below as Table 7.3.7.

Table 7.3.7: Summary of economic costs and benefits by component and aggregate, EUR and (US$)

	Capital Investment	Operation & Maintenance	Total Cost	Benefit	Net Benefit
Mamaia Sud "A"	10.67 (13.67)	4.16 (5.27)	14.83 (18.78)	84.28 (106.73)	69.45 (87.95)
Eforie Nord "B" [a)]	26.87 (33.90)	10.21 (12.99)	37.08 (46.96)	91.44 (115.81)	54.36 (68.85)
Aggregate (A+B)	37.54 (47.57)	14.37 (18.20)	51.91 (65.74)	150.27 (190.32)	98.36 (124.58)

[a)] Benefit estimates are based on the LRMC pricing method.

[42] It would be noted that the aggregate benefit of two sub-component projects are not identical to the simple summation of the benefits as reflected in the preceding sections, due to the difference in the methodological approaches in search of economic benefit, namely, WTP method and the LRMC pricing method for the component A for component B, respectively.

Table 7.3.8: Summary Net Cash-flow Table for Mamaia Sud

Year	Capital Cost	Operation and Maintenance	Total Cost	WTP	Inc Beach	Cost Saved Beach	Cost Saved Cliff/ Promenade	Total Benefit	Net Benefit
1st	3.20		*3.20*						**-3.20**
2nd	7.47		*7.47*						**-7.47**
3rd		0.11	*0.11*	1.95	0.24	0.39		*2.58*	**2.47**
4th		0.11	*0.11*	1.85	0.23	0.47		*2.55*	**2.44**
5th		0.11	*0.11*	1.74	0.21	0.55		*2.50*	**2.39**
6th		0.11	*0.11*	1.63	0.20	0.62		*2.45*	**2.34**
7th		0.11	*0.11*	1.55	0.19	0.69		*2.43*	**2.32**
8th		0.11	*0.11*	1.46	0.18	0.70		*2.34*	**2.23**
9th		0.11	*0.11*	1.38	0.17	0.84		*2.39*	**2.28**
10th		0.11	*0.11*	1.29	0.16	0.91		*2.36*	**2.25**
11th		0.11	*0.11*	1.21	0.15	0.97		*2.33*	**2.22**
12th		0.11	*0.11*	1.20	0.14	1.03		*2.37*	**2.26**
13th		0.11	*0.11*	1.06	0.13	1.10		*2.29*	**2.18**
14th		0.11	*0.11*	0.99	0.12	1.16		*2.27*	**2.16**
15th		0.11	*0.11*	0.91	0.11	1.22		*2.24*	**2.13**
16th		0.11	*0.11*	0.84	0.10	1.27		*2.21*	**2.10**
17th		0.11	*0.11*	0.77	0.09	1.33		*2.19*	**2.08**
18th		0.11	*0.11*	0.70	0.08	1.38		*2.16*	**2.05**
19th		0.11	*0.11*	3.00	0.07	1.44		*2.14*	**2.03**
20th		0.11	*0.11*	0.60	0.07	1.44		*2.11*	**2.00**
21st		0.11	*0.11*	0.50	0.06	1.44		*2.00*	**1.89**
.. ..		..	..	..	..	..		..	..
40th		0.11	*0.11*	0.50	0.06	1.44		*2.00*	**1.89**
41st		0.11	*0.11*	0.50	0.06	1.44		*2.00*	**1.89**
Total	10.67	4.16	*14.83*	32.23	4.02	48.03		*84.28*	**69.45**

Table 7.3.9: Summary Net Cash-flow Table for Eforie Nord

Year	Capital Cost	Operation and Maintenance	Total Cost	Total Benefit	Net Benefit
1st					
2nd					
3rd	18.81		*18.81*		**-18.81**
4th	8.06	0.27	8.33	*2.51*	**-5.82**
5th		0.27	*0.27*	*2.50*	**2.23**
6th		0.27	*0.27*	*2.50*	**2.23**
7th		0.27	*0.27*	*2.49*	**2.22**
8th		0.27	*0.27*	*2.48*	**2.21**
9th		0.27	*0.27*	*2.47*	**2.20**
10th		0.27	*0.27*	*2.46*	**2.19**
11th		0.27	*0.27*	*2.45*	**2.18**
12th		0.27	*0.27*	*2.44*	**2.17**
13th		0.27	*0.27*	*2.43*	**2.16**
14th		0.27	*0.27*	*2.42*	**2.15**
15th		0.27	*0.27*	*2.41*	**2.14**
16th		0.27	*0.27*	*2.40*	**2.13**
17th		0.27	*0.27*	*2.40*	**2.13**
18th		0.27	*0.27*	*2.39*	**2.12**
19th		0.27	*0.27*	*2.38*	**2.11**
20th		0.27	*0.27*	*2.38*	**2.11**
21st		0.27	*0.27*	*2.38*	**2.11**
.. ..		..	..	..	..
40th		0.27	*0.27*	*2.38*	**2.11**
41st		0.27	*0.27*	*2.38*	**2.11**
Tota1	26.87	10.21	*37.08*	*91.44*	**54.36**

Table 7.3.10: Summary Net Cash-flow Table for Mamaia Sud and Eforie Nord

Year	Capital Cost	Operation and Maintenance	Total Cost	WTP	Inc Beach	Cost Saved Beach	Cost Saved Cliff/ Promenade	Total Benefit	Net Benefit
1st	3.20		*3.20*						**-3.20**
2nd	*7.47*		*7.47*						**-7.47**
3rd	18.81	0.11	*18.92*	1.95	0.24	0.39		*2.58*	**-16.34**
4th	8.06	0.38	*8.44*	3.06	0.35	0.48	0.12	*4.01*	**-4.43**
5th		0.38	*0.38*	2.95	0.34	0.56	0.12	*3.97*	**3.59**
6th		0.38	*0.38*	2.84	0.32	0.64	0.12	*3.92*	**3.54**
7th		0.38	*0.38*	2.75	0.31	0.71	0.12	*3.89*	**3.51**
8th		0.38	*0.38*	2.66	0.30	0.79	0.12	*3.87*	**3.49**
9th		0.38	*0.38*	2.57	0.29	0.86	0.12	*3.84*	**3.46**
10th		0.38	*0.38*	2.48	0.28	0.93	0.12	*3.81*	**3.43**
11th		0.38	*0.38*	2.39	0.27	1.00	0.12	*3.78*	**3.40**
12th		0.38	*0.38*	2.31	0.26	1.06	0.50	*4.13*	**3.75**
13th		0.38	*0.38*	2.23	0.25	1.13	0.50	*4.11*	**3.73**
14th		0.38	*0.38*	2.15	0.24	1.19	0.50	*4.08*	**3.70**
15th		0.38	*0.38*	2.07	0.23	1.25	0.50	*4.05*	**3.67**
16th		0.38	*0.38*	1.99	0.22	1.31	0.50	*4.02*	**3.64**
17th		0.38	*0.38*	1.92	0.21	1.37	0.50	*4.00*	**3.62**
18th		0.38	*0.38*	1.85	0.20	1.43	0.50	*3.98*	**3.60**
19th		0.38	*0.38*	1.77	0.19	1.49	0.50	*3.95*	**3.57**
20th		0.38	*0.38*	1.70	0.18	1.49	0.50	*3.87*	**3.49**
21st		0.38	*0.38*	1.64	0.18	1.49	0.50	*3.81*	**3.43**
. . . .		**. .**	*. .*	**. .**	**. .**	**. .**		*. .*	**. .**
. . . .		**. .**	*. .*	**. .**	**. .**	**. .**		*. .*	**. .**
40th		0.38	*0.38*	1.64	0.18	1.49	0.50	*3.81*	**3.43**
41st		0.38	*0.38*	1.64	0.18	1.49	0.50	*3.81*	**3.43**
Total	37.54	14.37	*51.91*	76.18	8.56	49.48	16.05	*150.27*	**98.36**

7.3.9 Sensitivity Analysis

Sensitivity analysis that indicates the resiliency of the project against project risks is undertaken with variation in relevant parameters of (i) lower benefit by 10 percent, (ii) capital cost overrun by 10 percent, and (iii) one year delay in project completion and associated generating benefit. As summarized in Table 7.3.11, the EIRRs remain satisfactory for all these cases, while revealing the project's salient robustness against the risks as specified above.

Table 7.3.11: Sensitivity analysis and the resulting EIRRs

Project	Base Case	Benefit –10%	Cost +10%	1-year delay[43]
Component "A" at Mamaia Sud	20.6 %	18.2 %	18.4%	17.3 %
Component "B" at Eforie Nord	7.8 %	6.7 %	6.8 %	6.7 %
Project as a whole	9.7 %	8.4 %	8.5 %	8.7 %

7.3.10 Incremental Employment Generated by the Project

As reflected in the Environment Sectoral Operational Program (ESOP), the number of skilled and non-skilled laborers incrementally employed during construction period is an indicative performance indicator for public interventions in the country[44]. In this light, the employment newly generated by the concerned project is projected to be 517 and 833 for the Component "A" (Mamaia Sud) and the Component "B" (Eforie Nord), respectively. The two components will not be implemented simultaneously, but the Component "A" is for the first and second years and the Component "B" is for the third and fourth years. With regard to the new employment at hotel and restaurants in the region, the incremental number of these employees is estimated at around 162 in aggregate[45], with around 70 (Mamaia Sud) and 92 (Eforie Nord) in the wake of project completion, while taking into account the average number of 93.2 tourists per employee in the hotels and restaurants sector in Constanța in 2004.

7.4 Conclusive Summary of Economic Analysis

As reflected in the section immediately above, the measurement index of the economic internal rate of return (EIRR) attributable to the proposed project in aggregate reveals economic feasibility high enough at 9.7 percent, while exceeding the generally acceptable cut-off rate of EIRR at 6 to 8 percent for environment sector projects. With this, the proposed project deserves implementation in terms of the efficient allocation of scare resources in the Romanian economy. In other words, the concerned project would likely to be the best investment opportunity at a margin, given that the economic return attributable well exceeds the economic foregone loss accrued. Net Present Value (NPV) stands at EUR 14.50 million (US$ 18.36 million) at the social discount rate (SDR) of 6 percent, robustly demonstrating the project's supremacy in resource allocation in the economy.

Disaggregating the project, the EIRRs for the Component "A" at Mamaia Sud and the Component "B" at Eforie Nord turned out to be 20.6 percent and 7.8 percent, respectively,

[43] It is assumed that the investment shares associated with the one-year delay in civil works are 50%, 30%, and 20% in the first through third years for both of the project components at Mamaia Sud and Eforie Nord.
[44] MoEWM, *SOP (draft)*, April 2006, p. 40, pp.71-73
[45] Reference: National Institute for Statistics, *The Romanian Statistical Year Book 2005*, sections 3.3 (employees) and 20.6 (tourists).

both of which revealing its worthiness of project implementation. In the light of these outturns specifically elicited for the sub-components of the project, it would be noteworthy that Mamaia Sud project be put in a priority place comparing to the Eforie Nord project, with the relatively lower cost accrued and the much higher benefits attributable in view.

CHAPTER 8:

INSTITUTIONAL ANALYSIS

Chapter 8 Institutional Analysis

8.1 Legal and Institutional Framework for Coastal Protection

8.1.1 Legal Framework for Environment Protection within EU Framework

Environment protection constitutes a part of the legal orders (*Acquis Communautaire*) and is defined in *Chapter 22* of the *Position Paper of 2000* with the outline view in the following paragraphs[1].

The overall objective of the community environment policy, in line with the integration of the issue into other community policies, preventive actions, the polluter-pays-principle, environmental damage at source and shared responsibility, is to promote sustainable development and protect environment for present and future generation. The *Aquis* comprises over 200 legal acts with seemingly lesser attention to coastal protection included in nature protection, while covering other areas of horizontal legislation, water and air pollution, management of waste and chemicals, biotechnology, industrial pollution and risk management, noise and radiation protection. Romania is to implement *acquis communautaire* in the field of environmental protection until the date of accession, with the exception of the EU[2] legal acts in the following:

[1] Reference: The Commission of the European Communities, *2004 Regfular Report on Romania's Progress towards Accession*, October 2004, pp.117-120

[2] In the present chapter, many abbreviated words are used. For reference, they are listed below.

ANAR:	National Administration Apele Romane (Romanian Waters)
CFCU:	Central Financial and Control Unit
CIGCCE:	Inter-Ministerial Committee for Guarantees and Credits for External Trade
DADL:	Directorate Apelor Dobrogea – Litoral (Department of Waters Dobrogea – Litoral)
EBRD:	European Bank for Reconstruction and Development
EU:	Europe Union
FB:	Final Beneficiary
GEF:	Global Environment Facility
GOR:	Government of Romania
HRMEP	Hazard Risk Mitigation and Emergency Preparedness Project
IFI:	International Financing Institution
IMF:	International Monetary Fund
JBIC:	Japan Band of International Cooperation
LCS:	Lease Cost Selection
IDA:	International Development Association (WB group)
M/E	Project monitoring and evaluation
MoAI:	Ministry of Administration and Interior
MoEWM:	Ministry of Environment and Water Management
MoPA	Ministry of Public Administration
MoPF:	Ministry of Public Finance
MoTCT:	Ministry of Transport, Construction and Tourism
MTEF:	Midium-Term Expenditure Framework
NAMR:	National Administration of Mining Resources
PCO:	Primary Credit Order
PMU (PIU):	Project Management (Implementation) Unit
QC:	Consultant Qualification
QCBS:	Quality and Cost Based Selection
SC:	Steering Committee
VAT:	Value Added Tax
WB:	World Bank (International Bank of Reconstruction and Development, IBRD)

Air quality:

- Council Directive No. 94/63/EC on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations; Romania requests a transition period of 3 years, until 2010.

Waste management:

- Council Directive No. 94/62/EC on packaging and packaging waste; Romania requests a transition period of 3 years, until 2010. This Directive was transposed in the Romanian legislation by: GD No. 621/2005; and Ministerial Order No. 927/2005; and the common Order of ministers of MoEWM, MET and Ministry of Administration and Interior (MAI) No. 1229/731/1095/2006.
- Council Directive No 99/31/EC on the landfill of waste; Romania requests a transition period of 10 years, until 2017. This Directive was transposed in the Romanian legislation by: MoEWM Order No. 757/2004; MoEWM Order No. 1230/2005; GD No. 268/2005; MEWM Order No. 756/2004
- Council Directive No. 2000/76/EC on incineration of waste; Romania requests a transition period of 3 years, until 2010. This Directive was transposed in the Romanian legislation by: GD No. 268/2005; MEWM Order No. 756/2004; MEWM Order No. 698/2005; common Ministerial order of MEWM and MET No. 1248/1426/2005

Water quality:

- Council Directive 2000/60/EEC The Water Framework Directive. This Directive was transposed in the Romanian legislation by Law No. 310/2004
- Council Directive No. 91/271/EEC concerning urban wastewater treatment; Romania requests a transition period of 15 years, until 2022. This Directive was transposed in the Romanian legislation by GD No. 352/2005. This GD declares the territory of Romania as sensitive area and requires communities having more than 10,000 persons equivalent (p.e.) to implement sewerage networks until December 31, 2013 and communities having between 2,000-10,000 p.e. to implement sewerage networks until December 31, 2018
- Council Directive No. 98/83/EC on the quality of water intended for human consumption; Romania requests a transition period of 15 years, until 2022. This Directive was transposed in the Romanian legislation by Law 458/2002, modified by Law 311/2004
- Council Directive No. 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (and the 7 Daughter Directives); Romania requests a transition period of 8 years, until 2015. These Directives were transposed in the Romanian legislation by GD. 351/2005 and MEWM Order No. 313/2006.
- Council Directive No. 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources; Romania requests a transition period of 7 years, until 2014. This Directive was transposed in the Romanian legislation by: common Order of MEWM and Ministry of Agriculture, Forests and Rural Development (MAFRD) No. 241/196/2005; common Order of MEWM and Ministry of Agriculture, Forests and Rural Development (MAFRD) No. 242/197/2005; common Order of MEWM and Ministry of Agriculture, Forests and Rural Development (MAFRD) No. 296/216/2005.

Industrial pollution control and risk management:

- Council Directive No. 96/61/EC concerning integrated pollution prevention and control (IPPC); Romania requests a transition period of 8 years, until 2015. This Directive was transposed in the Romanian legislation by Law No. 84/2006, approving Urgent Government Ordinance (UGO) No. 152/2005

- Council Directive No. 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (VOC); Romania requests a transition period of 8 years, until 2015. This Directive was transposed in the Romanian legislation by MEWM Order No. 859/2005
- Council Directive No. 2001/80/EEC on the limitation of emissions of certain pollutants into the air from large combustion plants (LCP); Romania requests a transition period of 5 years, until 2012. This Directive was transposed in the Romanian legislation by: GD No. 541/2003, amended by GD No. 322/2005; MEWM Orders No. 322/2005, 347/2004, 712/2003

8.1.2 Legal Framework for Coastal Protection within EU Framework

In the meantime, the integrated management of coastal zone is new to the country in the light of the concept and practices as well. It definitely entails a policy framework to look into the balance of economic, social, and environmental factors in place and that come in the areas in concern, as such the country's natural asset could be sustained now and for future generations. With this in view and to get the country prepared for a unified promotion of integrated coastal zone management at a required EU level, the government referred to the EU Recommendation 2002/C 58 E/01 regarding the integrated management of European costal areas such that Romania could embark on a strategic approach based on preserving the ecosystem's integrity and functionality and on durable management of natural resources from the marine and terrestrial components of the costal areas.

At the outset of the policy commitment to the issue, the country was to develop strategies to streamline the roles of diverse administrative entities in the process and to establish the necessary instruments for implementation at the national, regional, and local level. It was also required to identify policy agenda for the marine and terrestrial areas to the following:

(i) facilitate public participation,
(ii) identify financing sources for public intervention measures in need,
(iii) establish monitoring/evaluation and information dissemination systems, and
(iv) prepare training and education programs for government officials as part of human capacity and institutional building.

The following is a list of the laws and regulations on integrated coastal protection that have been promulgated thus far:

(1) LAW No. 280 on 24 June 2003 for the approval of the Government Emergency Ordinance No. 202/2002 regarding the integrated management of the coastal zone;
(2) Government decision No. 164 on 12 February 2004 for the approval of the program regarding measures for protection and rehabilitation of the coastal zone;
(3) Government Decision No. 317 on11 march 2004 regarding the use of humid coastal zones as anchoring sites;
(4) Government decision No. 1015 on 25 June 2004 for the approval of the Regulations regarding the functioning and organization of the National Coastal zone Committee;
(5) Government decision No. 241/2006, approving renting out of the beaches;
(6) Urgent Government Ordinance No. 19/2006, regarding activities that may be developed on the beaches and their control;
(7) MoEWM Order No. 222/2006, regarding the bidding procedure, beach sectors set out for renting and the template of the rental agreement; and
(8) Technical norm regarding restoration of beaches through sand-filling, issued in 2005.

The Government Emergency Ordinance No. 202/2002, as noted above, is a foremost guiding principle for coastal protection, with the measures inclusive of the following:

(i) marking the coastal zone and establishing the measures for ensuring integrity in coastal use and protection,
(ii) guarantying the public use of the Romanian coastal zone except of national security,
(iii) regulating durable use of coastal zones based on the principles that ensure environment, background, cultural legacy, and historical and archaeological protection,
(iv) reconstructing and conserving coastal zones trough adequate methods,
(v) integrating environmental politics for coastal zones in the regional politics regarding agriculture and forestry, energy, mineral resources, industry, tourism, fishing and aquaculture, transports and local area development, and water management policies, and
(vi) ensuring public access to information and it's participation in decision making regarding the integrated management of the Romanian coastal zones.

Regarding the legal procedure currently in place in Romania, detail is provided in **B.2** of Annex 2 in Volume 3.

8.1.3 Institutional Framework for Coastal Protection – Game Players and TOR

(1) The Ministry of Environment and Water Management

By the Governmental Decision No. 17/2001(GD), the Ministry of Environment and Water Management (MoEWM) has since 2003 been responsible, as the line ministry, for the overall aspects of environmental protection and development, with the following major activities:

(i) policy-making for water and environmental protection at the central level,
(ii) devising strategies and specific regulations,
(iii) implementing Government strategy in the concerned areas, and
(iv) pursuing roles and functions as a state authority for the synthesis, co-ordination and control in the light of the above.

The administrative structure of the ministry and the officials currently in place are given in the subsequent Fig. 8.1.1. As depicted in this figure, the Minister is assisted by the Secretaries of State and a General Secretary, with each of the office being responsible for the following areas:

(i) Environmental Protection,
(ii) Water Management,
(iii) European Integration, and
(iv) Secretary General (general administration and partnership with the Parliament).

Faced with EU accession now being scheduled on the 1st of January 2007, all of the policy issues in connection with the preparatory process for European integration has been given a priority. In this respect, the Secretary of State for European Integration coordinates the activities of national legislation to expedite processing of drafting, promoting and controlling the implementation of the new legislations in compliance with the environment-related *acquis communautaire*. The directorate with specific responsibilities for waste and hazardous chemicals management was established in consideration of the complexity of the issue. The Public Relation Directorate has been established in order to develop dialogues between the governmental structure in the field of

environmental protection and civil society, as well as for providing a realistic view on the role and activity of the MoEWM and its subordinate units. In conformity with Governmental Decision No 352/2001 amending the GD No. 17/2001, the Unit for the Coordination of the Implementation of the Structural Pre-accession Instrument ISPA was established under the direct coordination of the Secretary of State for European Integration and Minister.

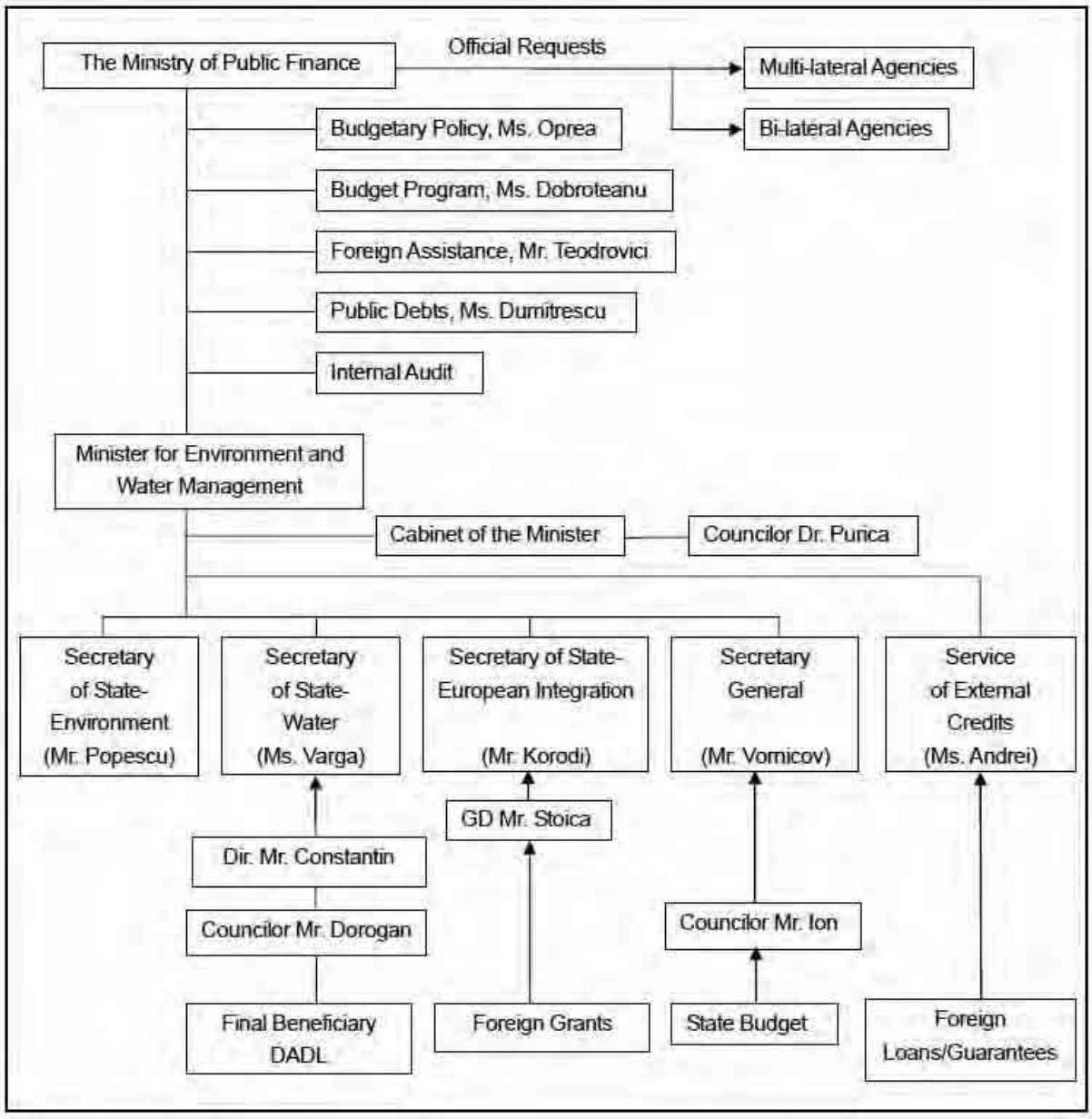

Fig. 8.1.1: Organizational framework of MoEWM for policy planning, coordination, and implementation

(2) National and regional environment protection agencies

The Environmental Protection Inspectorates (EPI), in accordance with the GD No. 17/2001 and then Order of the Minister of Waters and Environmental Protection No. 92/2001, as well as Emergency Ordinance No. 195 on environmental protection, is responsible for the enforcement, monitoring, and implementation of the legislation at the county level. EPI was established through

the reorganization of the Environmental Protection Agency (EPA)[3], each of which has a Unit for capacity development for policy planning and implementation in line with the domestic legislation and EU legal framework. Furthermore, in order to decentralize decision-making process within the legally stipulated administrative system, the Department of Nature Protection and Protected Areas and the Department of Waste and Hazardous Chemicals Management have been set up in each of EPIs. The Department for Integrated Monitoring of Environment Factors and the Department for Ecological Control and Monitoring of Environment Investments have been also established.

Specific TOR for EPI at the national level includes, among others, the following:

(i) Authorizing investment activities that bring about environmental impact,
(ii) Ensuring technical support for the elaboration of strategies and politics in the environment protection field,
(iii) Coordinating stakeholders in accomplishment of the sectoral action plans and the national action plan for the environment protection,
(iv) Functioning the national reference laboratories for air, wastes, noise and vibrations, and radioactivity, and
(v) Monitoring and evaluation of environment protection measures in general in line with what had been agreed upon between the government and the European Commission.

The regional EPA in Galati is an administrative body functioning as an *Intermediary Body* in the scheme of the project implementation in Constanța, while closely involved in authorization procedures as well as fund management. Specific TOR for REPA Galati, in the light of project prêt processing and implementation includes, among others, as follows:

(i) Authorizing investment measures in line with conformities with the authorization documents,
(ii) Coordinates the accomplishment of the sectoral action plans and of the regional action plan for the environment protection,
(iii) Monitors the implementation stage of the engagements in the environment protection field, assumed through the implementation plans negotiated with the European Commission in the adoration process to the European Union at the regional level,
(iv) Elaborates the synthesis reports on the environmental status at the regional level and monitor the conformity process of the economical operators with the environmental legislation requirements,
(v) Sustains and is involved in the civil society initiatives in the environment protection field,
(vi) Participates in the elaboration and monitoring of the regional development plan,
(vii) Collaborates with the county agencies for the environment protection from the development region for the elaboration of the synthesis reports and the environmental data bases constitution, at the regional level,
(viii) Coordinates the elaboration and monitoring of the regional action plans for the environment protection,
(ix) Evaluates and updates annually, in cooperation with the National Environment Guard and with other public authorities, the regional specific plans or the environment chapters, integrated in other regional plans,
(x) Ensures the specialty assistance for the county agencies for environment protection,

[3] Government Decision No. 462/2005 on reorganization and functioning of National Environmental Protection Agency,

(xi) Collaborates with the National Environment Guard for the issuance of the authorization documents and for the conformity control and enforcement of the environmental law, and
(xii) Manages and disseminates, according to the legal provisions, the environmental information at the regional level.

Specific responsibilities REPA as *Intermediate Body* is liable to include:

(i) Identify the regional priorities to be integrated in SOP Environment, based on the regional environment strategies;
(ii) Promote partnership at regional level;
(iii) Provide guidance to beneficiaries on SOP procedures related to programming and implementation of measures;
(iv) Carry out formal evaluation of applications;
(v) Monitor the procurement of services and works under SOP Environment;
(vi) Gather data necessary for monitoring and evaluation of programme implementation;
(vii) Prepare supporting documents for the annual and final reports of the SOP;
(viii) Support MoEWM in institutional assessment of DADL;
(ix) Monitoring of projects under SOP implementation at the level of the region; carry out on-the-spot checks; verification of expenditure;
(x) Confirm the correctness of claims, progress in implementation, payments and take-overs of the works etc;
(xi) Detect the potential irregularities at the regional level and report them to the MA; and
(xii) Ensure the awareness and publicity actions, at the level of the region; ensure dissemination of information on SOP financing opportunities.

In the field of water management, this activity is developed in an integrated manner (quantity-quality, ground-surface) on hydrographical basins. At the level of each hydrographical basin (or in some cases groups of hydrographical basins), Basin Department for Water Management is responsible for the effective management of water resources, in consistent with the EU Water Framework Directive (WFD) and the basin planning programs. In accordance with the requirements of WFD, the Governmental Decision No. 1212/2000 was approved for the establishment of the Basin Committees in a bid to harmonize responsibilities and activities amongst the stakeholders concerning environment protection. The committees comprise representatives of MoEWM, the Ministry of Health and Family (MoHF), the local public administration, the National Company "Apele Romane"(ANAR), the National Authority for Consumers' Protection, and the non-governmental organisations (NGOs). Some of the major responsibilities are, among others, to (i) advise schemes for water management for each river basin, (ii) approve the classification into a water quality category of river waters within the basin, and (iii) analyse and recommend financing priorities to the central and local public administration.

(3) The National Administration "Romania Waters" (ANAR)

(a) *Law, Act, Regulations*

By the Water Law (No. 107/1996), the National Administration "Romania Waters" (ANAR) with its river 11 basin branches was set up in 1996 to (i) integrate water management, (ii) operate water management structures, and (iii) implement national water strategy and policy on behalf of the ministry.

In order to put into practice priority projects on environment protection, and to expedite processing of legislations, the Law No. 73/2000 concerning the Environment Fund has been adopted. In order to ensure the Fund functioning, the GEO No. 93/2001 has also been adopted to amend the above-mentioned law. After the adoption of the law for the approval of the GEO No. 93/2001, the institutional structure of the Fund Administration was established and approved by the Government Decision (GD).

(b) *Objective, responsibility, and TOR (Job description)*

The National Administration "Romanian Waters" manages the waters of the public state domain and the infrastructure for the National System for the Water Management, formed of accumulation lakes, flood defending dams, channels, inter-basin deviations, water sources and other specific works as well as the national systems infrastructure for hydrological and hydro-geological supervising and for water quality monitoring, for the knowledge and unitary management over the country, for the surface and underground waters.

The National Administration "Romanian Waters" is liable, among others, for the following activities and duties:

- Comprehensive management of water resources for the surface and ground waters for protection against degradation and exhaustion;
- Protection and rehabilitation of resources of aquatic ecosystems in order to achieve a good state for waters;
- Administration, exploitation, maintenance, repair and modernization of the National System for the Water Management, the National System for Hydrological and Hydro-geological Surveillance, and the National System for the Quality Monitoring of Water Resources;
- Coordination of lakes exploitation on the hydrographical basins, no matter the owners are, to secure operative measures during high waters and in the case of water polluting accidents;
- Elaboration and follow-up of the water usage plans application, during normal hydrological periods and used waters evacuation;
- Elaboration of water balance, for hydrographical basins and for the hole country, the elaboration and enforcement of the restriction plans for the water use during the deficit periods on hydrographical basins as well as the coordination of the elaboration of the water alimentation restriction plans, in case of any, by the water users;
- Devising programs and investment measures for each of the hydrological units in order to achieve a good state of the waters;
- Elaboration of the protected areas registry, in conformity with the provisions of the national legislation that is in line with the European Directives;
- Administration of the minor bed rivers, of the lakes and pounds, naturals or arranged, of the coast and of the sea beach, of the humid areas and of those protected or belonging to the state;
- Monitoring of the evolution and state of water quantity and quality;
- Accomplishment of physical, chemical, biological and bacteriological analysis, for waters, deposits and biota;
- Elaboration of diagnosis and hydrological prognosis, as well as warnings in case of dangerous hydrological phenomena as a Romania's representative to the World Meteorological Organization, for hydrological issues;

- Protection against flooding through water management works under its administration and the constitution of the specific materials and means for their flood protection;
- Devising flood protection plans with in view meteorological phenomena and accidents at the hydrological constructions in the administrative region;
- Participation, in case of accidental pollution, in the operative activities for water users warning and public administration downstream, for the initial cause's elimination and for the effects diminishing and monitoring of the polluting wave;
- Elaboration and the application of basin plans for the prevention and elimination of accidental pollution effects, coordination of the elaboration by the water users of the own prevention and accidental pollution prevention plans as well as the insurance of an extended protection and the improvement of the aquatic environment through specific measures for the progressive pollution reduction;
- Legal and administrative guidance to the National Administration "Romanian Waters" in general and for the accidental pollution monitoring and control;
- Elaboration and updating of the National Fund for hydrological, hydro geological and water management data;

(4) ANAR – Water Department Dobrogea Littoral (DADL)

(a) *Law, Act, Regulations*

- *Urgence Ordinace No.73/2005* and the following *Urgence Ordinance No.107/2007* concerning the establishment of "Romanian Water" National Administration

(b) *Objective, responsibility, TOR* (*Job description*)

i) Data regarding the coastal erosion department (Exploitation Department)[4]

While DADL does not have in its organizing structure a coastal protection department, its branch office "SGA[5] Exploitation Department" has the tasks of exploitation, maintenance, and repairing the administrated hydro-technical work (jetties, dams, weirs, cadastral watercourses maintenance, and cantons maintenance). It also undertakes maintenance works of the Black Sea beaches as a public goods and national interest goods in the administration of DADL.

DADL has, since the beaches entered in their administration in 1999, been liable for beach maintenance and protection to preserve environment and to prevent erosion during the cold season. Black Sea maintenance and exploitation works are carried out by three work formations (with three formation leaders and their subordinate 15 workers) and the firms that sign contracts with DADL to perform services. These activities are coordinated and checked by special departments belonging to Constanţa Water Management department and to the Exploitation Office from DADL (SGA manager, Littoral Hydro technical chief, three persons from the Exploitation Office – and Exploitation department – SGA).

ii) Beach maintaining activity

DADL executes maintenance works for the Black Sea beaches for a 172 ha surface from the breakwater of Midia breakwater in the north to Vama Veche in the south. This surface includes the touristy beaches and the unarranged ones also.

[4] Source: DADL Water Exploitation Dept., Interview Survey by the team, 20 June 2006

[5] SGA (Societatea de Gestiune Apelor) Society for Water Management (DADL Branch Offices)

DADL through SGA Constanta executes the above-mentioned works with own equipment and manpower and with the contracted firms in three activity areas:

- Navodari–Mamaia area and the beach afferent to Constanta County.
- Eforie Nord–Eforie Sud–Costinesti area.
- Olimp–Neptun–Jupiter–Cap Aurora–Venus–Mangalia–2 Mai–Vama Veche area.

(5) Categories of works executed on the littoral beach

(a) *Works for preparing the summer season – the execution period of February to April*

Preparation activities for the summer season take place on the entire beach surface and consist in the execution of a diverse scale of works destined to bring the beaches to an optimum use level regarding the tourists comfort.

Work categories for summer season preparation are as follows:

- Manual hygiene, and solid waste transport to the garbage platforms.
- The transport and equalization of the sand deposits accumulated in the protection "curtains" area.
- The protection "curtains" dismantling.
- The pedestrian alley sand escape.
- Sand embankment for the poor beach area compensation, by local transportation from the sectors with excess to the eroded beach sectors, for the beach rehabilitation.
- The shell deposits evacuation.
- Sand breaking up works, by disking.
- Ecological work executed with special equipment.

(b) *Maintenance works for the beaches in the summer season – execution period of May to September*

Maintenance activities for the summer season take place on the beaches that are not rented and consist of the following:

- Manual hygiene.
- Disking works.
- Ecological work with special equipment.

The removal works for the algae deposit at the shoreline is made on the entire beach surface during the algae development periods for the discomfort elimination and consist of the following:

- Manual removal with workers teams in the area where the access for loading equipment is being burden by the sand.
- Removal with loading equipment (multifunctional loaders, Wolle)
- Algae transportation with dump trucks and tractors with trailer, to the specialized ecological pits for their neutralization or to high capacity containers which will be placed in different locations on the beach.
- Shore rehabilitation with high capacity equipment.

(c) *Works for the beach preserving in the cold season – easy protection for stopping the wind erosion*

- Beach preserving works during the cold season: reel panels assembly for the protection against wind erosion and making sand dunes and the thin beach sectors (littoral belt)
- During the cold season 2005-2006 reed panels were assembled on a 7450 m length in Mamaia = 5580 m, Eforie Nord = 670 m, Neptun = 900 m, and Jupiter = 300 m.
- Reed panels assembling were established after the study by the National Institute for Marine Research and Development "*Grigore Antipa*" entitled "The sand deposits protection against wind action during the cold season" elaborated at the request of DADL.
- Protection fence assembling maintains on the beach surface an important sand of 50.000 m^3/year.

8.2 Overall Management Scheme

8.2.1 Institutional Framework for Project Implementation

(1) Overview

The overall policy objective of the project envisaged is to uphold sustainable development and protection of the coastal areas of the Southern Black Sea shore region on an environmentally and economically sound basis in a long-term time span. With this, the project in concern is a very front-runner in the history of Romania striving to mainstream environmental as well as technical, economic and institutional considerations into the coastal protection sector, which would be followed by other complementary projects under the finance of international and bi-lateral development partner institutions in the days ahead. In this light, managerial and operational schemes in the overall institutional framework of the project will need a close look at those currently in place in association with the ongoing environment-sector related projects in Romania under the auspices of EU (ISPA fund), the World Bank, and others of relevance.

The managerial issue and the current practices of delegation of administrative power and authority in project processing are summarized in Table. 8.2.1. It would be noted that in the past, except small-scale and grant-type projects, the overall responsibility of investment measures under the auspices of international financing institutions and bi-lateral development partner agencies has been attached to the Ministry of Public Finance with close guidance and consultation with sector-related ministries.

Table 8.2.1: Management Schemes of the externally funded projects previously and currently in place

Alternatives	Model Projects	Oversighting Unit	Management Unit	Implementing Unit	Consultant	Bank Account
Pre-EU Accession	ISPA-WWTP6	MoPF	MoPF	Parestatal17/ (Raja)	MoPF /Raja	MoPF
WB-Loan	Hazard Risk Mitigation	Steering Committee/ MoPF	MoPF	Parestatal (ANAR)	MoPF/ ANAR	MoPF/ ANAR
WB-Small/Grant	Agricultural Pollution Control	MoEWM	MoEWM	MoEWM	MoEWM	MoEWM
JBIC	Constanta South Port	MoPF	MoLIT	Parestatal (CPA)	Parestatal (CPA)	Parestatal (CPA)

The subsequent sections delineates discussions on the issues of implementing framework during the project processing of the study in concern and the institutional scheme mutually understood and agreed amongst the Romanian counterpart officials and the study mission, with EU post-accession Cohesion Fund closely in view[8].

(2) In the advent – three alternatives proposed

In the advent of final discussions and mutual understanding and agreement that took place with the Romanian counterpart officials at MoEWM and DADL, the Study team had proposed the a diagram showing a prospective scheme of project implementation unit (PIU) with expertise in need, with the three alternatives of managerial scheme during the fourth on-site study in June to July 2006, notably,

(i) Alternative "A": Conventional type with MoEWM – ANAR HQ – DADL in the line of administrative order,
(ii) Alternative "B": DADL-on-the-front type of MoEWM – DADL, and
(iii) Alternative "C": Direct control and implementation by MoEWM.

The schematic frameworks for these alternatives are depicted and given as Figs. 8.2.1, 8.2.2, and 8.2.3. In this light, SWOT analysis, which is an assessment of the major institutional and organizational issues identifying the strengths and weaknesses, has been undertaken for each of the alternatives in a bid to smoothly set up the framework and scheme in an efficient and effective manner in the days that come. Table 8.2.2 summarizes the result.

[6] ISPA Wastewater Treatment Plant Project in Constanta
[7] *Parstatal* legally means "Special Law Agency " and is equivalent to "Project Implementing (Executing) Agency"
[8] As reflected in **7.2** of this volume, the concerned coastal protection and rehabilitation project is currently in the list of pipe-line projects included in the Environment Sector Operational Program (ESOP), as such will most probably be financed under the EU Cohesion Funding scheme in the wake of Roman accession to EU most likely in January 2007.

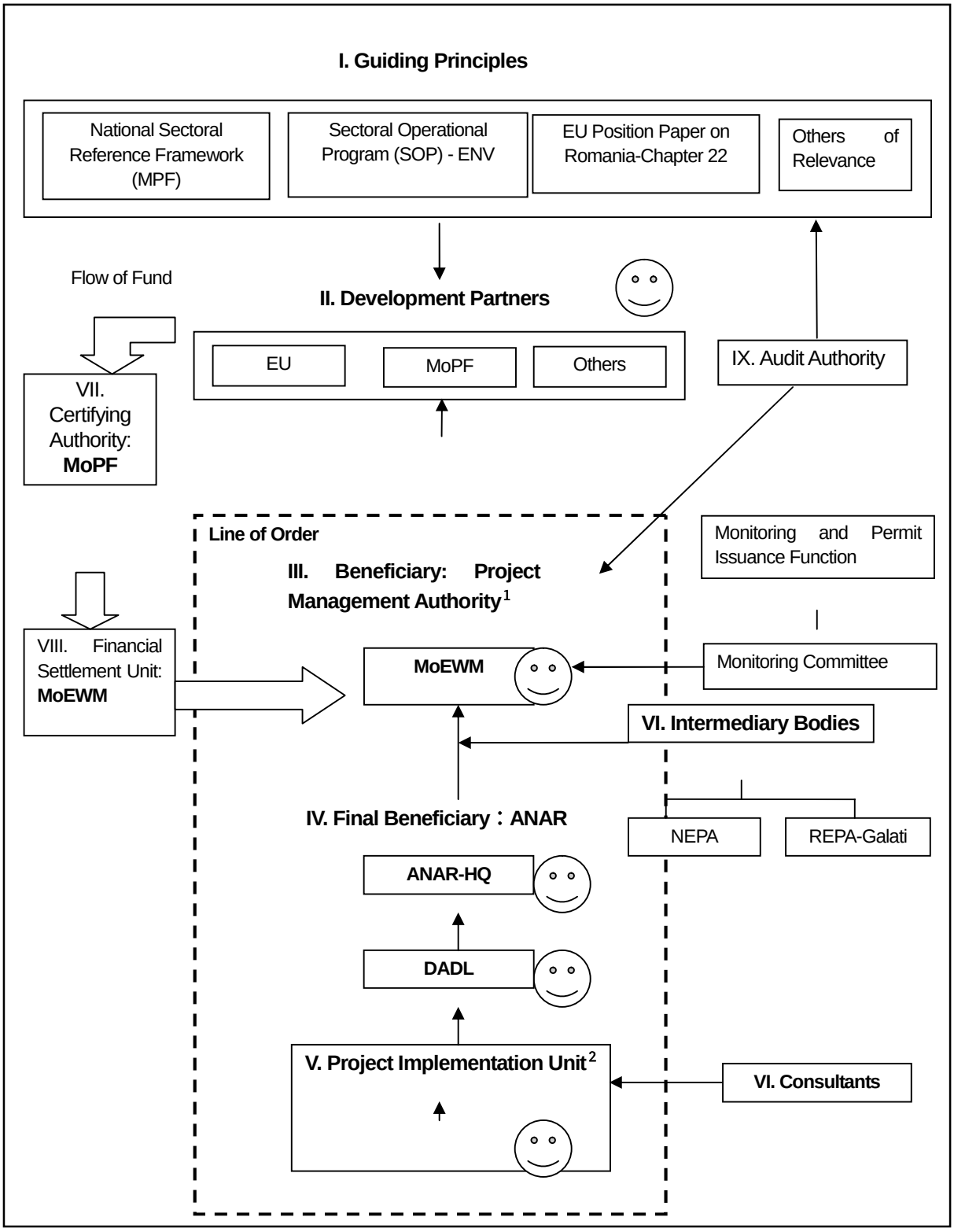

Fig. 8.2.1: Alternative "A": MoEWN - ANAR HQ - DADL line of order

1/ Classification according to MOEWM, *TOR for Project Implementation Unit*, "Technical Assistance for Strengthening Institutional Capacities for the ISPA Final Beneficiaries in the Water and Wastewater Sector in Romania", 2003. Full-time assignment of PMU Director and other experts by the fund of the Project would profoundly be recommended.

2/ "PMU" is likely to be in use by and large for projects financed by EU, whereas "PIU" by WB.

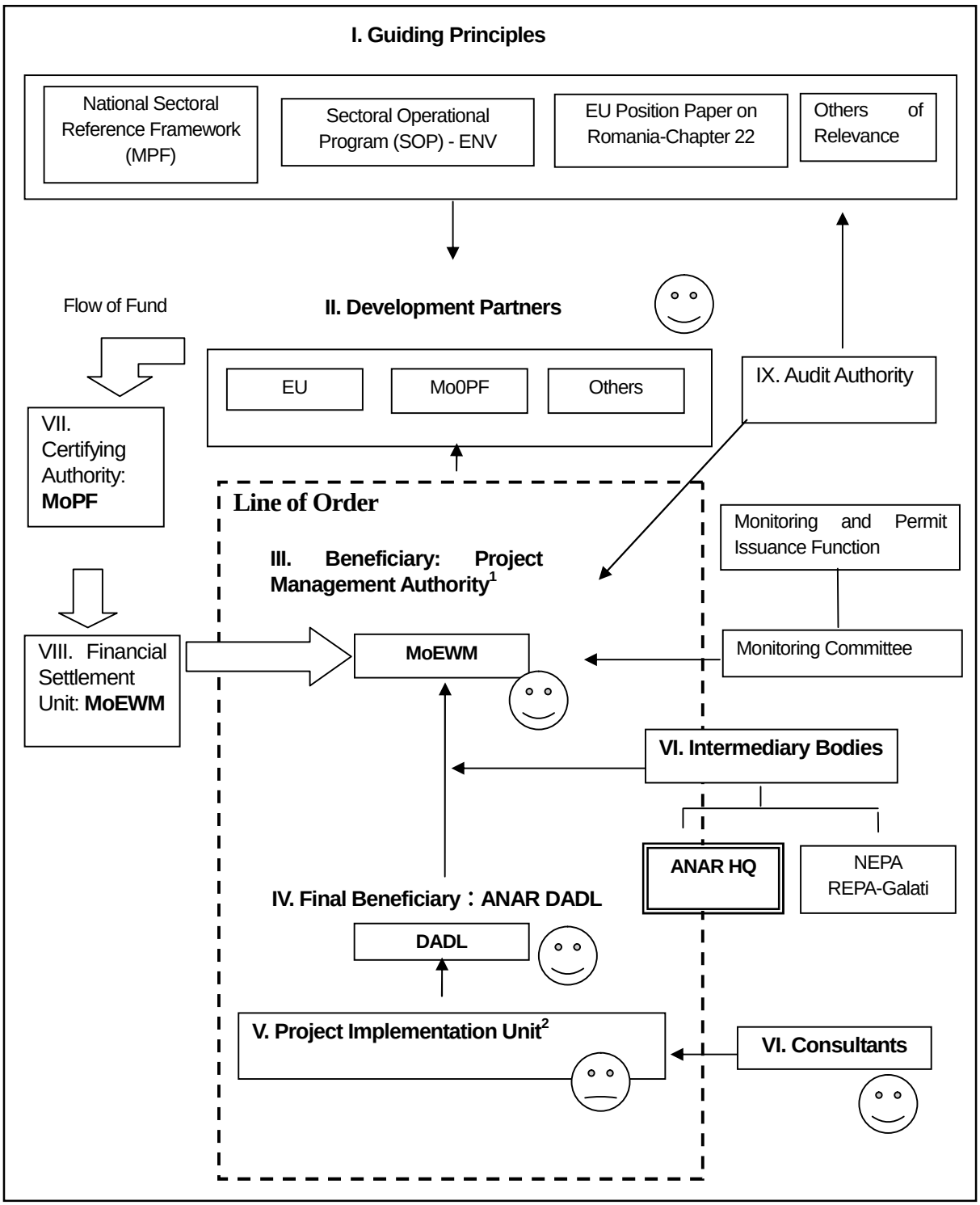

Fig. 8.2.2: Alternative "B": MoEWM – DADL line of order

1/ Classification according to MoEWM, *TOR for Project Implementation Unit*, "Technical Assistance for Strengthening Institutional Capacities for the ISPA Final Beneficiaries in the Water and Wastewater Sector in Romania", 2003. Full-time assignment of PMU Director and other experts by the fund of the Project would profoundly be recommended.

2/ Autonomous status according to *Ordonanta de urgenta Nr. 107 din 5 Septenbrie 2002 privind infiintarea administratiei Nationale "Apele Romane"*, as stipulated in Art. 1 (4), (4[1]), ANEXA Nr. 1: *Denumirea si sediile unitatilor aflate in subordinanea Administratiei Nationale "Apele Romane"* (A), *STATUT din 29 septienbrie 2005 de organizare si functionare a Administratiei Nationale "Apele Romane"* CAPITOLUL V: Structural organizatorica si functionala Art. 11 (1) a) ans Art 12 (1) and (4) regarding administrative and financial autonomy at the Central and District level.

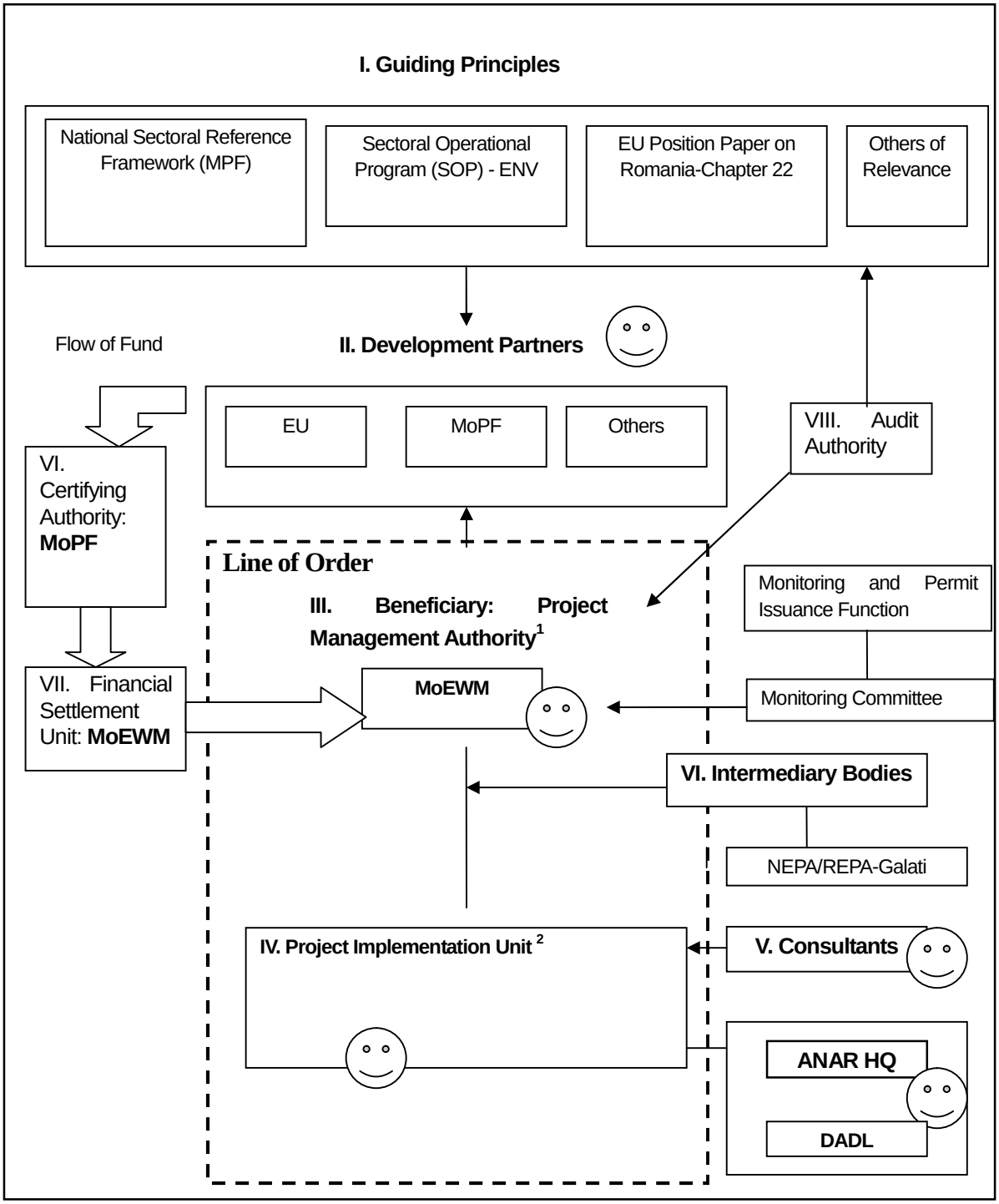

Fig. 8.2.3: Alternative "C": MoEWN direct implementation type

1/ Classification according to MoEWM, *TOR for Project Implementation Unit*, "Technical Assistance for Strengthening Institutional Capacities for the ISPA Final Beneficiaries in the Water and Wastewater Sector in Romania", 2003. Full-time assignment of PMU Director and other experts by the fund of the Project would profoundly be recommended.

2/ Autonomous status according to *Ordonanta de urgenta Nr. 107 din 5 Septenbrie 2002 privind infiintarea administratiei Nationale "Apele Romane"*, as stipulated in Art. 1 (4), (4[1]), ANEXA Nr. 1: *Denumirea si sediile unitatilor aflate in subordinanea Administratiei Nationale "Apele Romane"* (A) regarding administrative and financial autonomy at the District level.

Table 8.2.2: SWOT analysis

	Positive Points	Concerns
Alternative "A" (Conventional: MOEWM - ANAR HQ - DADL)	1. Conventional pattern of project management with relevant agencies in the line of order, and commonly applied in Romania. 2. Division of responsibility and authority as delivered in the administrative order in the government and *Parestatal.* 3. Capacity building at the local level in project preparation, implementation, O/M, and further planning of long-term coastal protection. 4. Strong linkage between the project bodies for further implementation of coastal protection plan.	1. Possible bureaucracy and cumbersome administrative procedures within the scheme that might lead to delay and irresponsibleness on the project implementation front. 2. Outsourcing for project experts in PMU in need (with project management under external funding, environment, financial management, monitoring and evaluation, internal auditing specialists in particular).
Alternative "B" (MOEWM -DADL)	1. Avoiding cumbersome bureaucracy in decision making and actions. 2. Continuity in project implementation from construction to operation and maintenance. 3. Capacity building at the local level in implementation and O/M of the projects. 4. Enhancing institutional and human capacity for planning projects that follow in the long-term coastal protection plan. 5. Secure autonomy of PMU director on the project implementation front.	1. Weak administrative responsibility of Headquarters over project implementation by DADL. 2. Legal justification for DADL as a status of independent judicial person in ANAR and extent of administrative and financial autonomy. 3. Outsourcing for project experts in PMU in need (with project management under external funding, environment, financial management, monitoring and evaluation, internal auditing specialists in particular).
Alternative "C" (MOEWM Direct)	1. Expediting project implementation including procurement of consultants and construction. 2. Experiences in rules and regulations of internal (MOPF) and external financing institutions to smoothly commence the project. 3. Capacity building at the local level (DADL) in construction and O/M works under the direct control of the ministry.	1. Weak linkages between project implementation (construction) and following operation and maintenance works. 2. Administrative coordination between MOEWM and ANAR Headquarters. 3. Functional linkages between PMU and DADL on the project front line. 4. Possible inconsistency with SOP-ENV clause that defines ANAR as "Beneficiary."[9] 5. Outsourcing for project experts in PMU in need (with project management under external funding, environment, financial management, monitoring and evaluation, internal auditing specialists in particular),

[9] The Ministry of Environment and Water Management (MOEWM), *The Sectoral Operational Program* (draft), April 2006, p1, MOEWM, *Programul Operational Sectorial Mediu*, p.54

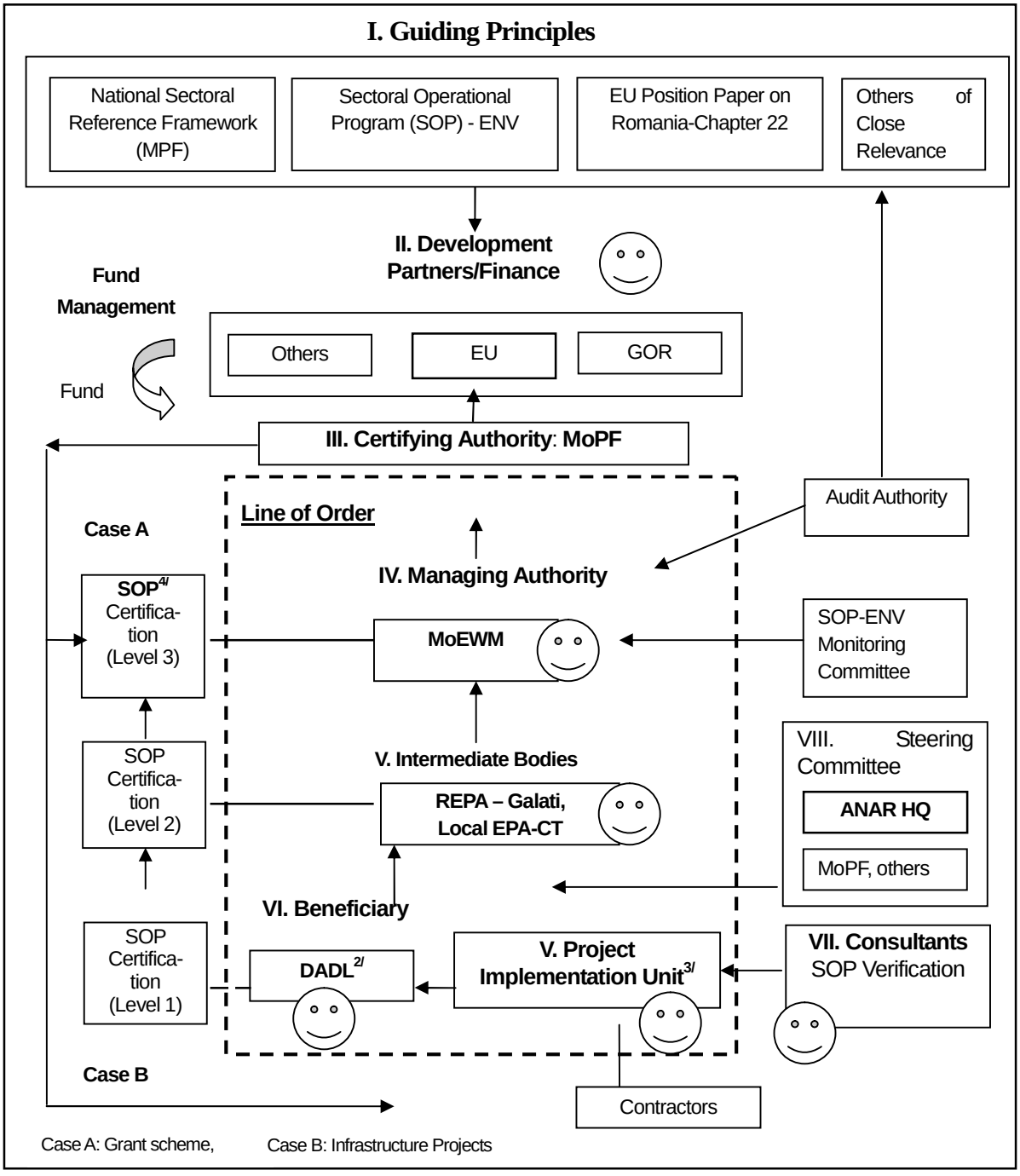

Fig. 8.2.4: Schematic framework for project implementation: alternative plan agreed[1/]

1/ Classification according to MoEWM, *The Sectoral Operational Program 2007-2013 (draft)*, pp. 65-90, *TOR for Project Implementation Unit*, "Technical Assistance for Strengthening Institutional Capacities for the ISPA Final Beneficiaries in the Water and Wastewater Sector in Romania", 2003.

2/ Autonomous status according. to *Ordonanta de urgenta Nr. 107 din 5 Septenbrie 2002 privind infiintarea administratiei Nationale "Apele Romane"*, as stipulated in Art. 1 (4), (4^1), ANEXA Nr. 1: *Denumirea si sediile unitatilor aflate in subordinanea Administratiei Nationale "Apele Romane"* (A), *STATUT din 29 septienbrie 2005 de organizare si functionare a Administratiei Nationale "Apele Romane"* CAPITOLUL V: Structura organizatorica si functionala Art. 11 (1) a) ans Art 12 (1) and (4) regarding administrative and financial autonomy at the Central and District level.

3/ Full-time assignment, and outsourcing, as necessary, of PIU Director and other experts by the Project fund would profoundly be recommended.

4/ Statement of Expenditure (SOP)

(3) Schematic framework agreed

In close consultation and discussions with the Romanian counterpart officials as well as those at the European Commission Delegation to Romania on the possible framework and scheme for project management and implementation that come, the idea has substantially been brought about to the one that is shown in Fig. 8.2.4. The overall scheme is like the one that had been proposed as "Alternative B", that is a "DADL on-the-front-line under MoEWM" type of operation, while ANAR HQ being a member of an off-line advisory board, *namely*, the Steering Committee. Salient feature of the scheme envisaged includes, besides the one immediately above, (i) the Ministry of Public Finance is a "final certifying authority" in charge of financial management and settlements (payments), likewise the projects under the finance of the Pre-Accession EU funding schemes, and (ii) Regional and Local Environment Protection Agency (REPA in Galati/LEPA in Constanta) are placed as "intermediary bodies" administratively responsible for project management and the part of fund management with procurement procedure in particular.

8.2.2 Game Players of In the Arena of Institutional Framework Agreed

A project financed by external sources involves a number of governmental ministries, agencies and other institutions which may be called a bunch of "game players." In the case of the concerned project in Constanța county, and would most likely be financed by EU in the wake of the country's Accession to the Union, these game players in the arena of implementation and management include:

i) The Ministry of Public Finance (Certifying Authority),
ii) The Ministry of Environment and Water Management (Managing Authority),
iii) Regional and Local Environment Protection Agency (REPA/LEPA) as Intermediary Body
iv) Water Department Dobrogea Litoral (DADL) as Final Beneficiary,
v) Project Implementation Unit (PIU) under DADL,
vi) Consultant group attached to MoEWM and closely work with PIU, and possibly MoPF in the light of procurement procedures,
vii) Steering Committee (an off-line advisory board), and
viii) Supreme Audit Institution as Auditing Authority

In tandem, indicative scheme of PIU structure and expertise in need has been discussed and in principle agreed upon amongst the game players of the proposed project (Fig. 8.2.5). In this connection, the Study team is of strong opinion that a corps of full-term experts recruited outside the ministries and ANAR-DADL should be deployed in PIU, wherever the unit is placed.

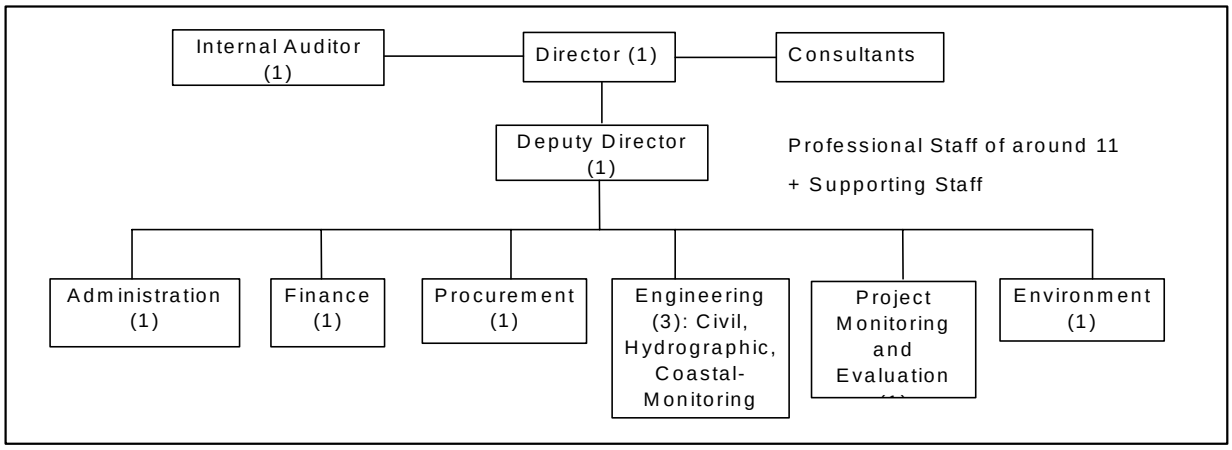

Fig. 8.2.5: Indicative structure of PIU with expertise in need

8.3 Operational Framework for Project Implementation

8.3.1 Indicative TOR for Game Players

(1) The Ministry of Public Finance

The Ministry of Public Finance (MoPF) is a receiver/borrower of external grant/loan funds, as a signer of Financial Memorandum (grants)/Loan Agreement (loans) on the Romanian side, and holds the legal authority to manage funds in all aspects. Provided that MoPF is a final certifying and payment authority in project implementation scheme, Central Financial and Control Unit (CFCU) is the central figure in project management, while eventually taking responsibility in procuring consultants/contractors, providing administrative guidance and all of the financial and contractual concurrence/approvals to project implementing body in consultation with Steering Committee (SC). Requests for approval of procurement documents and for payment are checked based on the consultant's certification, and sequentially disbursed from the MoPF accounts, as delineated in **8.3.2**.

In the context of the concerned project, and in line with what has been discussed with the government officials regarding fund management within the framework of the Environmental Sectoral Operational Program (ESOP, draft) during the on-site mission in June-July 2006, MoPF would be a final certifying and payment authority, unlike other project implementation schemes under the finance of the World Bank, the Japan Bank for International Cooperation (JBIC) and/or others, while leaving PIU substantially little authority and power delegated for fund management. Accounts for replenishment of loan proceeds and grants are opened and managed by CFCU, and disbursements are eventually made by CFCU upon the receipt of a Request for Interim Payment from Contractor, certified by the consultants, and endorsed by PIU.

(2) The Ministry of Environment and Water Management as managing authority

The Ministry as a managing body takes full responsibility in implementation on a sound, efficient and effective manner as well as the resulting outputs and outcome attributable to the project to all of stakeholders, inclusive of the civil society and the people of Romania. Major tasks of oversight responsibility of the ministry will rest on, but not limited to,

(i) Coordination amongst the stakeholders, while redressing balances of conflicts with leadership and providing guidance to DADL and PIU in compliance with the legal and diplomatic frameworks as agreed and setup at the outset of project commencement,
(ii) Oversight of procurement of goods, works, and services,
(iii) Supervising financial management and reporting systems in practice at PIU,
(iv) Undertaking monitoring and evaluation as part of internal auditing,
(v) Providing administrative guidance, as necessary, to DADL and PIU in seeking for breakthrough when difficulties in project implementation was encountered by DADL/PIU, and
(vi) Reporting periodically in a systematic form to stakeholders and the civil society the progress and output/outcomes of the intervention measure in concern.

(3) REPA/LEPA as intermediary bodies

REPA-Galati and subordinate LEPA in Constanta are responsible, in connection with the concerned project, for the followings.

(i) Authorizing activities in the light of environment protection for mitigating negative impacts, in compliance with competencies established by the legislation in force and coordinates this process at the regional and local level,
(ii) Adopting legal measures in case of non-conformities with the authorization documents,
(iii) Coordinating stakeholder institutions and groups for the accomplishment of the sectorial action plans and of the regional plans for environment protection,
(iv) Monitoring the implementation of public investment measures in Mamaia Sud and Eforie Nord in the light of and in compliance with implementation plans as agreed with the European Commission in the accession process to the European Union, at the regional level,
(v) Submitting synthesis reports on the environmental status at the regional level and monitoring the conformity process of economic agencies with the environmental legislation requirements,
(vi) Keeping civil society initiatives in the environment protection field,
(vii) Participating in the elaboration and monitoring of regional development plan,
(viii) Collaborating with national agencies for environment protection and reporting while maintaining environmental databases at the regional level,
(ix) Coordinating the elaboration and monitoring of the regional action plans for the environment protection,
(x) Evaluating and updating annually, in cooperation with the National Environment Guard and other public authorities of relevance, the regional specific plans or the environment chapters to be integrated into other regional plans,
(xi) Providing assistance with expertise and experiences to national agencies in the light of regional environment protection,
(xii) Collaborating with the National Environment Guard for the issuance of the authorization documents, and conformity control and enforcement of the environmental law, and
(xiii) Managing and disseminates environmental protection-related information at the regional level.

(4) DADL as final beneficiary

The Final Beneficiary (FB) is a kind of project executing agency as power and authority in association with technical issues has been devolved from CFCU, while Project Implementation Unit (PIU) is set up as a specialized unit within DADL. The Final Beneficiary with PIU as a front-line operator of the project plays a role of, among others, project coordinator for the project contractors and the consultants. Tasks as borne out by FB and PIU includes, but not limited to, administrative support and endorsement for contractors to acquire lands, obtaining approvals of land use and others as necessary from national and local-level agencies of relevance. PIU also functions as a secretariat of Steering Committee that is called for at least once a month in Constanța.

With regard to fund management, DADL as the beneficiary contributes to the project either in cash or in kind, with the signing of financing agreement between DADL and PIU. The agreement will delineate the rights and obligations to be borne out by each of the parties. To note that in the case of contribution in kind, the agreement will detail the mechanism of quantifying the in kind contribution in monetary terms as well as the contents of in kind contribution that would include labor, land, raw materials, consumables, transportation, and/or others as appropriate.

(5) Project Implementation Unit (PIU)

Project Implementation Unit (PIU), an autonomous body for efficient and effective implementation of the project, is responsible for overall project implementation activities inclusive of technical designing, procurement, fund management and financial reporting, progress monitoring and reporting, and maintenance of project-related bank accounts in compliance with agreement between MoPF and MoEWM. While PIU will be established by MoEWM in the compound of, or closer to, DADL office in Constanța, the Unit will be closely tied with MoEWM in Bucharest, with a formal reporting relationship to the Secretary of State for Water, possibly with a direct contractual relationship with the Minister. PIU funds will be provided from replenishment of external fund to meet salaries and operating costs accrued to all of the overall activities of PIU. Further, project fund will, wherever appropriate, cover the costs of local agencies assisting engineering design, supervision, monitoring, and other activities of relevance.

With regard to the fiduciary aspect of project management in terms of management monitoring and evaluation, PIU will design a simple Management Information System with the reporting format for each of the project components "A" (Mamaia Sud) and "B" (Eforie Nord) including targeted annual performance objectives and monitoring indicators, according to the agreement between financier(s) and the Romanian government. In line with what has been in place under the EU- and the World Bank-financed projects in the country and the region, quarterly reports will cover progress in physical implementation, the use of manpower and project funds, and project impact. The quarterly reports will be consolidated by PIU into a half-yearly progress reports to be submitted through DADL, REPA/LEPA[10], and MoEWM (eventually to the Secretary of State for Water for approval) to financier(s) within two months, or as agreed upon between financier(s) and the ministry, of the end of each six-month reporting period. These semi-annual progress reports will also include an implementation plan and work program for the next six months following period.

Indicative TOR for PIU is attaches as Appendix I of this volume.

(6) Consultants

As administratively subordinated to MoEWM[11] and financed under external fund, the consultant team is closely, but independently, working with DADL, to support PIU and DADL in implementing the project on an efficient and effective manner. In tandem, the consultant team is to coordinate all of the stakeholder agencies inclusive of the project owners (PIU, DADL, MoEWM), other miniseries and agency, financier(s), and the private sector stakeholders. In addition to management and logistic support to PIU and DADL as Final Beneficiary, consultant team will engage, as a corps of excellency, in extensive capacity building and "technical transfer" in all of the areas of project management, such that by the end of the project the capacity will immensely be in place within DADL to independently function for the ensuing design and implementation of coastal protection measures in a medium-term.

In compliance with what has been in place in the ISPA-funded projects, the consultants will, as

[10] Role and function of REPA and LEPA as intermediary bodies in the project implementation scheme proposed are not finalized yet at the time of June-July 2006 on-site study mission except procurement (certification of statements of expenditure), as such further discussions on this issue would take place at the time occasion arises in the days that come.

[11] Consultants could be procured by the Ministry of Public Finance (CFCU) as ire the common cases for EU-funded ISPA projects. Nonetheless, the JICA team would stress the importance of leadership of MoEWM and DADL in particular in the selection of consultants.

necessary and appropriate, be requested to provide qualified contract documents for contraction works while functioning as an "Engineer" in the FIDIC-type-contracts to be liable for (i) providing quality technical, procurement, and quality control services, and (ii) enhancing institutional capacity of PIU as well as DADL and the Ministry.

(7) Project Steering Committee (PSC) and Project Coordination Committee (PCC)

A project steering committee is an advisory board comprising representatives of the MoPF (Certifying Authority), MoEWM (Managing Authority), NEPA/REPA/LEPA (Intermediary Bodies), ANAR, and possibly, the Ministry of Public Administration, with the overall objective of providing project oversight advice and guidance in resolving issues associated with project implementation, while ensuring commitment of the concerned ministries and agencies. The Minister for the Environment and Water Management will chair the Committee, with the director of PIU as the *ex-officio* Secretary. SC will meet on a monthly basis, unless otherwise agreed upon, with agenda prepared by PIU and the consultant team. At the meeting, PIU and the consultant will present reports on the progress of work and the major problems encountered that require solutions, to which SC will provide administrative guidance and, wherever appropriate, propose measures to ensure smooth project implementation.. In the light of financial and fiduciary management, payment schedule will be presented to the Committee every three months.

Provided that a close consultation and collaboration is in need at the local level, Project Coordination Committee (PCC) for overall coordination and decision would be established at the regional level, while inviting representatives from Judet and municipality offices, REPA and LEPA, the private sector inclusive of the Constanța Chamber of Commerce, Industry and Agriculture, NGOs, and others as appropriate. Representative of MoEWM will chair the meeting with the one from DADL as vice-chair, whereas PIU Director will be the *ex-officio* Secretary. Specifically, the Committee will be responsible for technical oversight, ensuring coordination between the implementing body and stakeholders together with commitment of local population to long-term sustainability of coastal protection.

8.3.2 Implementing Procedures

(1) Procurement arrangement

In due course of project implementation, procurement of goods and services is to be conducted in accordance with Guidelines separately prepared by financing institutions and the Romanian updated public procurement system promulgated by the *Government Ordinance No. 34/2006.* While the project in concern will be internationally financed either on a grant or loan basis, the forefront suppliers of these external funds are likely to be the European Union and the World Bank. With this in view, this section provides the outline framework for competitive and fair procurement administration, with specific thresholds by procurement arrangement for each category of "goods," "civil works," and "services".

To note that the figures as given herewith are indicative, as applied to the World Bank group-financed projects and are alike in the EU procurement guidelines. Accordingly, the issue of procurement management with specific thresholds by arrangement will austerely be subject to discussions, consultation, and agreement between the government of Romania and forthcoming financier(s).

As noted by the European Union[12], procurement of goods and services involved in the public sector development projects should be carried out in the framework of *Public Financial Management* (*PFM*), while securing accountability, transparency, predictability, and participation in practices. In so doing, honesty and fairness in carrying out procurement is an underlying principle and a *Must*. Likewise, contracting authorities need to be cost-effective and efficient in the use of public resources in pursuance of *Value for Money* in project management, while upholding morality, integrity, and the highest standard of output quality. In this light, the public sector procurement in Romania is subject to audit and scrutiny under the Controller and Auditor General (Amendment) Act 1993, and auditors are accountable to the public for expenditures incurred[13].

In the meantime, the Governmental Emergency Ordinance No. 34 issued in 19 April 2006 takes into consideration the urgent needs for the elaboration and promotion of a new legislation in public procurement. The Ordinance is in line with the Chapter 1 of "The free circulation of goods" and the recommendations by the European Union on public acquisition, and public works and services concession contracts on a fair and competitive basis.

The main principles to be applied for a public acquisition contract are the following:

(i) Non-discrimination,
(ii) Equal treatment,
(iii) Mutual acknowledgement,
(iv) Transparency,
(v) Proportionality,
(vi) Efficiency in resource allocations, and
(vii) Responsibility and Accountability.

According to the guidelines regardless of financiers, it would be noteworthy that, in general, contracts are to be grouped to the extent possible in package sizes such that (international as well as local) competitive bidding is encouraged. Indicatively the Guidelines under EU-financed projects provide the schematic framework for procurement of goods and services with the following threshold values[14]:

(i) Goods and services under EUR 5,000 in value might be procured by verbal quotes from one or more competitive suppliers, and
(ii) Supplies or services contracts between EUR 5,000 and EUR 50,000 in value might be awarded by responses to specification sent by fax or e-mail to at least three suppliers or service providers.

Meanwhile, procurement methods applied under the international financing institutions (IBRD and IDA) - financed projects are provided as follows.

[12] The European Union, *Public Procurement Guidelines-Competitive Process*, 1994, p.6, *www.etenders.gov.ie*
[13] As part of implementation framework for Public Financial Management, the country's supreme institution of public auditing is requested to duly undertake not only compliance accounting, but also Value for Money performance auditing for government ministries and or public entities.
[14] Reference: EU, *Ibid*.,1994, *www.etenders.gov.ie*

(a) *Procurement of goods and equipment*[15]

(i) International competitive bidding (ICB)

The objective of ICB is to provide all eligible prospective bidders with timely and adequate notification of borrower's requirements and an equal opportunity for bid for the required goods and works. In carrying out procurement on ICB basis, the borrower is to carry out due diligence on the technical and financial qualification of eligible bidders to be assured of their capabilities in relation to the specific contract.

(ii) National competitive bidding (NCB)

NCB is the competitive bidding procedure normally used for public procurement in the country of the borrower. This procedure would be the most appropriate method of procurement where foreign bidder are not expected nor to be interested because of (i) small amount of contracts, (ii) geographically scattered work sites and/or very much elongated work schedule, (iii) labor-intensive works, or (iv) lower domestic prices of goods and works than international prices.

(iii) Shopping (S)

Shopping is the method based on comparison of price quotations obtained from short-listed suppliers (goods) or contractors (works) of minimum three, while assuring competitive prices. This is appropriate to adopt when (i) procuring readily available off-the-shelf goods or standard specification commodities of small value, or (ii) simple civil works of small value. Quotation are to be submitted by mail, fax or by e-mails. Evaluation processing follows the same principles as of the open bidding, and the terms of the accepted offer shall be incorporated in a purchase order or brief contracts.

(iv) Direct contracting (DC)

This is the contracting without competition (single source) and would be applied when: (i) an existing contracts accepted fully in compliance with the Bank Guidelines might be extended for additional goods or works of a similar nature (repeat order), (ii) the Bank is satisfied that no possible advantage of further competition, (iii) the prices offered are reasonable, (iv) equipment or spare parts that are compatible with existing ones, (v) the required equipment is properly and obtainable only from one source, (vi) the contractor in responsible requires the purchase of critical items from a particular supplier as a condition of performance guarantee, or (vii) emergency purchase in response to natural disaster, as an exceptional case.

(b) *Selection of Consulting Services*[16]

(i) Quality and cost-based selection (QCBS)

QCBS will be appropriate when: (i) complex or highly specialized assignments that are difficult to devise precise TOR and the required inputs from consultants, (ii) the clients require the consultants to demonstrate innovation in their proposals (*e.g.* country economic or sector studies, multi-sectoral feasibility studies, design of an urban master plan, financial sector reform), (iii) assignments have a high downstream impact and in which the objective is to have the best experts (*e.g.* feasibility and structural engineering design of major infrastructure projects, policy studies of

[15] The World Bank, *Guidelines for Procurement under the IBRD Loans and IDA Credits,* pp. 11-40, May 2004
[16] The World Bank, *Guidelines for Selection and Employment of Consultants by World Bank Borrowers,* pp.30-34, May 2004

national significance, management studies of large government agencies), and (iv) assignments that can be carried out in substantially different ways, such that the proposals will not be comparable (*e.g.* management advice, sector and policy studies where the quality of services depends on the quality of analysis).

(ii) Selection based on the consultant's qualification (CQ)

This method may be used for small assignments[17] for which the need for preparing and evaluating competitive proposals is not justified. In such cases, the borrower will request, upon the preparation of TOR, expressions of interest and information on the competency relevant to the assignments from consulting firms, and establish a short list. Among the firms enlisted therein, the firm with the most appropriate qualification will be selected and subsequently requested to submit a combined technical-financial proposal for negotiation.

(iii) Least cost selection (LCS)

Only when assignments are standardized or routine nature with well-established practices and standards, this method will be applied. These include, for instance, audits, engineering design of noncomplex works, and so forth. Under this method, two-envelop-proposals will be submitted from the short-listed firms, of which technical proposals under a "minimum" qualifying mark for the "quality", as established by project authority, will be rejected. In the wake of filtering of technical proposals, financial proposals will be opened in public, and sequentially the lowest bidder will be selected and warded the contract.

Tables 8.3.1 and 8.3.2 summarize the procurement thresholds for goods and services as agreed upon for compliance between the Bank and GOR[18].

Table 8.3.1: Procurement threshold-goods and equipment

	Goods and equipment	Civil works
ICB	= US$ 0.1 million	= US$ 3.0 million
NCB (LCB)		< US$ 3.0 million
Shopping	< US$ 0.1 million	< US$ 0.1 million

Table 8.3.2: Procurement threshold-consultant services, technical assistance (TA) and training

	Consultant services, TA and training
Quality and cost based selection (QCBS)	(more than) > US$ 0.2 million
Consultant qualification (QC)	< US$ 0.2 million
Least cost selection (LCS)	< (less than) US$ 0.1 million

PIU, in the meantime, is to submit a quarterly report for procurement administration to eventually financer(s) through MoEWM and MoPF, with information on (i) status of procurement, (ii) updated procurement plan, and (iii) compliance with aggregate limits on specified procurement methods as shown above.

[17] While, the equivalent amount of "small" varies depending on the nature and complexity of the assignment, it is stipulated not to exceed US$200,000. (*Guidelines for Selection and Employment of Consultants by World Bank Borrowers*, p33, May 2004)

[18] While these thresholds for goods and services are specific to each of the specific loan/credit projects, those provided in the main text above would be applied in general to the Bank-financed projects.

(2) Fund management

The financial management system of the project, at this moment in time, has not yet come in place for specific and substantial discussions amongst government officials, thus it would be too early to draw any decisively conclusive remarks. Nonetheless, the following scheme would be provided while highlighting financial and accordingly somewhat managerial autonomy on the project implementation front, namely, MoEWM and DADL in particular. It would be reiterated, in the meantime, that the issue in concern will fully be subject to further discussions and elaboration in due course of project processing that come.

Funds from financier(s) would be allocated to the Ministry of Public Finance (MoPF) according to the grant/loan agreement, followed by a signing of "grant agreement"[19] between MoPF and MoEWM conferring legitimate rights for the use of grant proceeds to MoEWM. The state budget is also appropriated to MoEWM for the project. Subsequently the special account (SA) and the local currency account are opened by MoEWM at respective of any commercial bank and the Treasury, from which the proceeds are transferred to the project account opened by PIU for financial settlements. A separate sub-bank account in foreign currency will be opened at commercial banks to receive the interest from SA and to cover bank charges for SA. Once the said agreements are signed and come into effect, PIU would commence financial settlements associated with the project activities of relevance, as invoices from suppliers being received by PIU. These invoices are verified by consultants and certified jointly by the representatives of PIU and DADL in a bid to ensure all of the goods delivered, works done, and services rendered are relevant as par technical specification and terms of reference.

Alternatively should the opportunity arises for MoPF to be solely responsible for the fund management and cash-flow, the special account (or escrow account, as necessary) will be opened and maintained by MoPF on terms and condition acceptable to financier(s) for disbursements. SA will be drawn upon to meet payments to contractors, suppliers, and/or consultants under the project by submission of withdrawal applications of relevance from PIU through verifications by the beneficiary (DADL), the intermediary body (REPA/LEPA), and the managing authority (MoEWM). Initial allocation to and ceiling of SA will be subject to discussions and agreement between financier(s) and MoPF, followed by replenishment application with reconciled bank statements and other supporting documents to be submitted every three months to financier(s) from MoPF. SA will be subject to annual auditing by an independent audit institute, with audit reports submitted to financier(s) for review and approval, commonly, within six months after the end of fiscal year.

(3) Monitoring and evaluation

A well-devised monitoring and evaluation system will be imperative for ensuring the project's timely and successful implementation, and enhancing its impact by a systematic analysis of lessons learnt and their effectiveness dissemination, while taking into account the project's accountability, predictability, and transparency. With this in view, PIU will be responsible for the monitoring and evaluation (M/E) system that will be in place during the project life. In so doing, performance indicators will be developed, as appropriate, to numerically monitor and evaluate project performance by all of the stakeholders, including PIU itself. The outputs of M/E activities will be fed-back into the implementation process as improved practices.

[19] In the country, debt servicing accrued to external public funds inclusive of borrowings loans is solely due to MoPF, and not on-lent to implementing ministry/agency. Thus the funneled fund from MoPF to implementing body is always a "grant" fund.

Likewise, PIU will be responsible for designing a simple reporting system and formats for each of the project components, with benchmarks for annual performance objectives and monitoring indicators. As previously mentioned above, quarterly reports will cover the progress in physical construction and rehabilitation, the use of project funds, move in staffing, if any, and project impacts. The report will be consolidated into a semi-annual progress report to be submitted to financier through the Ministry, while covering an implementation plan and work program for the next six month following the report period.

CHAPTER 9:

CONCLUSIONS, RECOMMENDATIONS AND FURTHER ISSUES

Chapter 9 Conclusions, Recommendations, and Further Issues

9.1 Conclusions

(1) Preliminary design of shore protection facilities

A feasibility study has been made for the Coastal Protection and Rehabilitation Project at Mamaia Sud and Eforie Nord. The Project has two components: "A" at Mamaia Sud and "B" at Eforie Nord. For the both components, preliminary designs of shore protection facilities and rehabilitation works have been made, execution schedules have been set up, and the project costs have been estimated.

The Component "A" at Mamaia Sud has the following major items of construction works:

Beach fill:	alongshore distance of 1.2 km, beach width increase of 50 m, and sand volume of 224,000 m^3.
Rehabilitation of two (2) breakwaters:	length of 250 m each.
Construction of one (1) sand retaining jetty:	length of 200 m.
Construction of three (3) submerged groins:	length of 100 m each.

The above beach fill is planned with using the river sand from the Danube around the location km 305 to km 340. Another design works have been undertaken for the case using the seas sand around Midia Port. In this case, the volume of beach fill sand is increased to 379,000 m^3 and an underwater dike of 1,230 m long needs to be constructed.

The Component "B" at Eforie Sud has the following major items of construction works:

Beach fill:	alongshore distance of 1.2 km, beach width increase of 80 m, and sand volume of 467,000 m^3.
Rehabilitation and extension of one existing jetty:	extension length of 60 m.
Rehabilitation of one existing jetty:	length of 180 m.
Construction of three (3) submerged breakwaters:	length of 200, 200, and 275 m.

(2) Implementation schedule

Because of the uncertainty of the exact data when the fund for the Project is secured and the Project Implementation Unit (PIU) is established, the implementation schedule is counted from the year after the provision of the fund. The Project Component "A" at Mamaia Sud is scheduled to start in July of the first year and to be completed by December of the second year.. The following is the periods of major construction works:

- rehabilitation of the first detached breakwater:	August to November of the first year
- rehabilitation of the second detached breakwater:	May to August of the second year
- sand-retaining jetty:	October of the first year to February of the second year
- submerged groins:	October of the first year to May of the second year

- beach fill:	March to May in of the second year and September to November of the second year

Major construction works are carried out in the off-season of summer tourism. However, rehabilitation works of existing breakwaters which are executed by floating vessels at the distance of 500 m from the shore are continued throughout the year, because they will not interfere with the beach users in the summer season.

With the condition same as that for the Component "A," the Project Component "B" at Mamaia Sud is scheduled to start in January of the third year and to be completed by June 2010. The following is the periods of major construction works:

- Removal of existing short groins:	February to May of the third year
- Submerged breakwaters:	February to December of the third year
- Rehabilitation and extension of two jetties:	February to May of the third year with minor works in the off summer season of the fourth year
- Beach fill:	March to May of the third year and September of the third year to May of the fourth year

Major construction works are carried out in the off-season of summer tourism. However, construction of submerged breakwaters which are executed by floating vessels at the distance of 300 m from the shore are continued throughout the year, because it will not interfere with the beach users in the summer season. When the construction works are completed as scheduled, the new beach at Eforie Nord will be fully available for the beach users in the summer of the fourth year.

(3) Project cost

The total project cost excluding price contingency is estimated as 40.2 million Euro for the aggregate of the Components "A" and "B" when the river sand is used for beach fill at Mamaia Sud on the basis of the market price in the summer of 2006. The project cost of the Components "A" and "B" are 11.53 million and 28.7 million Euro, respectively. When the sea sand is to be used for beach fill at Mamaia Sud, the total project cost increases by 7.4 million Euro to 47.7 million Euro.

(4) Social and environmental considerations

During the feasibility study, field sampling and laboratory analysis of the sediment have been made at the sand source areas of the Danube and the seabed around Midia Port as well as on the sea bottom of the two project sites. The analysis clarified no presence of harmful materials regulated by the Romanian laws in the sediment. A traffic volume survey was also conducted on the three routes through which beach fill sand and construction materials are transported. Compared with the daily traffic, the expected trips of dump trucks for construction works is around ten percent and the impact of air pollution, noise and vibration on the area around the road is evaluated as of low level.

The effect of sand mining from the Danube on the river flow regime seems not to be significant in consideration of the current commercial aggregate mining activities and annual maintenance dredging of the international fairway.

Moderate or low impact is potentially expected on water, fauna, flora and biodiversity, landscape, waste, fishery, and social and economic environment by the project implementation. Thus, continuous monitoring will be needed on the project implementation. Other environmental factors such as soil and subsoil, human settlement, cultural heritage and others are not affected by the Project and thus no impacts are foreseen.

(5) Affordability analysis of project investment

With regard to the macro-front of the coastal protection and rehabilitation scheme in the Romanian economy, there are readily available of external public funds for collaborative effort for the country's socio-economic development, with the EU post-accession fund as a forerunner in particular. Financing from other international financing institutions would readily be of avail. The Government of Romania itself has a medium-term rolling budget program for coastal protection over the forthcoming three years of the first year to the third year, with US$157.8 million in aggregate.

On the micro-side of affordability, the Coastal Protection and Rehabilitation Project at Mamaia Sud and Eforie Nord constitutes a part of the pipeline projects for EU post-accession financing within the operational framework for the Environmental Spectral Operational Program. The proposed project is most likely to take a lead for financing from EU-post accession Cohesion Fund, provided that technical details and environment issues are delineated and get ready for application to Brussels

(6) Economic analysis of the project

With the major item of the project benefit being the people's welfare as perceived by the presence of beaches on a sound basis (use- and non-use value) expressed by the amount of Willingness-to-Pay, the economic internal rate of return (EIRR) has been calculated as 20.0% for the Component "A" at Mamaia Sud, 7.8% for the Component "B" at Eforie Nord as, and 9.4% for the Project aggregate of "A" and "B." Sensitivity analysis has also been presented. This estimate of 9.4 percent exceeds the generally acceptable cut-off rate of EIRR at 6 to 8 percent for environment sector projects. With this, the proposed project deserves implementation in terms of the efficient allocation of scare resources in the Romanian economy. Net Present Value (NPV) stands at EUR 13.7 million (US$ 17.4 million) at the social discount rate (SDR) of 8 percent, robustly demonstrating the project's supremacy in resource allocation in the economy.

(7) Operational framework of the project

In close consultation with the Romanian government officials concerned and other international institutions, the operational framework of the project has been proposed. The Ministry of Public Finance serves as a "final certifying authority" in charge of financial management and settlements (payments), and the Ministry of Environment and Water Management acts as the managing authority. The Regional and Local Environment Protection Agency (REPA in Galati/LEPA in Constanta) are placed as "intermediary bodies" administratively responsible for project management and the part of fund management with procurement procedure in particular. The final beneficiary is DADL, within which the Project Implementation Unit (PIU) is set up. Indicative

TORs for the above ministries, agencies and institutions are respectively given.

PIU is proposed to be composed of around eleven professional staff supported by secretaries and workers. The staff is to be full-time assignment having been recruited outside sources with the Project fund. Indicative TOR for PIU is given in Appendix J.

9.2 Recommendations

For implementation of the Coastal Protection and Rehabilitation Project at Mamaia Sud and Eforie Nord, the following items should be taken into consideration:

1) Because of progression of severe beach erosion at present with heavy damage being anticipated, a prompt implementation of the project should be achieved.
2) Proper execution of the geophysical and environmental monitoring proposed in Chapter 6 is the key to the successful project implementation as well as the integrated coastal zone management of the Romanian Black Sea shore.
3) Especially for beach fill sand, proper execution of the monitoring is significant on the operation and maintenance process. Beach fill sand will be gradually lost owing to the alongshore sediment transport, the rate of which has been predicted by the numerical simulation. There is also the cross-shore sediment transport toward the offshore which has not been taken into account. Although the lifetime of twenty years is predicted for the filled beach, preparedness should be made for earlier necessity of re-supply of beach fill sand.
4) The shoreline will indicate seasonal change and/or temporarily deformation by storms. Because the natural process of beach deformation may defy the technology of humankind, careful and continuous monitoring should always be executed and appropriate measures should be taken when unexpectedly severe beach erosion is observed.
5) Submerged groins at Mamaia Sud are designed with geotextile sand bags, the lifetime of which is limited. Vandalism may also damage the bags and the inside sand may flow out. Regular inspection of geotextile bags should be undertaken and replacement of damaged bags should be made without delay.
6) The execution plan has been made so as to avoid the summer tourist season except for the marine works of breakwater construction and rehabilitation, but the beaches are utilized throughout the year by anglers, strollers and others. Due caution should be taken for the safety of beach users during execution of the Project.
7) If the decision is so made to use the sea sand for beach fill at Mamaia Sud, the underwater dike may produce a deep spot behind it by wave overtopping. Appropriate notice to the beach users should be made and safeguard measures should be taken.
8) Several facilities such as detached breakwaters, submerged breakwaters and head sections of jetties are not safe and should be off-limit to the beach users.
9) The grain size of beach fill sand should appropriately be specified in the tender documents by referring to Table 2.5.4, because the grain size is the important factor for success of a beach fill project.
10) Although the spoil of the maintenance dredging carried out by the River Administration of the Lower Danube, Galati is not included in the candidate of beach fill sand, it may be utilized if its grain size and quality is suitable for beach fill; the utilization can reduce the project cost. For example, fine sand around the Seimeni area at km 291 – km 293 may be used for filling of the backshore area where waves attack less frequently.

11) The river sand for beach fill may contain coarse fractions of gravel and pebbles, which will gather themselves around the shoreline by the sorting action of waves. It may become necessary to remove them from the shore when the beach cleaning operation is executed by DADL.

12) For execution of construction works, due mitigation measures for environmental protection described in Chapter 5 should be taken together with environmental survey of the project sites and the source areas of beach fill sand.

13) For the planning of the future coastal protection projects after the Mamaia Sud and Eforie Nord project, it is recommended to carry out a detailed survey on the number of beach users so that the project benefit will be measured on a firmer basis.

9.3 Further Issues

A scenario has been drawn for the start of the coastal protection and rehabilitation project at Mamaia Sud and Eforie Sud. Preliminary designs of shore protection facilities are presented with the execution schedule and cost estimate. Affordability of the fund for the project is acknowledged, and economic analysis yields the economic internal rate of return (EIRR) at a high value of 9.4 percent. Operational framework of the project is set in close consultation with the Romanian government officials concerned, and the function and framework of the project implementation unit (PIU) are prescribed.

During the public debate of the SEA procedure on the coastal protection and rehabilitation plan of the Southern Romanian Black Sea shore, which was held on March 29, 2007 at the National Institute for Marine Research and Development in Constanța, several questions and opinions were raised regarding the Master Plan. Among them, the following is the main opinions:

- Consultations with and approval from the local community (especially the fishermen) and owners are needed.
- Transport of sand by dump trucks on road may cause significant environmental impact. The methods of transport by water should be studied and examined.

Due to the decision of Romanian government on the application of Strategic Environment Assessment (SEA) to the Study in March 2006, SEA was carried out during the feasibility study, though SEA needs to be conducted prior to the feasibility study according to the processes stated in Romanian SEA as well as JICA's guidelines for the environmental and social considerations. Appropriate measures were needed to be taken to comply with the operational procedure of SEA. For this reason, the Romanian proponent first prepared the coastal protection and rehabilitation plan as well as a draft SEA report based on JICA's pre-draft final report of the Study. Then, the proponent held a public debate on the plan and a draft SEA report in accordance with the Romanian SEA procedure. The outcome of the public debate was included in the final SEA report.

Meanwhile, JICA provided necessary assistance to the Romanian proponent for producing the draft SEA report. Specifically, JICA revised its pre-draft final report by reflecting the outcomes of the public debate so that the revised report could be used by the proponent as the basis for the final SEA report. Appraisal of the final SEA report was completed by the Environmental Management Bureau. After that the outcomes of the public debate have been incorporated in this final report of the Study.

In preparation of EIA application documents and execution of EIA procedures in future, it is recommended to pay due considerations to outcomes of public debates and other relevant matters.

Coastal protection is a long range task in any country. It cannot be achieved by a crash program in a short time span, but must be carried on by a long-term planning and continuous efforts of the Romanian officials concerned. Establishment of a special coastal administrative unit within the Ministry of Environment and Water Management and the corresponding sections in ANAR and DADL, as recommended in **8.1** of Volume 1, should be the first step for the proper protection and maintenance of the coast along the Romanian Black Sea. Coordinated efforts by MoEWM, ANAR, and DADL by fully utilizing their manpower are on request.

When the coastal protection and rehabilitation project at Mamaia and Eforie Nord will successfully be initiated, it will be a kind of crash project with the budget of some 40 million Euro to be completed in full three years. All the personnel concerned will be demanded of utmost concentration and efforts, but they will gain invaluable experience for the forthcoming projects in other sub-sectors stipulated in the Coastal Protection Plan described in Volume 1. The project at Mamaia Sud and Eforie Nord is just the beginning. Inhabitants in other areas are looking forward to having the projects in their locality.

APPENDICES

Appendix A: Statistics of Seaside Tourists

A.1 Data Source of Tourists in Accommodations

The National Institute of Statistics, Romania has been publishing a series of Romanian Statistical Yearbook, and Chapter 10 of the 2004 edition deals with trade, services, and tourism. Its section 10.4.6 lists the statistics of the tourist accommodation capacity and activity by tourist destinations, which are classified into seaside, spas, mountain, Danube delta, county residences, and other localities. Because the statistics with the destination of Constanța Municipality are excluded from the statistics of seaside destination, the latter is directly related with checked-in tourists who have stayed in the accommodations along the coastal zone of the Study area. Various data have been extracted from this information as listed in Table A.1.1.

Table A.1.1: Statistics of seaside tourists (source: Romanian Statistical Yearbook 2004 and 2005 editions)

Year	Nos. of accommodation		Capacity of accommodations (thousands / thous. place-days)		Functioning days[2]		Occ-upancy rate (%)	Tourists staying in accommodations		Staying nights	
	total	hotels[1]	existing	function-ing	total	hotels		total (thou.)	foreign.[3] (thou.)	Domes-tics	Foreign-ers
1994	709	257	118.0	10,788	91.4	104.8	52.3	797	100	6.9	8.5
1995	712	258	118.3	11,243	95.0	103.8	56.9	919	68	6.8	8.6
1996	715	259	118.8	11,503	96.8	108.5	51.8	865	62	6.8	8.2
1997	708	258	118.3	10,714	90.6	101.9	47.6	767	58	6.5	8.1
1998	698	257	118.1	10,539	89.3	101.3	49.0	806	49	6.3	7.9
1999	729	255	118.2	9,454	80.0	93.3	45.9	679	35	6.3	7.5
2000	764	258	119.4	8,730	73.1	86.8	51.1	672	33	6.6	8.1
2001	767	258	117.4	9,671	82.4	97.9	46.8	659	45	6.8	8.3
2002	758	259	116.4	10,390	89.4	104.1	41.3	685	58	6.1	7.5
2003	793	270	116.5	10,516	90.2	108.3	39.9	718	67	5.7	7.0
2004	844	275	116.9	10,383	88.8	105.7	41.8	755	84	5.6	7.1

Note: 1) The number of hotels is included in the total.
2) The functioning days are calculated by dividing the functioning capacity by the existing capacity.
3) The number of foreigners is included in the total.

In addition, Constanța County has supplied the Study team with the information of tourists to the county in 2004 by origin and administrative units, which is shown as Fig. 7.3.4 of **7.3** of this volume. It is also shown hereinafter with the figure number of Fig. A.1.1. The bar diagrams of this figure have been read off to yield the approximate numbers.

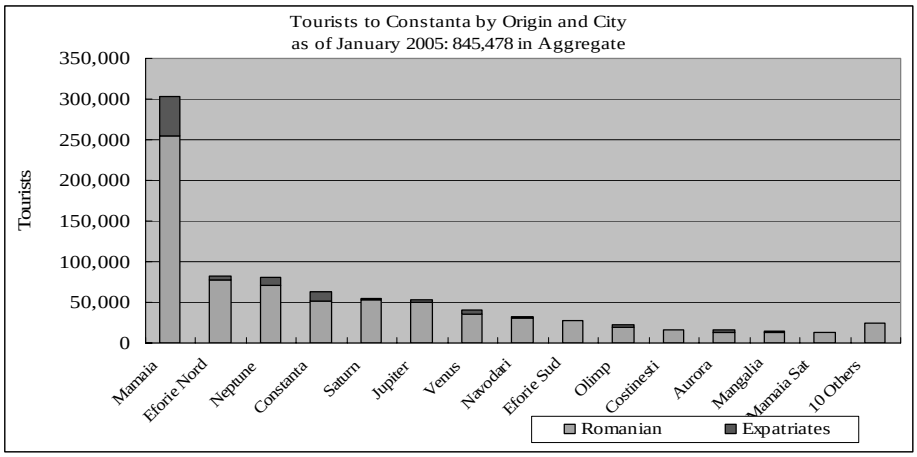

Fig. A.1.1: Tourists to Constanta County by origin and administrative unit

A.2 Analysis of Tourists Statistics

The yearly variation of checked-in tourists to the seaside area is exhibited in Fig. A.2.1 with separation of domestic and foreign tourists. The number of tourists declined in the latter half of the 1990s, and the decrease was larger for the foreigners than the nationals. During this decade, the annual rate of the consumer price increase is calculated as 183%[1]; the rate of service sector was 194%. The former rate went down in the 2000s such as 135% in 2001, 123% in 2002, 116% in 2003, and 113% in 2004. The inflation in the 1990s reflects the difficulty in economic activities and must have dissuaded people to enjoy tourism; cease of inflation must have helped recovery of tourism. Thus the number of tourists began to increase after 2001 and the increase is strong for the foreigners.

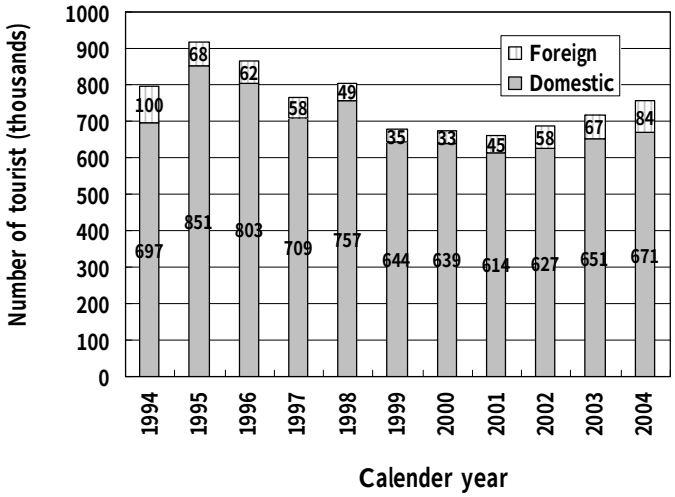

Fig. A.2.1: Yearly variation of numbers of checked-in tourist

A regression analysis has been made for the total number of yearly tourists with a parabolic curve. The result is shown in Fig. A.3.2 with the best fitted curve of the following:

$$y = 3385x^2 - 57{,}924x + 948{,}400: \qquad x = \text{year} - 1993 \tag{A.1}$$

where y refers to the total number of annual tourists. The regression line may underestimate the future increase of tourists, because the rate of tourists increase from 2001 to 2004 is faster than the

[1] Calculated from the data of Section 11.1 "Consumer price indices" of the Romanian Statistical Yearbook 2004 edition.

tendency of the regression line. Nevertheless, the annual number of tourists staying in the accommodations along the coastal zone will exceeds 1 million in near future.

A similar regression analysis is made for the number of foreign tourists with the result shown in Fig. A.3.3. The best fitting curve is represented by

$$y = 2033x^2 - 25{,}646x + 120{,}280: \qquad x = \text{year} - 1993 \tag{A.2}$$

The variation of yearly foreign tourists is much larger than that of the overall tourists or that of domestic tourists. The decrease in the late 1990s is large and the recovery in the early 2000s is fast. As the result of such a rapid change, the trend in recent years suggests a large number of foreign tourists in near future, exceeding 150,000 in 2007 or so.

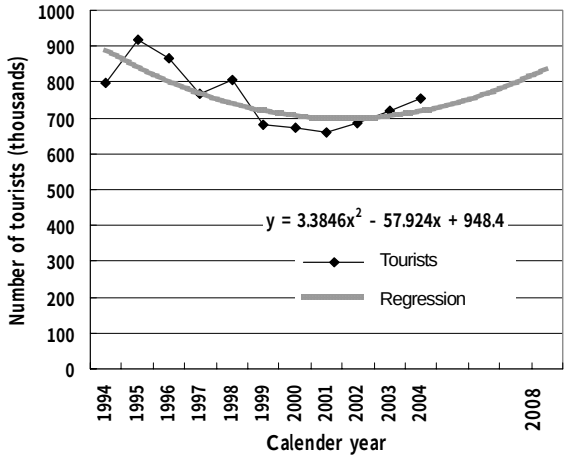

Fig. A.2.2: Regression analysis of all tourists

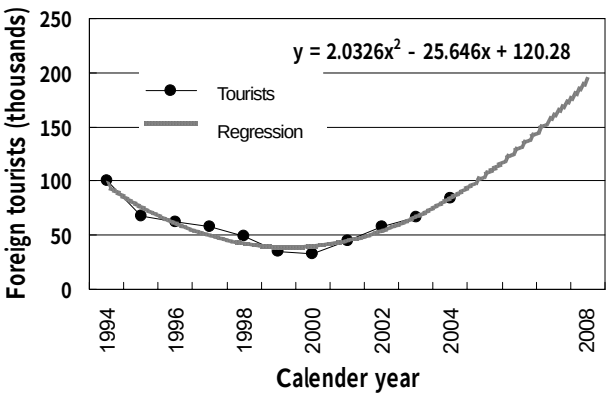

Fig. A.2.3: Regression analysis of foreign tourists

According to Table A.1.1, hotels and other accommodation facilities open only during the summer season. Hotels open to the tourists for about 100 days, though there are some fluctuations. Small facilities other than hotels open their houses for about 65 days and the overall mean is about 89 nights. This makes a big contrast with hotels in county residences, which opens for 340 days.

Another interesting feature is a long stay of tourists in hotels and other accommodations. In the 1990s, they used to stay for about seven nights, but recently their stay becomes about six nights. Visitors from foreign countries stay longer than Romanians by more than one night. The statistics of staying nights suggests that the turnover of tourists in summer is around 15 times. A simple calculation yields an estimate of the daily number of tourists staying in accommodations as around 50,000.

A.3 Estimate of Daily Number of Beach Visitors

In addition to the tourists staying in hotels and other accommodations in the seashore zone, there are a large number of local citizens enjoying sunbathing and ocean bathing every day during the summer season. A crude estimate on the total number of beach visitors is made hereby with the casual observation of visitor density made on August 10, 2005 by the Study team, which is listed as Table A.2.1 of Annex **A.2** in Volume 3. Table A.3.1 lists the result of the estimate of beach visitors for each sub-sector and the total count.

Table A.3.1: Estimate of daily number of beach visitors based on approximate visitor density

Sector no.	Sector name	Effective beach area		Visitor density		Count of visitors	
		Length (m)	Width (m)	Persons /m^2	Persons /m	Area-wise	Length-wise
I-1	Năvodari North	2,300	50	–	0.01	–	23
I-2	Năvodari South	2,200	50	–	0.1	–	220
I-3	Mamaia North	4,100	50	–	1.5	–	6,150
I-4	Mamaia Center	1,800	50	–	1.0	–	1,800
I-5	Mamaia South	1,700	20	0.5	–	17,000	–
I-6	Tomis North	500	20	–	1.0	–	500
I-7	Tomis South	2,000	30	–	1.0	–	2,000
II-1	Eforie Nord	1,400	20	0.3	–	8,400	–
II-2	Eforie Middle	1,600	50	–	0.2	–	320
II-3	Eforie Sud	1,500	30	0.2	–	9,000	–
IV	Costineşti	1,200	30	0.3	–	10,800	–
VI-1	Olimp – Neptun	3,000	20	0.1	–	6,000	–
VI-2	Venus	2,500	30	–	0.1	–	250
VI-3	Saturn	2,200	30	–	0.3	–	660
VII-1	2 Mai	1,000	20	0.1	–	2,000	–
VII-2	Vama Veche	1,200	30	0.2	–	7,200	–
					Total	60,400	11,923
					Grand total	72,323	

The reliability of the estimate cannot be high with a confidence interval of 50% or so. Nevertheless, an estimate of 72,000 visitors seems to be not far from the reality. Among 50,000 daily tourists, a half of them may spend leisure time on beaches. Thus, the daily number of local citizens coming to beaches may be around 47,000.

The Study team had an occasion of revisiting the beaches of the Southern Black Sea on the 20th of August 2006, which was a hot Sunday with the air temperature having risen above 35ºC. The number of people coming to beaches was much more than those estimated in Table A.3.1. Many people were swimming and/or playing in the water with friends to escape from the heat. The beach of Năvodari North, which had the thinnest density of visitors in 2005, was crowded with one person in every meter of the shoreline. The highest visitor density of 0.3 to 0.5 persons per square meters remained the same as that in 2005, but the zone occupied by people was enlarged in both the cross-shore width and the alongshore distance. For example, the effective beach width occupied by people at Costineşti was about 60 m compared with 30 m in 2005.

The Study team did not make an overall survey in 2006 as before, but the total number of people must have been roughly twice the estimated number of 2005. The increase owes to the very hot weather and the day being Sunday. The survey in 2005 was made on a weekday with a comfortable weather of around 26ºC. Thus, the grand total number of 72,323 listed in Table A.3.1 could be regarded rather a conservative estimate for the daily number of people visiting beaches during the summer season.

Appendix B: Regional Economy of Constanța County

B.1 Gross Domestic Regional Product of Southeast Region

According to the Romanian Statistical Yearbook (2004 edition, Section 20.48 and 2005 edition, Section 11.11 – 11.15), the gross domestic regional product (GDRP) and its value per capita have varied as listed in Table B.1.1. The data is for the Southeast Region of Romania that is composed of six counties of Brăila, Buzău, Constanța, Galați, Tulcea, and Vrancea. The total population of the Southeast Region on 1 July 2002 was 2,867,936, among which 713,567 belong to Constanța County; it was 2,850,318 and 713,825 on 1 July 2004, respectively.

Table B.1.1: Gross regional domestic product (GDRP) of the Southeast Region, consumer price indices, and foreign exchange rate (source: Romanian Statistical Yearbook 2004)

Item	1997	1998	1999	2000	2001	2002	2003
GDRP – total (billion lei)	33,369	48,959	66,167	92,868	131,652	171,123	222,264
GDRP per capita (thousand lei)	11,337	16,636	22,532	31,853	44,900	59,667	77,881
Consumer price indices (year 2002 = 100)	0.17961	0.28575	0.41663	0.60690	0.81608	1.00000	1.15274
Foreign exchange rate (thousand lei to US$1.00)	7.17	8.88	15.33	21.69	29.06	33.06	33.20

The nominal GDRP increased greatly as the year passes, but the real value in consideration of the consumer price indices was the highest in 1997 and the lowest in 2000. The GDRP in terms of US dollars have been listed in Table 2.2.3 in **2.2.5** of Volume 1. The inflation in Romania was very severe during the 1990s and it became moderate only after 2003.

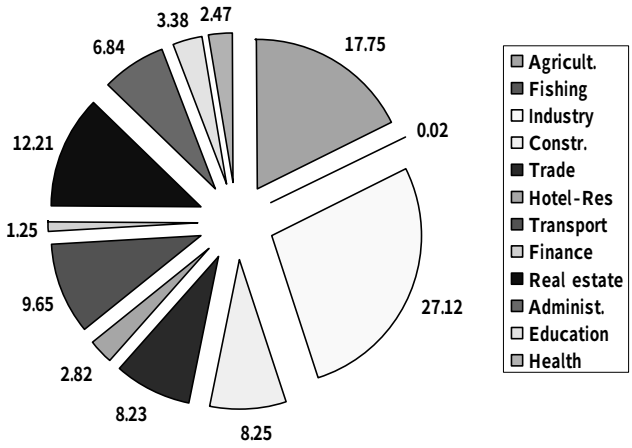

Fig. B.1.1: Share of gross domestic regional product of the Southeast Region by activity in 2002

Note: Agricult.: Agriculture, hunting, and sylviculture; Fishing: fishing and fish culture, Industry: mining and quarrying, manufacturing, thermal energy, gas and water; Constr.: construction; Hotel-res: hotels and restaurants; Transport: transport, storage and communications; Finance: financial intemediations, Real estate: real estate transactions, renting and service activities; Administ.: public administration and defense, Health: health and social assistance.

Figure B.1.1 shows the share of various sectors of economic activities in GDRP of the Southeast Region in 2002. The sector of industry has the largest share of 31.6%, followed by the sectors of agriculture (16.2%), transport (9.9%), and so on. There are some fluctuations in the sectoral share from year to year even though the absolute amount of GDRP of each sector continued to increase. For example, the share of the industry sector in 2003 was 27.1%, while the share of the education sector increased from 2.95% in 2002 to 3.38% in 2003.

B.2 Employment in Constanța County

The County of Constanța has the population of 713,563 as of 1 July 2002, of which 506,077 live in the urban area and 207,706 in the rural area. The ratio of the urban inhabitants to the total population in Constanța County (0.71) is highest among the six counties in the Southeast Region; the ratio in Buză is lowest (0.40). The average number of employees in the County of Constanța was 172,527 in 2002 (Section 20.19 of Romanian Statistical Yearbook 2004), but the civil employment counted 274.2 thousands at the end of the year 2002 (Section 20.17). The major source of difference is the agriculture sector, which recorded 8,173 as the average number, but the civil employment was 79,500 at the end of year. The difference originates from their definition. The average number of employees represents a simple arithmetic mean obtained by dividing the sum of the numbers of all daily employees by the total calendar days of the year (365 days). The civil employment refers to all persons who carried out a socio-economic profitable activity during the reference year, excluding military staff and others. The number of employees other than the agriculture sector is 164 thousands on the average and 195 thousands as the civil employment at the end of the year 2002.

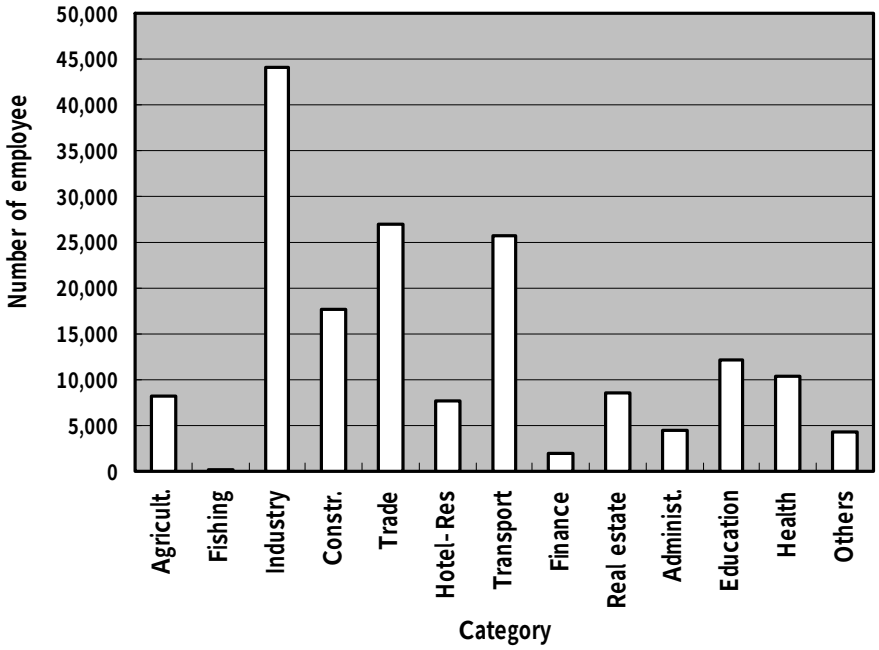

Fig. B.2.1: Number of average employee in respective sectors of activities in 2002
(see Note of Fig. B.1.1 for explanations of category names)

The sector-wise average numbers of employees in 2002 are shown in Fig. B.2.1. The sector of industry has the largest number of 44,177, being followed by the sectors of trade (26,880),

transport (25,741), construction (17,602) and so on. The sector of hotels and restaurants has the average employees of 7,619, while the sector of fishery has only 260.

The average net nominal monthly earnings of the total employees in Constanța County were 4,067,551 lei in 2002, which was 1.073 times the national average. The earnings differ among various sectors of economic activities. Figure B.2.2 shows the ratio of the earnings of respective sectors to the overall average in percentage. The ratio is the average of five years from 2000 to 2004. The sector of financial intermediations is the highest with the ratio of 190%, being followed by the sector of transport etc. (137%), industry (128%), and so on. The earnings in the sector of hotels and restaurants are low (67%), being slightly above trade (61%) and fishery (59%).

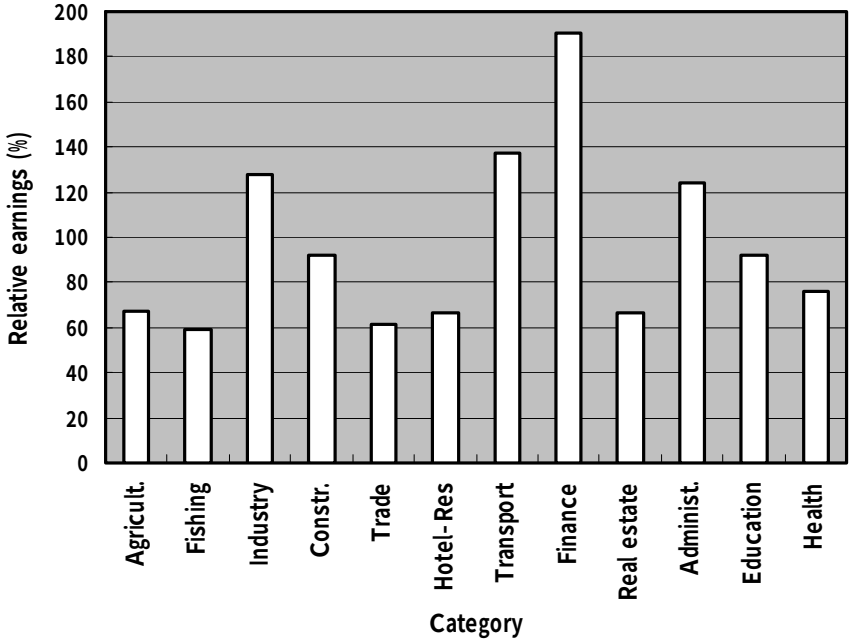

Fig. B.2.2: Relative earnings of employees in various sectors of economic activities

B.3 Tourism

Statistics of tourism can be analyzed from the two sources, i.e. the number of tourists and the gross domestic regional products. As discussed in Appendix A of this volume, the number of tourists staying in hotels and other accommodations along the seashore zone counts some 760,000 in 2004, among which foreigners are about 84,000. They stay for five and half nights on average, and foreigners stay for seven nights on average.

From the analysis of the gross domestic regional products in the Southeast Region, the sector of hotels and restaurants has the share of 3.1% (4686 billion lei or about US$147 millions) in 2002. Although the above share of the hotels and restaurants does not seem large, the national share, in the Domestic Gross Product, of the sector of hotels and restaurants in 2002 was 2.4%. Among the eight regions in Romania, the Southeast Region has a large contribution of this sector among the national sectoral share by 15.4%, which is next to the contribution of 30.1% by the Bucharest Region.

No published statistics of the sector-wise GDRP of Constanța County have not been found at the time of preparing this report. The available information is such that the share of GDRP of Constanța County among the Southeast Region (total of 154,814 billion lei before addition of VAT) was 35% in 2002 and the numbers of all touristic accommodations and hotels in Constanța County were 897 and 306 in 2004, respectively, while those of the Southeast Region were 1152 and 387, respectively. By assuming that the GDRP of the hotel and restaurant sector is proportional to the number of hotels, the GDRP of the hotel and restaurant sector of Constanța County in 2002 is estimated as about 3,705 billion lei or about US$112 million. It means that the hotel and restaurant sector has the share of 6.8% of GDRP in Constanța County.

As shown in Fig. A.1.1, the majority of tourists in Constanța County stay in the seaside accommodation. Thus, the seaside tourism is the very important sector of economical activities in Constanța County.

Appendix C: Sediment Grain Size Characteristics at Project Site and Beach Fill Sand Sources

C.1 Outlines

Under the contract with ECOH CORPORATION, the National Institute of Marine Geology and Geo-ecology (GeoEcoMar) has conducted a series of field study for sediment and water sampling and laboratory analysis of grain size, mineralogical and geochemical characteristics. A copy of the contract report is attached in the CD-ROM Database of Annex L of Volume 3. In this appendix, major results on the sediment grain size characteristics are presented.

Sediment sampling was made in June 2006 at the following seven areas:

- Eforie Nord (E): 10 samples of sea sand
- Mamaia Sud (M): 10 samples of sea sand
- Cape Media (CM): 9 samples of sea sand
- Sulina (SU): 10 samples of sea sand from seabed
- Sulina (D) 3 samples of sea sand from hopper of dredger “Dunărea”
- Cernăvoda (CNV): 6 samples of river sand
- Cochirleni (CCH): 16 samples of river sand
- Oltina (OTN): 12 samples of river sand

Information on the sampling stations and sieve analysis data are presented hereinafter.

C.2 Sampling Stations Coordinates and Water Depth

Table C.2.1: Coordinates of sampling stations at Eforie, Mamaia and Cape Midia

Area	Station	Latitude	Longitude	Measured depth	Corrected depth[1]
Eforie North (27.05.2006)	E06/A	44°03.884	28°38.562	5,25	4,9
	E06/1/0	44°03.989	28°38.374	0	0
	E06/1/1	44°03.988	28°38.394	1	0,7
	E06/1/3	44°03.993	28°38.482	3	2,65
	E06/1/5	44°03.991	28°38.562	5	4,65
	E06/2/0	44°04.315	28°38.320	0	0
	E06/2/1	44°04.318	28°38.330	1	0,7
	E06/2/3	44°04.333	28°38.430	3	2,65
	E06/2/5	44°04.357	28°38.517	5	4,65
	E06/B	44°04.492	28°38.526	5	4,65
Mamaia South(27.05.2006)	M06/A	44°13.330	28°38.670	5	4,65
	M06/1/0	44°13.185	28°38.193	0	0
	M06/1/1	44°13.201	28°38.226	1	0,7
	M06/1/3	44°13.319	28°38.396	3	2,65
	M06/1/5	44°13.424	28°38.533	5	4,65
	M06/2/0	44°13.365	28°38.049	0	0
	M06/2/1	44°13.408	28°38.074	1	0,7
	M06/2/3	44°13.477	28°38.197	3	2,65
	M06/2/5	44°13.609	28°38.355	5	4,65
	M06/B	44°13.804	28°38.150	5	4,65
Cape Midia (29.05.2006)	CM0601/1	44°19.122	28°40.514	5,66	5,36
	CM0601/2	44°19.170	28°41.308	8,95	8,65
	CM0601/3	44°19.152	28°41.481	11,07	10,77
	CM0602/1	44°19.062	28°41.392	9	8,7
	CM0602/2	44°19.222	28°41.485	11	10,7
	CM0602/3	44°19.347	28°42.015	9,6	9,3
	CM0603/1	44°20.090	28°41.339	3,9	3,6
	CM0603/2	44°19.553	28°41.474	6,9	6,6
	CM0603/3	44°19.478	28°41.573	8,7	8,4

[1] - corrections made to the Black Sea – Constanta reference level (+0.35 on 27.05.2006 and +0.30 on 29.05.2006)

Table C.2.2: Coordinates of sampling stations at Sulina

No.	Station	Latitude	Longitude	Measured depth
1	SU 01	45°08`42”	29°46’20”	8
2	SU 02	45°08`32”	29°46‘34”	15
3	SU 03	45°08`30”	29°46‘49”	8
4	SU 04	45°08`39”	29°46‘43”	8
5	SU 05	45°08`53”	29°46‘47”	7
6	SU 06	45°08`56”	29°46‘50”	7
7	SU 07	45°08`26”	29°46‘26”	5
8	SU 08	45°08`15”	29°46‘27”	5
9	SU 09	45°08`01”	29°46‘24”	4
10	SU 010	45°07`59”	29°46‘21”	4

Table C.2.3:Coordinates of sampling stations at Cernăvoda and Cochirleni

Station	Latitude	Longitude	Measured depth	Corrected depth
CNV 1/1	44°20 52,8	28°01’22,2	9,2	3,45
CNV 1/2	44°20‘55,6	28°01’20,0	7,0	1,25
CNV 1/3	44°20‘56,0	28°01’16,6	7,0	1,25
CNV 2/1	44°20‘42,6	28°01’15,8	8,7	2,95
CNV 2/2	44°20‘44,5	28°01’14,5	8,0	2,25
CNV 2/3	44°20‘43,2	28°01’12,0	9,1	3,35
CCH 4/1	44°18‘12,4	27°59’49,2	8,9	3,15
CCH 4/2	44°18‘07,0	27°59’57,3	6,8	1,05
CCH 4/3	44°18‘10,5	28°00’06,7	4,4	-1,35
CCH 5/1	44°17‘07,0	27°59’38,0	5,6	-0,15
CCH 5/2	44°17‘40,9	27°59’32,5	7,5	1,75
CCH 5/3	44°18‘05,8	27°59’39,9	9,8	4,05
CCH 6/1	44°17‘28,1	27°59’20,3	8,2	2,45
CCH 6/2	44°17‘26,8	27°59’25,4	6,5	0,75
CCH 6/3	44°17‘49,9	27°59’15,8	6,2	0,45
CCH 7/1	44°17‘17,1	27°59’03,6	7,2	1,45
CCH 7/2	44°17‘27,7	27°58’46,4	6,5	0,75
CCH 7/3	44°17‘06,5	27°58’48,9	8,0	2,25
CCH 8/1	44°16‘48,2	27°58’48,0	9,4	3,65
CCH 8/2	44°17‘10,9	27°58’33,1	4,8	-0,95
CCH 8/3	44°17‘15,4	27°58’32,0	5,8	0,05
CCH 9/1	44°16‘37,5	27°58’30,6	10,0	4,25
CCH 9/2	44°16‘36,4	27°58’23,3	4,0	-1,75
CCH 9/3	44°16‘41,5	27°58’19,1	5,0	-0,75

Note: Water level at the Cernavoda gauge = +575. Negative values represent vertical positions above the normalized water level.

Table C.2.4: Coordinates of sampling stations at Oltina

No.	Station	Latitude	Longitude	Measured depth	Corrected depth
1	OTN 1/1	44° 11' 36.1"	27° 41' 50.0"	6.7	2.2
2	OTN 1/2	44° 11' 37.3"	27° 41' 51.6"	6.6	2.1
3	OTN 1/3	44° 11' 38.3"	27° 41' 55.1"	6.3	1.8
4	OTN 2/1	44° 11' 22.2"	27° 40' 52,7"	7.8	3.3
5	OTN 2/2	44° 11' 24.1"	27° 40' 35.0"	7.5	3
6	OTN 2/3	44° 11' 28.3"	27° 40' 33.6"	6	1.5
7	OTN 3/1	44° 11' 26.1"	27° 39' 22.4"	7.5	3
8	OTN 3/2	44° 11' 28.2"	27° 39' 23.7"	7.3	2.8
9	OTN 3/3	44° 11' 29.1"	27° 39' 24.1"	5.8	1.3
10	OTN 4/1	44° 11' 39.6"	27° 37' 53.6"	4.5	0
11	OTN 4/2	44° 11' 40.0"	27° 37' 54.7"	5.5	1
12	OTN 4/3	44° 11' 43.1"	27° 37' 54.6"	5.6	1.1

Note: Water level at the Calarasi gauge = + 450. Negative values represent vertical positions above the normalized water level.

C.3 Location Maps of Sampling Stations

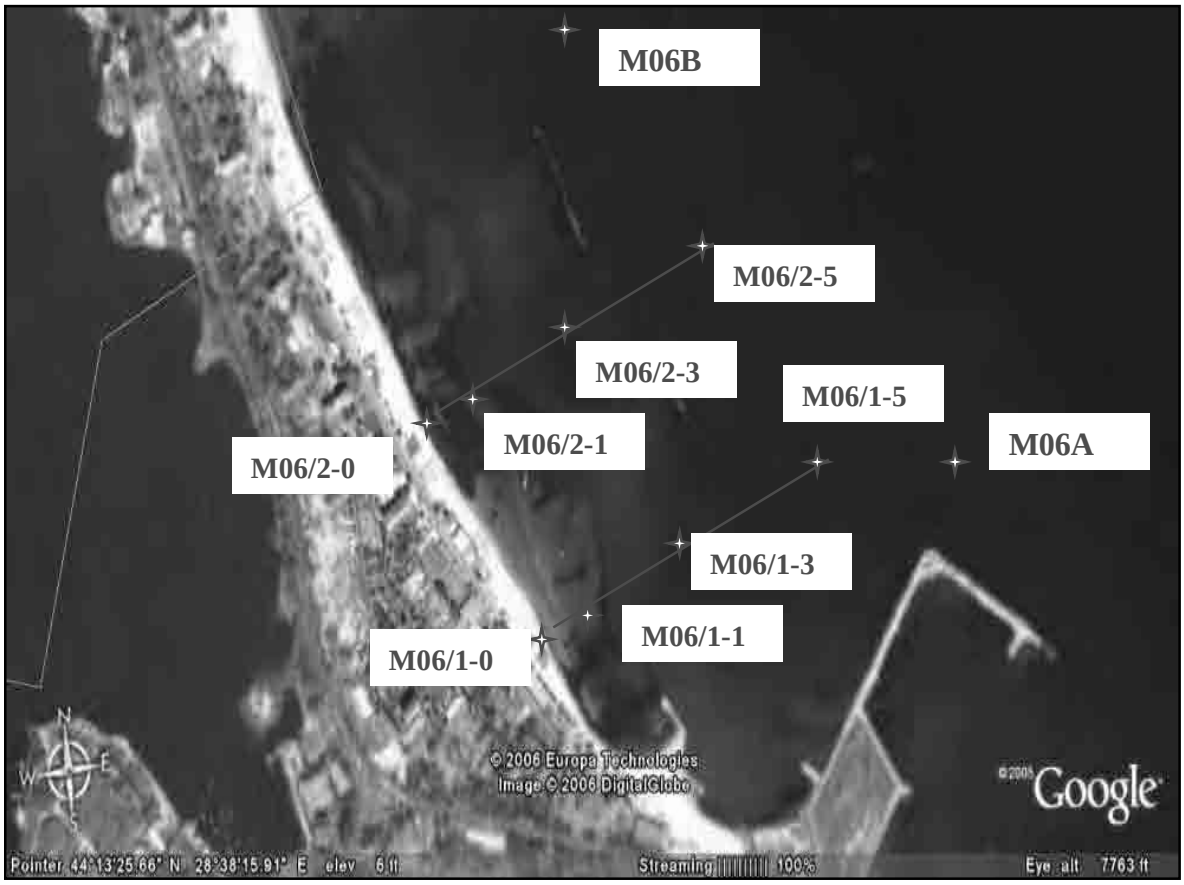

Fig. C.3.1: Locations of sampling stations in Mamaia Sud

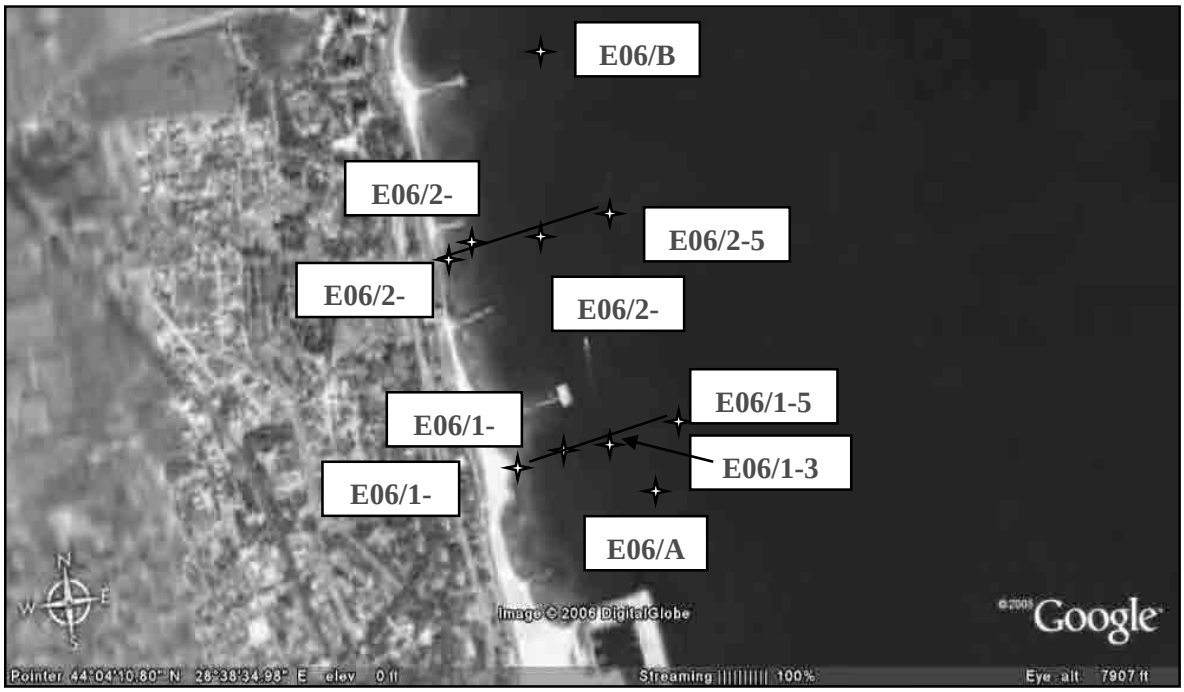

Fig. C.3.2: Locations of sampling stations in Eforie Nord

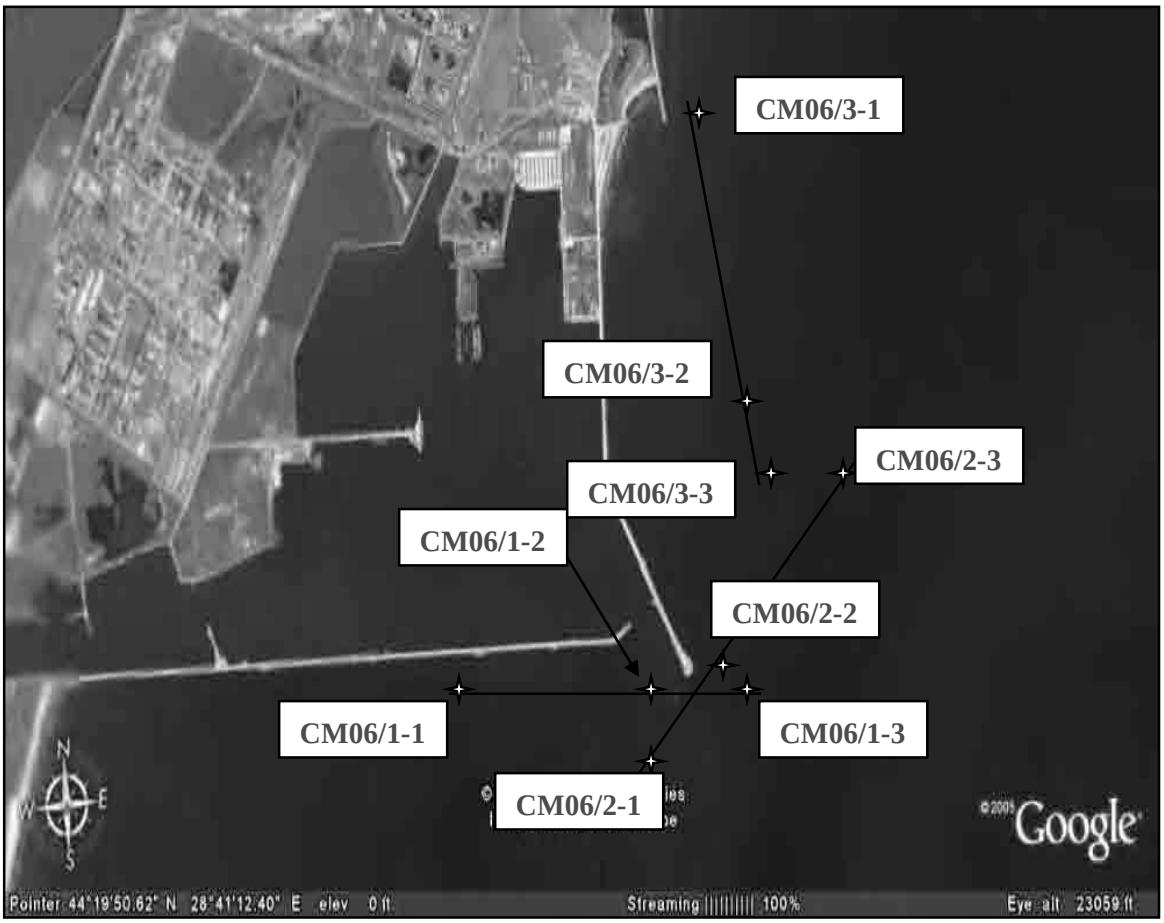

Fig. C.3.3: Locations of sampling stations in Cape Midia

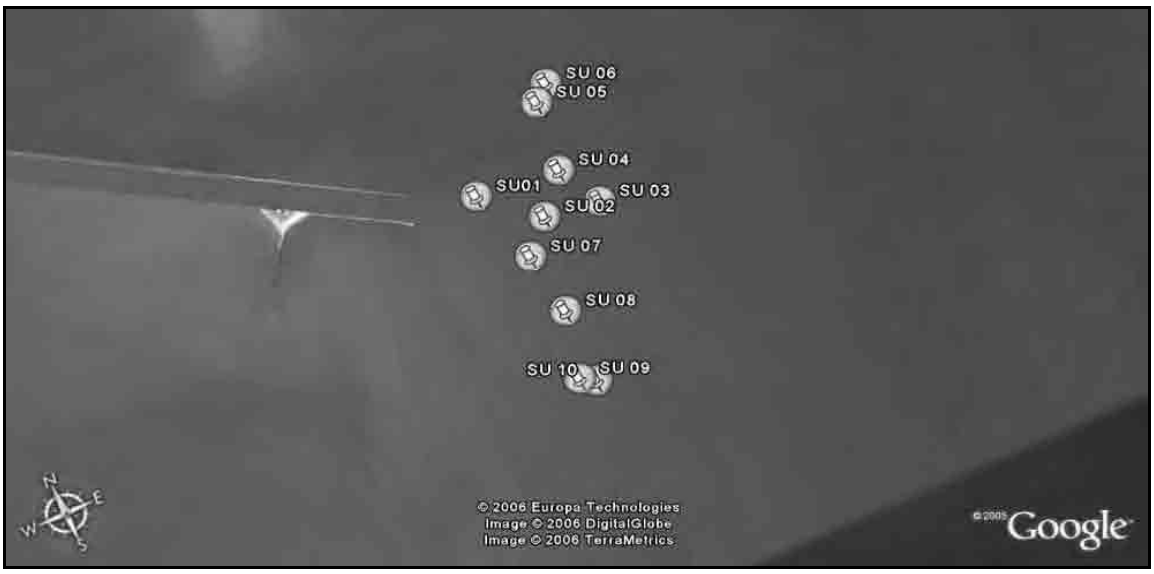

Fig. C.3.4: Locations of sampling stations in Sulina area

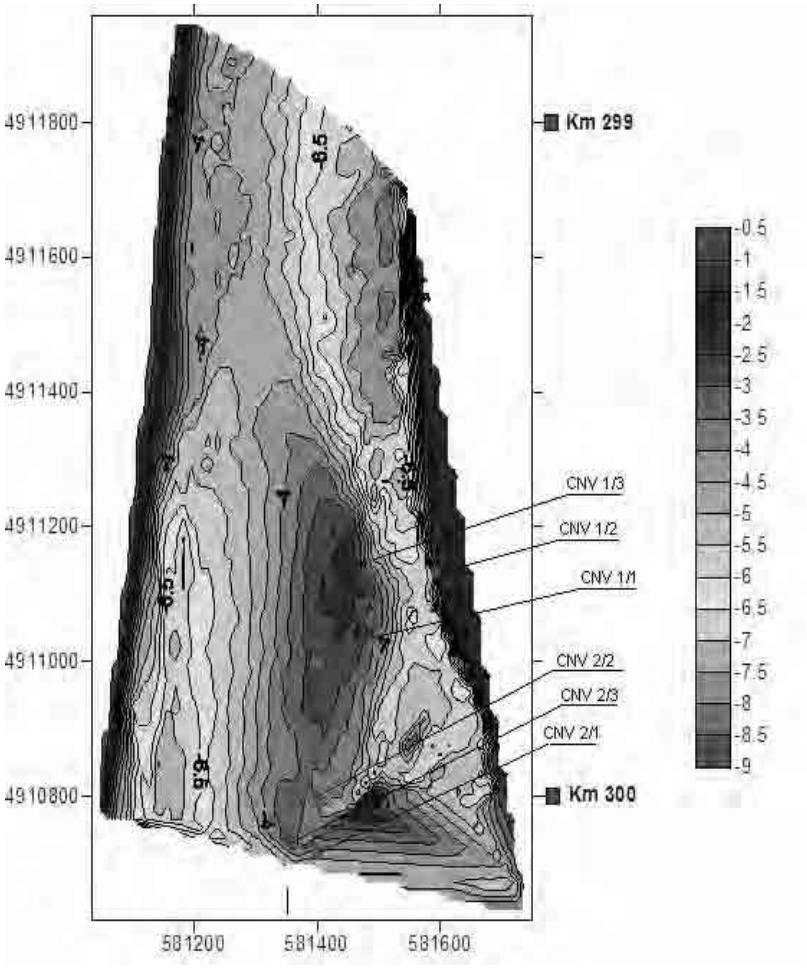

Fig. C.3.5: Bathymetric chart with sampling locations around Cernăvoda between Km 299 – 300 (Depths corrected for Cernăvoda gage)

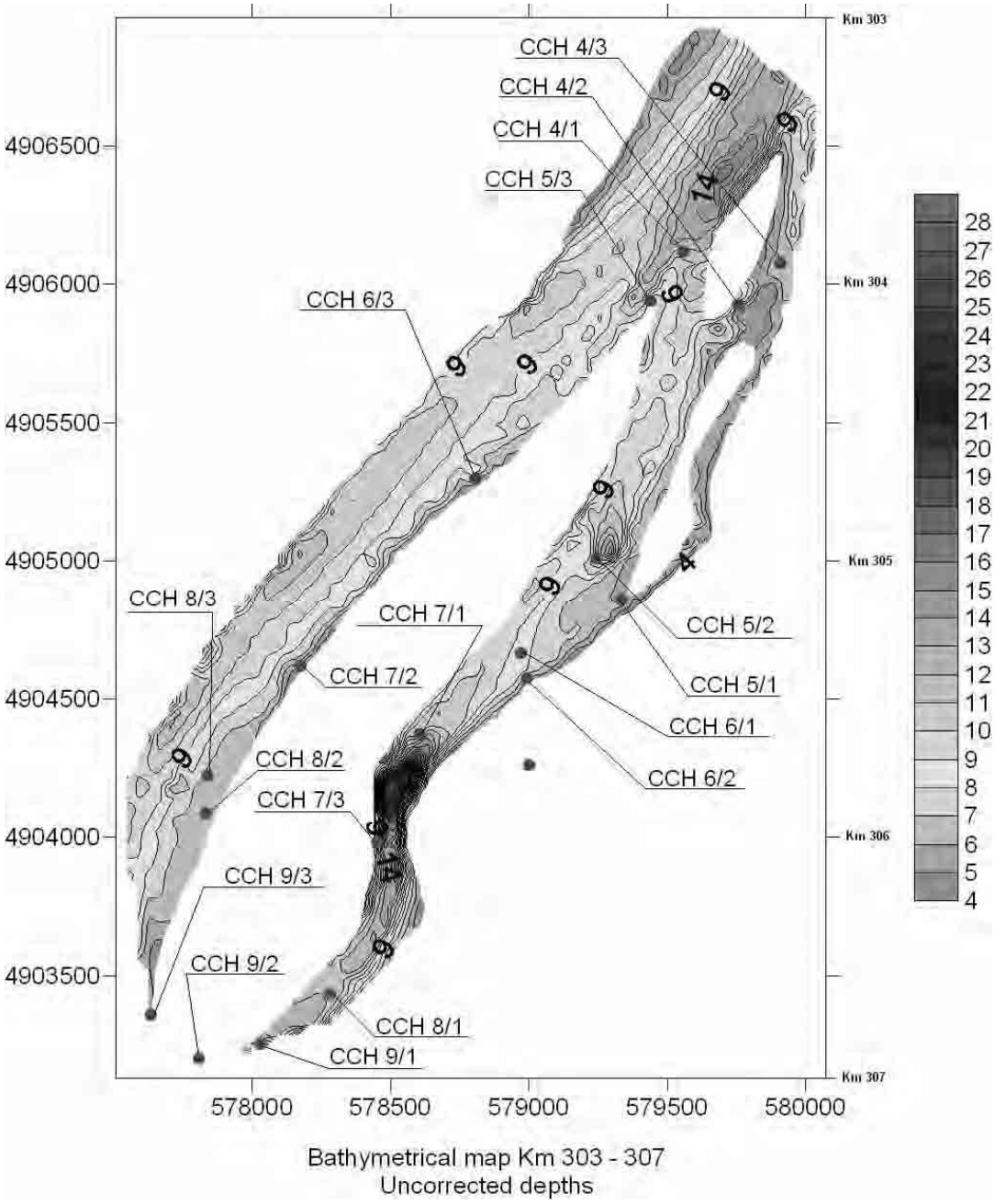

Fig. C.3.6: Bathymetric chart with sampling locations around Cochirleni between Km 303 – 307 (depth not corrected for the Cernavoda gauge)

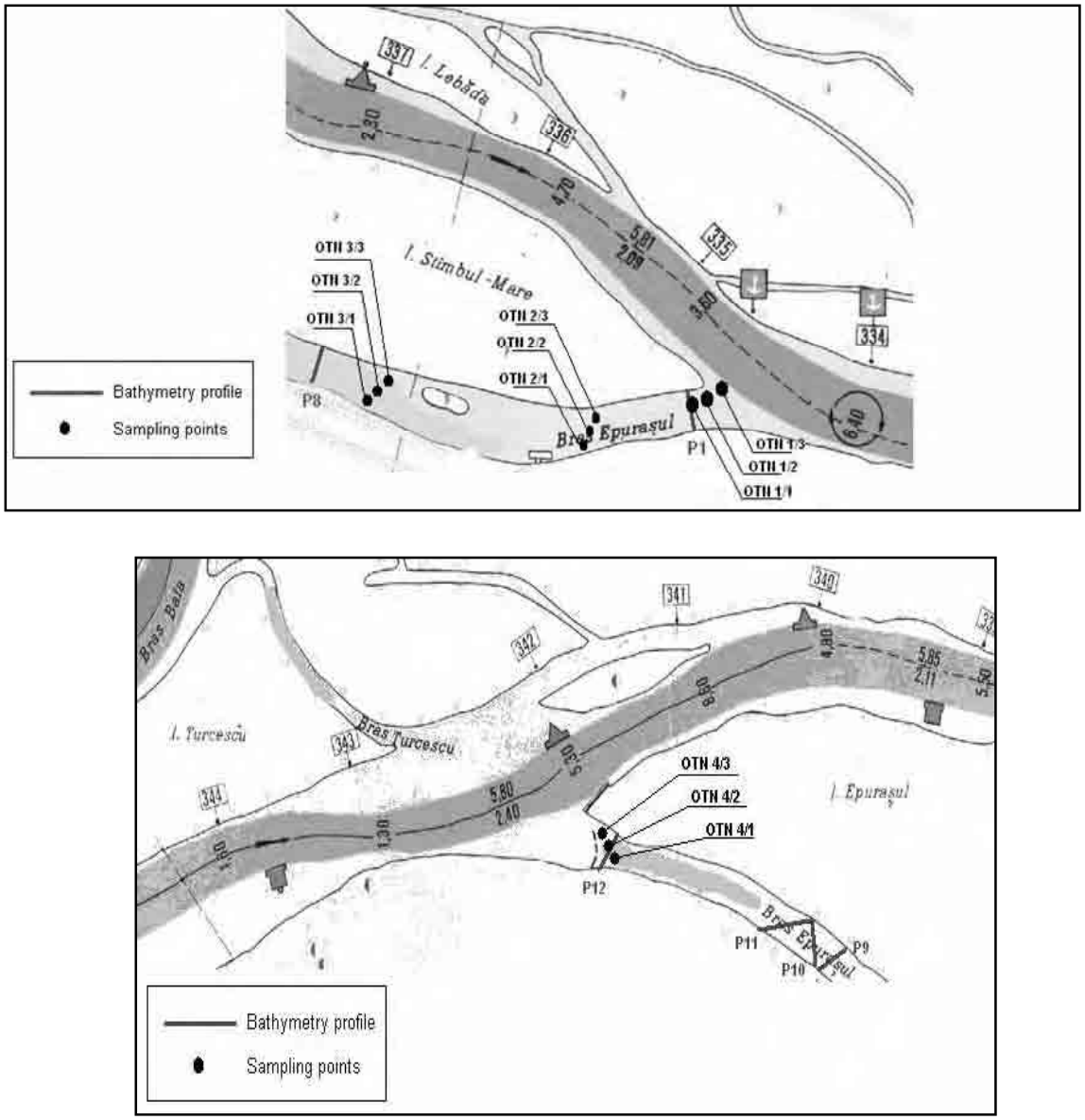

Fig. C.3.7: Locations of sampling stations around Oltina in the Epuraşul branchi between Km 334 – 342

C.4 Grain Size Distribution Data

Results of the sieve analysis of sediment samples are expressed with the percents of fractions based on Udden-Wentworth scale. They are tabulated in the following pages.

Table C.4.1: Percentage of the sediment fractions in the samples at Mamaia area

	Gravel		Sand %					Silt %				Clay		
Sample/	**medium**	**fine**	**very coarse**	**coarse**	**medium**	**fine**	**v. fine**	**coarse**	**mediu m**	**fine**	**very fine**	**coarse**	**medium**	**fine**
Interval mm.	**>4.0mm**	**2.00 -4.00**	**1.00 -2.00**	**0.500 -1.00**	**0.250 -0.500**	**0.125 -0.250**	**0.062 -0.125**	**0.03 -0.062**	**0.016 -0.031**	**0.008 -0.016**	**0.004 -0.008**	**0.002 -0.004**	**0.001 -0.002**	**<0.001**
M06 01/00	0,00	0,00	6,41	3,58	4,55	74,10	11,36	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 01/01	0,00	0,00	0,43	0,46	1,02	81,69	16,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 01/03	0,00	0,00	0,88	0,47	1,11	89,32	8,22	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 01/05	0,00	0,00	0,52	0,52	0,87	40,98	57,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 02/00	0,00	0,00	7,26	33,95	37,24	20,33	1,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 02/01	0,00	0,00	0,50	0,58	1,46	86,30	11,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 02/03	0,00	0,00	0,79	0,70	0,95	58,35	39,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 02/05	0,00	0,00	0,54	0,49	0,56	64,75	33,66	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 A	0,00	0,00	0,20	0,16	0,25	20,35	79,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M06 B	0,00	0,00	0,32	0,20	0,24	17,70	81,54	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table C.4.2: Percentage of the sediment fractions in the samples at Eforie area

	Gravel		Sand %					Silt %				Clay		
Sample/	**medium**	**fine**	**very coarse**	**coarse**	**medium**	**fine**	**v. fine**	**coarse**	**mediu m**	**fine**	**very fine**	**coarse**	**medium**	**fine**
Interval mm.	**>4.0mm**	**2.00 -4.00**	**1.00 -2.00**	**0.500 -1.00**	**0.250 -0.500**	**0.12 5-0.250**	**0.062 -0.125**	**0.03 -0.062**	**0.016 -0.031**	**0.008 -0.016**	**0.004 -0.008**	**0.002 -0.004**	**0.001 -0.002**	**<0.001**
E06 01/00	0,00	18,23	19,62	35,67	25,76	0,71	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 01/01	0,00	0,00	0,72	18,44	72,77	8,03	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 01/03	0,00	0,00	2,04	17,29	54,61	25,13	0,93	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 01/05	0,00	0,00	0,86	0,93	2,88	61,92	33,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 02/00	0,00	0,00	8,37	33,87	51,64	6,11	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 02/01	0,00	0,00	0,96	8,12	52,60	38,10	0,23	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 02/03	0,00	0,00	1,57	5,94	22,86	58,89	10,74	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 02/05	0,00	0,00	0,22	0,28	2,89	73,48	23,14	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 A	0,00	0,00	0,58	1,69	15,34	60,87	21,52	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E06 B	0,00	0,00	0,82	0,75	5,28	62,94	30,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table C.4.3: Percentage of the sediment fractions in the samples around Cape Midia

	Gravel		Sand %					Silt %				Clay		
Sample/	**medium**	**fine**	**very coarse**	**coarse**	**medium**	**fine**	**very. fine**	**coarse**	**medium**	**fine**	**very fine**	**coarse**	**medium**	**fine**
Interval mm.	**>4.0mm**	**2.00 -4.00**	**1.00 -2.00**	**0.500 -1.00**	**0.25 0-0.500**	**0.125 -0.250**	**0.062 -0.125**	**0.03 -0.062**	**0.016 -0.031**	**0.008 -0.016**	**0.004 -0.008**	**0.002 -0.004**	**0.001 -0.002**	**<0.001**
CM06 01/1	0,00	0,00	2,01	3,50	3,52	57,06	33,92	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CM06 01/2	0,00	0,00	0,44	0,41	1,95	22,36	50,60	8,77	3,09	1,79	0,95	0,94	1,72	6,99
CM06 01/3	0,00	0,00	0,00	0,00	0,00	0,15	1,44	3,87	15,36	27,21	12,09	7,13	7,37	25,37
CM06 02/1	0,00	0,00	0,04	0,43	3,69	23,11	42,27	19,75	5,52	0,74	0,82	0,34	0,28	3,01
CM06 02/2	0,00	0,00	0,17	0,15	0,30	3,87	76,57	13,32	2,59	0,30	0,09	0,15	0,26	2,24
CM06 02/3	0,00	0,00	0,07	0,24	0,28	2,25	72,47	7,50	2,83	3,88	2,07	1,01	0,94	6,47
CM06 03/1A	0,00	0,00	0,14	0,10	0,12	1,83	90,16	4,48	0,69	0,18	0,45	0,11	0,07	1,68
CM06 03/1B	0,00	0,00	0,24	0,24	0,29	64,28	34,95	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CM06 03/2	0,00	0,00	0,14	0,16	0,23	43,23	52,30	2,26	0,03	0,15	0,11	0,22	0,30	0,86

Table C.4.4: Percentage of the sediment fractions in the samples at Sulina area and within the dredger's hopper

	Gravel		Sand %					Silt %				Clay		
Sample/	**medium**	**fine**	**Very coarse**	**coarse**	**medium**	**fine**	**v. fine**	**coarse**	**medium**	**fine**	**very fine**	**coarse**	**medium**	**fine**
Interval mm.	**>4.0mm**	**2.00 -4.00**	**1.00 -2.00**	**0.500 -1.00**	**0.250 -0.500**	**0.125 -0.250**	**0.062 -0.125**	**0.03 -0.062**	**0.016 -0.031**	**0.008 -0.016**	**0.004 -0.008**	**0.002 -0.004**	**0.001 -0.002**	**<0.001**
SU 1	0,00	0,00	0,10	0,26	22,14	64,74	8,76	0,70	0,53	0,38	0,19	0,20	0,19	1,80
SU 2	0,00	0,00	0,00	0,07	4,13	74,78	12,29	1,34	1,16	1,15	0,61	0,58	0,62	3,27
SU 3	0,00	0,00	0,00	0,09	0,77	48,48	26,82	5,72	4,94	2,08	2,29	1,70	1,86	5,25
SU 4	0,00	0,00	0,00	0,07	0,38	14,33	31,58	12,50	10,07	6,05	4,47	3,66	5,32	11,58
SU 5	0,00	0,00	0,00	0,01	0,26	2,45	46,73	34,47	4,52	2,26	1,12	1,36	1,54	5,29
SU 6	0,00	0,00	0,00	0,04	0,28	2,01	46,90	35,20	4,24	1,40	1,23	1,34	2,32	5,05
SU 7	0,00	0,00	0,52	0,82	3,46	86,53	8,66	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SU 8	0,00	0,00	0,00	0,01	8,00	89,86	2,13	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SU 9	0,00	0,00	0,00	0,03	0,26	15,17	48,09	13,89	7,62	2,54	1,75	2,12	1,45	7,07
SU 10	0,00	0,00	0,00	0,11	0,93	19,88	47,60	12,76	5,00	1,02	2,05	1,69	1,80	7,15
D1	0,00	0,00	0,01	0,11	2,34	54,98	18,63	4,41	4,39	3,04	2,38	1,91	1,90	5,89
D2	0,00	0,00	0,09	0,16	0,64	33,82	21,08	10,62	7,29	5,38	4,54	3,18	3,14	10,09
D3	0,00	0,00	0,00	0,04	0,50	25,87	30,78	10,18	8,10	4,71	3,92	3,28	3,69	8,94

Table C.4.5: Percentage of the sediment fractions in the samples at Cernăvoda and Cochirleni

	Gravel		Sand %				Silt %			Clay		
Sample/	**medium**	**fine**	**very coarse**	**coarse**	**medium**	**fine**	**v. fine**	**coarse**	**medium**	**fine**	**very fine**	**coarse**	**medium**	**fine**
Interval mm.	**>4.0mm**	**2.00 -4.00**	**1.00 -2.00**	**0.500 -1.00**	**0.250 -0.500**	**0.125 -0.250**	**0.062 -0.125**	**0.03 -0.062**	**0.016 -0.031**	**0.008 -0.016**	**0.004 -0.008**	**0.002 -0.004**	**0.001 -0.002**	**<0.001**
Danube														
CNV 1/1	0,00	0,00	0,01	0,11	67,27	32,08	0,54	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CNV 1/2	0,00	0,16	0,11	0,88	60,30	38,09	0,45	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CNV 1/3	0,00	0,43	0,77	5,56	75,78	17,31	0,15	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CNV 2/1	0,59	0,21	1,07	9,53	78,22	10,30	0,07	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CNV 2/2	0,43	0,61	2,79	14,31	74,21	7,60	0,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CNV 2/3	1,90	2,39	6,63	18,35	63,32	7,35	0,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 4/1	0,00	0,00	0,27	1,58	38,38	56,11	3,66	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 4/2	0,34	0,04	1,00	2,98	31,73	60,03	3,88	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 4/3	0,00	0,00	0,00	0,11	0,98	6,32	22,09	30,34	13,25	3,81	3,39	3,08	3,43	13,21
CCH 5/1	0,00	0,08	0,21	0,61	16,07	77,98	5,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 5/2	0,14	0,32	0,33	0,32	15,38	81,04	2,47	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 5/3	0,00	0,00	0,00	0,09	6,61	86,18	7,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 6/1	0,00	0,00	0,11	1,28	63,78	34,58	0,25	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 6/2	0,00	0,00	0,21	0,57	39,37	59,14	0,72	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 6/3	0,00	0,00	0,00	0,05	12,84	85,23	1,88	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 7/1	0,00	0,00	0,01	0,19	29,85	68,82	1,13	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 7/2	0,00	0,00	0,02	0,07	16,96	82,16	0,79	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 7/3	0,00	0,05	0,13	0,99	37,24	60,63	0,96	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 8/1	0,00	0,00	0,00	0,05	1,17	22,80	30,03	11,26	11,46	2,92	4,08	2,96	1,82	11,45
CCH 8/2	0,00	0,00	0,11	0,70	45,43	53,02	0,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 8/3	0,00	0,64	0,72	1,16	36,95	59,64	0,89	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 9/1	91,44	4,89	1,27	0,53	0,87	0,79	0,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 9/2	0,00	0,00	0,07	0,41	42,85	56,15	0,53	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CCH 9/3	0,00	0,00	0,03	0,29	37,63	61,66	0,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table C.4.6: Percentage of the sediment fractions in the samples at Oltina area

	Gravel		Sand %					Silt %				Clay		
Sample/	**medium**	**fine**	**very coarse**	**coarse**	**medium**	**fine**	**v. fine**	**coarse**	**medium**	**fine**	**very fine**	**coarse**	**medium**	**fine**
Interval mm.	**>4.0mm**	**2.00 -4.00**	**1.00 -2.00**	**0.500 -1.00**	**0.250 -0.500**	**0.125-0.250**	**0.062 -0.125**	**0.03 -0.062**	**0.016 -0.031**	**0.008 -0.016**	**0.004-0.008**	**0.002 -0.004**	**0.001 -0.002**	**<0.001**
OTN 1/1	0,00	1,31	1,03	3,71	53,47	39,97	0,49	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 1/2	0,00	0,00	0,07	0,34	26,76	71,81	1,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 1/3	0,00	0,00	0,00	0,04	3,33	84,29	12,34	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 2/1	0,00	0,00	0,04	0,14	24,97	73,46	1,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 2/2	0,00	0,14	0,15	0,73	49,79	47,79	1,39	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 2/3	0,00	0,00	0,01	0,10	15,89	79,30	4,71	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 3/1	0,94	1,58	2,74	10,84	74,49	9,01	0,41	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 3/2	0,00	0,00	0,04	0,49	28,28	69,63	1,56	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 3/3	0,00	0,00	0,00	0,01	1,20	86,48	12,31	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 4/1	0,00	0,27	0,37	3,18	72,61	23,24	0,34	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 4/2	0,00	0,00	0,07	1,12	62,43	35,63	0,75	0,00	0,00	0,00	0,00	0,00	0,00	0,00
OTN 4/3	0,00	0,00	0,00	0,02	8,11	85,28	6,59	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Appendix D: Survival Rate of Fill Sand on Beach

D.1 Concept of Survival Rate of Fill Sand

Beach fill is an operation of artificially expanding or newly creating beaches by bringing sand from an outside source and placing sand on the foreshore and inshore zones. In this kind of operation, we cannot expect that the whole of filled sand will remain in the filled area. Filled sand as well as beach sand has a certain range of grain size distribution. When the grain size distribution of the filled sand has a larger fraction of fine grain size than that of the beach sand, the portion of fine sand is carried away offshore and/or toward neighboring beaches by the actions of waves and currents and it cannot function as a permanent beach fill. It is because the sand grains on beach have been exposed to waves and currents and sorted out by them for a long time. Thus the beach sand is regarded to be at an equilibrium state corresponding to the prevailing marine conditions.

The ratio of the volume of sand remaining on the filled beach to the input volume is hereby called the survival rate of fill sand. Estimation of the survival rate is an important step in beach fill plan. A reciprocal of the survival rate is referred to as the beach fill augmentation factor. In this appendix, estimate is made for the survival rate or the augmentation factor for the river and sea sand when employed for beach fill at Mamaia Sud and Eforie Nord by means of the James method[1].

D.2 Grain Size Characteristics of Fill Sand and Beach Sand

The survival rate of fill sand is governed with its median diameter relative to the beach sand. In this appendix, four sources of fill sand are taken for consideration: sea sand outside the Sulina Channel, sea sand around Midia Port, river sand of the Danube at Cochirleni (around km 305), and river sand of the Danube at Oltina (around km 340). Sediment samples taken at the water depth around 1 and 3 m at Mamaia Sud and Eforie Nord are used to represent the beach sand. Many of sediment samples at Sulina and Midia indicated considerable fractions of silt and clay, but one sample at Midia and two samples at Sulina did not have any silt and clay fractions and they are used here to represent the sea sand for beach fill. The grain size distributions of the above six sand are shown in Fig. D.2.1.

The grain size is here expressed in the ϕ (phi) units, where $\phi = -\log_2 d$ with d being the grain size in mm. Thus, $\phi = 1$ corresponds to $d = 0.5$ mm and $\phi = 2$ to $d = 0.25$ mm. Use of the phi units enables to define a mean diameter M_ϕ and a sorting parameter σ_ϕ with the 16% and 84% cumulative grain sizes ϕ_{16} and ϕ_{84} as in the following:

$$\left.\begin{aligned} M_\phi &= (\phi_{16} + \phi_{84})/2 \\ \sigma_\phi &= (\phi_{84} - \phi_{16})/2 \end{aligned}\right\} \qquad \text{(D.2.1)}$$

[1] Krumbein, W.C. and James, W.R. (1965): A lognormal size distribution model for estimating stability of beach fill material, TM-16, U.S. Army, Corps of Engineers, Costal Engineering Research Center, Washington, D.C.

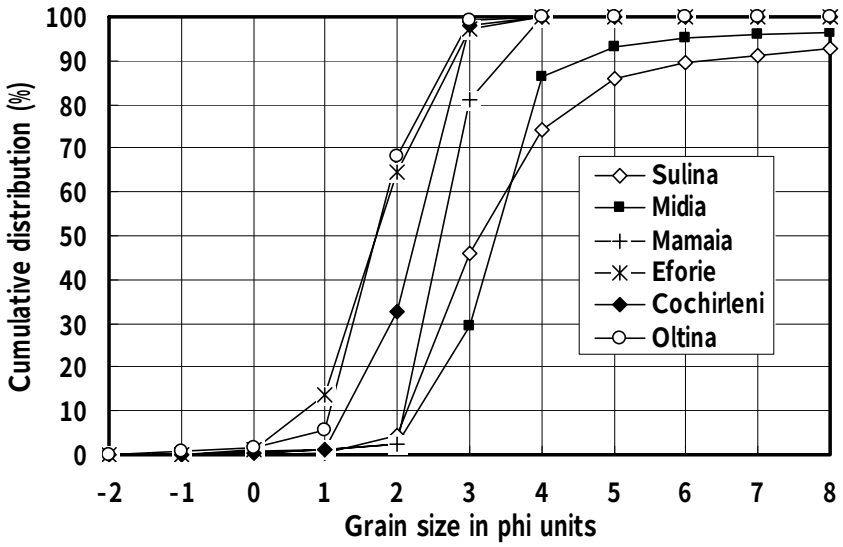

Fig. D.2.1: Representative grain size distributions of fill sand and beach sand

The grain size characteristics are summarized in Table D.2.1 with the cumulative grain sizes ϕ_{16}, ϕ_{50}, and ϕ_{84} having been estimated by linear interpolation.

Table D.2.1: Grain size characteristics of beach sand and fill sand

Grain size characteristics	Beach sand		Fill sand			
	Mamaia South	Eforie Nord	Sulina	Midia	Cochirleni	Oltina
ϕ_{16}	2.173	1.044	2.109	2.122	1.476	1.166
ϕ_{50}	2.604	1.715	2.494	2.718	2.268	1.709
ϕ_{84}	3.147	2.600	2.880	3.528	2.787	2.508
σ_ϕ	0.487	0.778	0.386	0.703	0.656	0.671
M_ϕ	2.66	1.822	2.494	2.825	2.133	1.837

D.3 Threshold Grain Size of Washing Out

Before calculation of the survival rate, an estimate is made for the threshold grain size below which sand grains will be washed out from the fill area. The fill site is taken at Eforie Nord on which the sea sand from Midia is supposed to be filled. For explanation, the mean grain size distribution of the whole sediment samples around Midia Port is employed here. The frequency distributions of the beach sand and fill sand are shown in Fig. D.3.1. The abscissa is the grain size in the phi units, and the ordinate is the frequency in weight percentage of respective classes of the grain size.

By referring to the James method, the ratio R of the frequency of fill sand $f_b(\phi)$ to the frequency of beach sand $f_n(\phi)$ is calculated, i.e. $R = f_b(\phi)/f_n(\phi)$. The resultant ratio R is shown with a dashed line in Fig. D.3.1. The threshold grain size is denoted as the size at which the ratio R takes the minimum value. The ratio R takes the values 0.0526, 0.0256, and 0.837 at the grain sizes of ϕ = 0.5, 1.5, and 2.5, respectively. Fitting of a parabolic curve to these three points yields the threshold grain size of ϕ_m = 1.03, which corresponds to d = 0.49 mm. The fraction of Midia sand larger than d = 0.49 mm or the phi units smaller than ϕ_m = 1.03 will

remain on the beach of Eforie Nord, and the frequency distribution of grain size finer than it will be deformed in a distribution similar as that of the beach sand. Figure D.3.1 indicates that the majority of the fill sand is located at the right-hand side of ϕ_m = 1.03 and it suggests that they will be washed out.

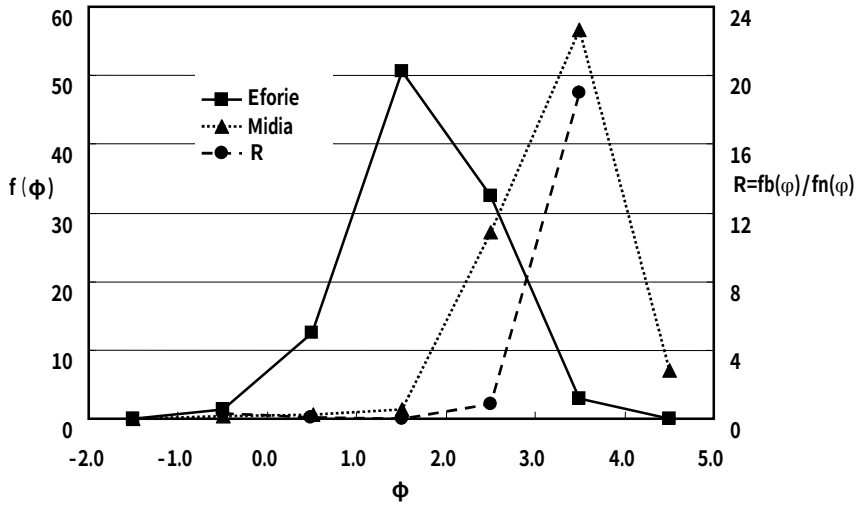

Fig. D.3.1: Frequency distributions of the grain sizes of fill sand (Midia) and beach sand (Eforie)

D.4 Estimation of Survival Rate of Fill Sand

Figure D.4.1 is a design diagram prepared by James for estimation of the survival rate of fill sand. The diagram employs the mean grain size M_ϕ and the sorting parameter σ_ϕ as the calculation parameters. The abscissa $(M_{\phi b}–M_{\phi n})/\sigma_\phi$ represents the relative difference in grain size, and the ordinate $\sigma_{\phi b}/\sigma_{\phi n}$ is the ratio of sorting parameter. A family of curves represents the lines of equal value of the augmentation factor R_A.

For the two fill sites at Mamaia Sud and Eforie Nord and the four sand sources of the sea and river sand, there can be eight combinations of the fill site and sand source. Calculation is made for these combinations with the results listed in Table D.4.1. The graphical points corresponding to the eight combinations are indicated with open circles in Fig. D.4.1.

The sea sand of good quality around Midia Port, when the mining site is carefully chosen, is expected to have the survival rate greater than 70%. The carefully mined sea sand of good quality outside the Sulina Channel will have the survival rate of 95%. The sand from the Danube will remain at filled beach with the 100% survival rate. Even if the sea sand of average quality around Midia Port is placed on Mamaia Sud beach, the survival rate will not decrease so appreciably because the fill site is protected by the detached breakwaters and a sand-retaining jetty.

On the beach at Eforie Nord, however, the sea sand is expected to have the survival rate less than 10% because the beach sand is much coarser than the sea sand. Even the river sand from Cochirleni will have the survival rate around 50% and it is not recommended for use there because of excessive beach fill cost. For the beach fill at Eforie Nord, it is necessary to employ the river sand of coarse grain size to be mined around the area such as Oltina.

Table D.4.1: Estimation of survival rate of fill sand at Mamaia Sud and Eforie Nord

Parameter	Case MS	Case MM	Case MC	Case MO
	Sulina -> Mamaia	Midia -> Mamaia	Cochirleni -> Mamaia	Oltina -> Mamaia
$(M_{\phi b}-M_{\phi n})/\sigma_{\phi}$	-0.34	0.34	-1.08	-1.69
$\sigma_{\phi b}/\sigma_{\phi n}$	0.79	1.44	1.35	1.15
R_A	1.05	1.35	1.00	1.00
Survival rate $1/R_A$	95%	74%	100%	100%
Parameter	Case ES	Case EM	Case EC	Case EO
	Sulina -> Eforie	Midia -> Eforie	Cochirleni -> Eforie	Oltina -> Eforie
$(M_{\phi b}-M_{\phi n})/\sigma_{\phi}$	0.86	1.29	0.40	0.02
$\sigma_{\phi b}/\sigma_{\phi n}$	0.50	0.90	0.84	0.86
R_A	Unstable	Unstable	2.0	1.07
Survival rate $1/R_A$	0	0	50%	93%

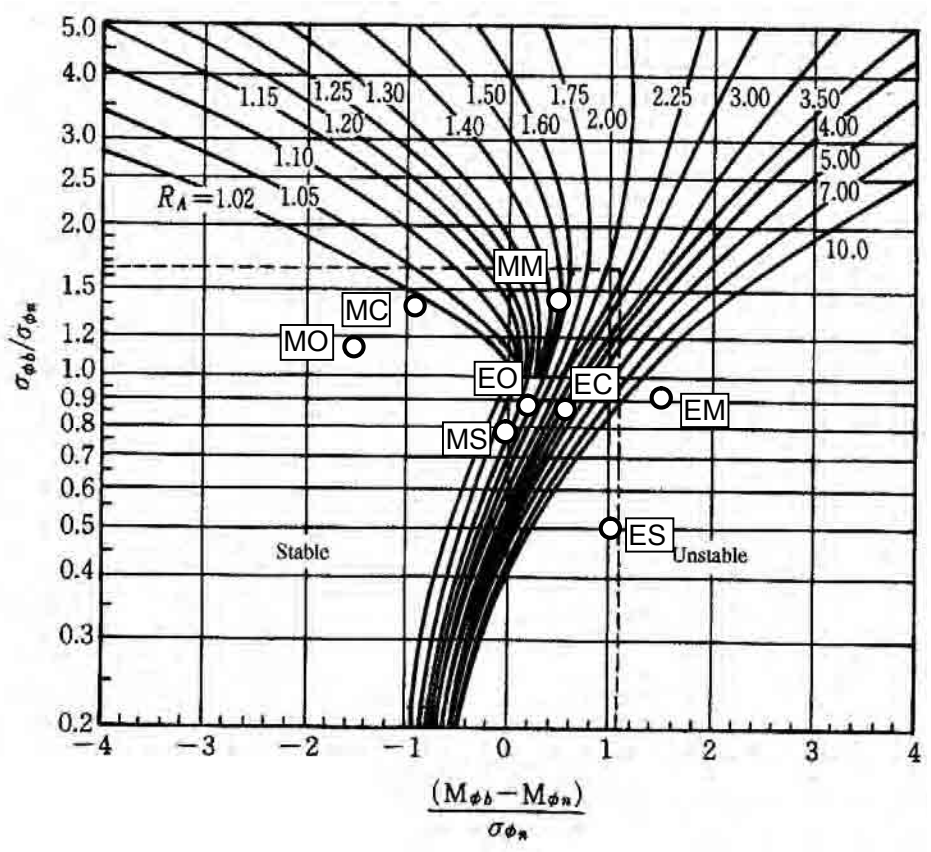

Fig. D.4.1: Calculation diagram of beach fill augmentation factor R_A by James

Appendix E: Execution Schedule with Bills of Quantities

Preparation of the drawings of coastal protection facilities, tabulation of the bills of quantities, making of execution schedules and cost estimate have been carried out by S.C. IPTANA S.A. under the contract with the Study team under the latter's supervision.

This appendix is comprised of the following diagrams of execution schedules, equipment schedules, and labor schedules. Each diagram is provided with the quantities of respective items.

E.1 Project Component "A" at Mamaia Sud with River Sand

Fig. E.1.1: Execution schedule at Mamaia Sud with river sand
Fig. E.1.2: Equipment mobilization schedule at Mamaia Sud with river sand
Fig. E.1.3: Labor mobilization schedule at Mamaia Sud with river sand

E.2 Project Component "A" at Mamaia Sud with Sea Sand

Fig. E.2.1: Execution schedule at Mamaia Sud with sea sand
Fig. E.2.2: Equipment mobilization schedule at Mamaia Sud with sea sand
Fig. E.2.3: Labor mobilization schedule at Mamaia Sud with sea sand

E.3 Project Component "A" at Eforie Nord with River Sand

Fig. E.3.1: Execution schedule at Eforie Nord with river sand
Fig. E.3.2: Equipment mobilization schedule at Eforie Nord with river sand
Fig. E.3.3: Labor mobilization schedule at Eforie Nord with river sand

E.1 Project Component “A” at Mamaia Sud with River Sand

No.	Description of Activities	Unit	Q'ty	Execution Period																					
				1st Year										2nd Year											
				VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII				
1	MOBILIZATION OF PERSONEL & EQUIPMENT	l.s.	1																						
2	SURVEY WORKS	l.s.	1																						
3	TEMPORARY WORKS FOR ACCESS	l.s.	1																						
4	REHABILITATION OF EXISTING BREAKWATER																								
	Stabilopod fabrication	no	2,808																						
	Geotextile - installation	m^2	6,666																						
	Rubble stone - installation	m^3	3,708																						
	Stone block - installation	m^3	11,206																						
	Stabilopod installation	no	2,808																						
5	RETAINING JETTY																								
	Stabilopod fabrication	no	296																						
	Excavation	m^3	127																						
	Geotextile - installation	m^2	4,822																						
	Rubble stone - installation	m^3	5,557																						
	Stone block - installation	m^3	3,617																						
	Stabilopod installation	no	296																						
	Concrete pavement	m^3	303																						
6	SUBMERGED GROINS																								
	Excavation and dredging	m^3	1,534																						
	Sand container bag fabrication	no	444																						
	Sand bag - installation	no	444																						
	Filling around jetty with existing sand	l.s.	1																						
7	SAND BAG GROINS																								
	Excavation		3,207																						
	Sand bags - preparation	no	1,545																						
	Supplementary works for execution	m^3	471																						
	Sand bag - installation	no	1,545																						
	Filling around jetty with existing sand	l.s.	1																						
8	BEACH FILL																								
	Supply of sand	m^3	223,947																						
	Pushing of sand and levelling	m^3	223,947																						
9	SURVEY FOR NEW WORKS	l.s.	1																						
10	AS BUILD DRAWINGS	l.s.	1																						
11	REMOVAL OF TEMPORARY WORKS	l.s.	1																						
12	FINAL CLEANING	l.s.	1																						
13	DEMOBILIZATION OF PERSONEL & EQUIPMENT	l.s.	1																						

Fig. E.1.1: Execution schedule at Mamaia Sud with river sand

Works Type	No.	Description of Equipment	Unit	Q'ty	Execution Period																							
					1st Year												2nd Year											
					VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII						
Beach Fill	1	Trucks 25 t	no	50																								
	2	Buldozer	no	3																								
	3	Excavator for sand loading in the trucks	no	6																								
	4	Barges 1500-2000 t for sand transportation	no	12																								
	5	Pushing boat	no	3																								
	6	Unloading crane	no	4																								
	7	Dredger 600-750 l	no	1																								
	8	Floating crane with grabs	no	1																								
Bags Groins	9	Truck 25 t for sand supply	no	1																								
	10	Mobile crane for loading the bags	no	1																								
	11	Truck 16 t for supply the bags to site	no	1																								
	12	Chain grabbing bucket for placing of bags excavation, filling etc.	no	1																								
	13	Truck 16 t for supplementary works	no	2																								
Submerged Groin	14	Chain grabbing bucket for excavation	no	1																								
	15	Excavator for sand container bags preparation	no	1																								
	16	Mobile crane for container bags loading and placing	no	1																								
	17	Truck 25 t for sand supply	no	1																								
Retaining Jetty	18	Excavator	no	1																								
	19	Tug boat for geotextile installation	no	1																								
	20	Truck 16 t for rubble stone and block stone transportation	no	8																								
	21	Buldozer for pushing of rubble stone	no	1																								
	22	Mobile crane for stone blocks arrangement and stabilopods installation and pavement concrete pouring	no	1																								
	23	Truck 16 t for stabilopods transportation	no	4																								
	24	Truck mixer for pavement concrete transportation	no	1																								

Works Type	No.	Description of Equipment	Unit	Q'ty	Execution Period																							
					1st Year										2nd Year													
					VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII						
Rehabilitation of the Existing Breakwaters	25	Truck mixer 5 m^3 for concrete transportation	no	2																								
	26	Mobile crane for concrete pouring and stabilopods handling	no	2																								
	27	2 x 300 HP tug boat for geotextile installation	no	1																								
	28	Truck 16 t for stone transportation	no	10																								
	29	Crane for loading the stone on the barges	no	1																								
	30	1000 t barge for transportation and placing	no	1																								
	31	2 x 300 HP tug boat for barges transportation	no	1																								
	32	Floating crane 15 tf for stone & blocks installation	no	1																								
	33	2x300 HP tug boat for floating crane transportation	no	1																								
	34	Mobile crane for loading the stabilopods in the truck	no	1																								
	35	Truck 16 t for stabilopods transportation from storage to quay	no	5																								
	36	Mobile crane for loading the stabilopods on the barge	no	2																								
	37	1000 t barge for stabilopods transportation	no	1																								
	38	2x300 HP tug boat for barge transportation	no	1																								
	39	Floating crane 15 t for stabilopods placing	no	1																								
	40	2x300 HP tug boat for floating crane transportation and assistance	no	1																								
	41	120 HP launch for works inspections	no	1																								

Fig. E.1.2: Equipment mobilization schedule at Mamaia Sud with river sand

Works Type	No.	Qualification	Unit	Quantity		Execution Period																							
						1st Year										2nd Year													
				skilled	unskilled	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII						
Beach Fill	1	Trucks driver	no	50	-																								
	2	Bulldozer - operator	no	3	-																								
	3	Excavator - operator	no	6	-																								
	4	Pushing boat - crew	no	30	-																								
	5	Unloading crane - operators	no	12	-																								
	6	Dredger – crew	no	31	-																								
	7	Floating crane – crew	no	30	-																								
	8	Traffic Operator	no	2	-																								
	9	Earth diggers for sand supply	no	-	3																								
Bags Groins	10	Truck driver	no	1	-																								
	11	Earth diggers	no	-	10																								
	12	Bags fastener	no	2	-																								
	13	Mobile crane operator	no	1	-																								
	14	Truck driver for bags supply to site	no	1	-																								
	15	Chain grabbing bucket - operator	no	1	-																								
	16	Truck driver for supplimentary works	no	2	-																								
	17	Breakwaters builder	no	1	-																								
	18	Helpworkers	no	-	2																								
Submerged Groins	19	Skilled workers for container bags preparation	no	2	-																								
	20	Excavator – operator for container bags preparation	no	1	-																								
	21	Chain grabbing bucket - operator	no	1	-																								
	22	Mobile crane – operator for container loading	no	1	-																								
	23	Helpworkers	no	-	4																								
	24	Breakwater builder	no	1	-																								
	25	Truck driver for sand supply	no	1	-																								
	26	Traffic operator	no	1	-																								
Retaining Jetty	27	Excavator operator	no	1	-																								
	28	Tug boat crew for geotextile installation	no	10	-																								
	29	Divers for geotextile installation	no	3	-																								
	30	Truck drivers for stone transportation	no	8	-																								
	31	Bulldozer - operator	no	1	-																								
	32	Breakwater builder	no	1	-																								
	33	Mobile crane operator	no	1	-																								
	34	Helpworkers	no	-	2																								
	35	Carpenters	no	2	-																								
	36	Concrete finishor	no	4	-																								
	37	Truck driver for stabilopod transportation	no	4	-																								
	38	Truck mixer - driver	no	1	-																								
	39	Truck mixer – drivers	no	2	-																								
	40	Mobile crane – operator	no	2	-																								
	41	Steel works erectors	no	4	-																								
	42	2x300 HP Tugboat crew	no	10	-																								
	43	Divers for geotextile installation	no	3	-																								
	44	Helpworkers	no	-	4																								
	45	Truck drivers for stone transportation	no	10	-																								
	46	Crane operator	no	1	-																								

Works Type	No.	Qualification	Unit	Quantity		Execution Period																				
						1st Year										2nd Year										
				skilled	lunskilled	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII			
Rehabilitation of the Existing Breakwaters	47	Operator for barge loading	no	1	-																					
	48	2 x 300 HP Tug boat crew	no	10	-																					
	49	Floating crane – crew for stone installation	no	30	-																					
	50	2x300 HP Tug boat – crew for floating crane transportation	no	10	-																					
	51	Breakwater builder	no	1	-																					
	52	Mobile crane operator for loading the stabilopods in the trucks	no	1	-																					
	53	Truck drivers for stabilopod transportation	no	5	-																					
	54	Helpworkers	no	-	6																					
	55	Mobile crane operator for loading of stabilopods on the barges	no	2	-																					
	56	Barge operator	no	1	-																					
	57	2x300 HP Tug boat – crew for barge transportation	no	10	-																					
	58	Floating crane – crew for stabilopod installation	no	30	-																					
	59	2x300 HP Tug boat – crew for floating crane transportation	no	10	-																					
	60	Helpworkers	no	-	2																					
	61	120 HP Launch - crew	no	3	-																					

Fig. E.1.3: Labor mobilization schedule at Mamaia Sud with river sand

E.2 Project Component “A” at Mamaia Sud with Sea Sand

No.	Description of Activities	Unit	Q' ty	Execution Period																					
				1st Year						2nd Year															
				VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII				
1	MOBILIZATION OF PERSONEL & EQUIPMENT	l.s.	1																						
2	SURVEY WORKS	l.s.	1																						
3	TEMPORARY WORKS FOR ACCESS	l.s.	1																						
4	REHABILITATION OF EXISTING BREAKWATER																								
	Stabilopod fabrication	no	2,808																						
	Geotextile - installation	m^2	6,666																						
	Rubble stone - installation	m^3	3,708																						
	Stone block - installation	m^3	11,206																						
	Stabilopod installation	no	2,808																						
5	RETAINING JETTY																								
	Stabilopod fabrication	no	296																						
	Excavation	m^3	127																						
	Geotextile - installation	m^2	5,107																						
	Rubble stone - installation	m^3	5,870																						
	Stone block - installation	m^3	3,961																						
	Stabilopod installation	no	296																						
	Concrete pavement	m^3	318																						
6	SUBMERGED GROINS																								
	Excavation and dredging	m^3	1,534																						
	Sand container bag fabrication	no	444																						
	Sand bag - installation	no	444																						
	Filling around jetty with existing sand	l.s.	1																						
7	SAND BAG GROINS																								
	Excavation	m^3	3,207																						
	Sand bags - preparation	no	1,545																						
	Supplementary works for execution	m^3	471																						
	Sand bag - installation	no	1,545																						
	Filling around jetty with existing sand	l.s.	1																						
8	UNDERWATER DIKE																								
	Rubble stone 200-500 kg	m^3	11,923																						
	Stone block 1.0 – 3.0 t	m^3	7,228																						
	Geotextile	m^3	23,413																						
	Sand bag fabrication	no.	1,625																						
	Sand bag installation	no.	1,625																						
9	BEACH FILL	m^3	378,996																						
10	SURVEY FOR NEW WORKS	l.s.	1																						
11	AS BUILD DRAWINGS	l.s.	1																						
12	REMOVAL OF TEMPORARY WORKS	l.s.	1																						
13	FINAL CLEANING	l.s.	1																						
14	DEMOBILIZATION OF PERSONEL & EQUIPMENT	l.s.	1																						

Fig. E.2.1: Execution schedule at Mamaia Sud with sea sand

Works Type	No.	Description of Equipment	Unit	Q'ty	Execution Period																				
					1st Year											2nd Year									
					VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII			
Underwater Dike	1	Trucks 16 t for stone transportation	no	9																					
	2	Crane for loading the Stone on the barges	no	2																					
	3	Barges for transportation	no	2																					
	4	Tug boat 2x300 HP for barge transportation	no	2																					
	5	Floating crane for stone and sand bag placing	no	1																					
	6	Tugboat 2x300 HP for floating crane transportation & assistance	no	1																					
	7	Tugboat for geotextile installation	no	1																					
	8	Mobile crane for sand bag loading on truck	no	1																					
	9	Trucks for sand bag transportation from Mamaia to Agigea Port	no	1																					
	10	Mobile crane for loading the sand bags on the barge	no	1																					
	11	Barge for sand bag transportation and installation	no	1																					
	12	Tugboat 2x300 HP for barge transportation	no	1																					
Beach Fill	13	Trailing suction hopper dredger (2650m3)	no	1																					
	14	Anchor boat	no	2																					
	15	Bulldozer	no	3																					
Bags Groin	16	Truck 25 t for sand supply	no	1																					
	17	Mobile crane for loading the bags	no	1																					
	18	Truck 16 t for supply the bags to site	no	1																					
	19	Chain grabbing bucket for placing of bags excavation, filling etc.	no	1																					
	20	Truck 16 t for supplementary works	no	2																					
Submerged Groin	21	Chain grabbing bucket for excavation	no	1																					
	22	Excavator for sand container bags preparation	no	1																					
	23	Mobile crane for container bags loading and placing	no	1																					
	24	Truck 25 t for sand supply	no	1																					
Retaining Jetty	25	Excavator	no	1																					
	26	Tug boat for geotextile installation	no	1																					
	27	Truck 16 t for rubble stone and block stone transportation	no	8																					
	28	Bulldozer for pushing of rubble stone	no	1																					
	29	Mobile crane for stone blocks arrangement and stabilopod installation and pavement concrete pouring	no	1																					
	30	Truck 16 t for stabilopod transportation	no	4																					
	31	Truck mixer for pavement concrete transportation	no	1																					

Works Type	No.	Description of Equipment	Unit	Q'ty	Execution Period																					
					1st Year												2nd Year									
					VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII				
Rehabilitation of the Existing Breakwaters	32	Truck mixer 5 m^3 for concrete transportation	no	2																						
	33	Mobile crane for concrete pouring and stabilopod handling	no	2																						
	34	2 x 300 HP tug boat for geotextile installation	no	1																						
	35	Truck 16 t for stone transportation	no	10																						
	36	Crane for loading the stone on the barges	no	1																						
	37	1000 t barge for transportation and placing	no	1																						
	38	2 x 300 HP tug boat for barges transportation	no	1																						
	39	Floating crane 15 tf for stone & blocks installation	no	1																						
	40	2x300 HP tug boat for floating crane transportation	no	1																						
	41	Mobile crane for loading the stabilopods in the truck	no	1																						
	42	Truck 16 t for stabilopod transportation from storage to quay	no	5																						
	43	Mobile crane for loading the stabilopods on the barge	no	2																						
	44	1000 t barge for stabilopod transportation	no	1																						
	45	2x300 HP tug boat for barge transportation	no	1																						
	46	Floating crane 15 t for stabilopod placing	no	1																						
	47	2x300 HP tug boat for floating crane transportation and assistance	no	1																						
	48	120 HP launch for works inspections	no	1																						

Fig. E.2.2: Equipment mobilization schedule at Mamaia Sud with sea sand

Works Type	No.	Qualification	Unit	Quantity		Execution Period																							
						1st Year														2nd Year									
				skilled	unskilled	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII						
Underwater Dike	1	Truck drivers	no	9	-																								
	2	Crane operators	no	6	-																								
	3	Tugboat 2x300 HP crew barge transportation	no	10	-																								
	4	Floating crane – crew	no	30	-																								
	5	Tugboat – crew for floating crane transportation	no	10	-																								
	6	Tugboat crew for geotextile installation	no	10	-																								
	7	Divers team for geotextile installation	no	3	-																								
	8	Unskilled workers for sand bags preparation	no	-	6																								
	9	Crane operator for loading the bags in the truck	no	1	-																								
	10	Truck driver for sand bag transportation	no	1	-																								
	11	Crane operator for loading bags on barge	no	1	-																								
	12	Tug boat – crew for barge transportation	no	10	-																								
	13	Traffic operator	no	1	-																								
Beach Fill	14	Trailing suction hopper dredger	no	(6)	(6)																								
	15	Anchor ship	no	2	4																								
	16	Bulldozer	no	3	3																								
Bags Groins	17	Truck driver	No	1	-																								
	18	Earth diggers	no	-	10																								
	19	Bags fastener	no	2	-																								
	20	Mobile crane operator	no	1	-																								
	21	Truck driver for bags supply to site	no	1	-																								
	22	Chain grabbing bucket - operator	no	1	-																								
	23	Truck driver for supplementary works	no	2	-																								
	24	Breakwaters builder	no	1	-																								
	25	Helpworkers	no	-	2																								
Submerged Groins	26	Skilled workers for container bags preparation	no	2	-																								
	27	Excavator – operator for container bags preparation	no	1	-																								
	28	Chain grabbing bucket - operator	no	1	-																								
	29	Mobile crane – operator for container loading	no	1	-																								
	30	Helpworkers	no	-	4																								
	31	Breakwater builder	no	1	-																								
	32	Truck driver for sand supply	no	1	-																								
	33	Traffic operator	no	1	-																								
Retaining Jetty	34	Excavator operator	no	1	-																								
	35	Tug boat crew for geotextile installation	no	10	-																								
	36	Divers for geotextile installation	no	3	-																								
	37	Truck drivers for stone transportation	no	8	-																								
	38	Bulldozer - operator	no	1	-																								
	39	Breakwater builder	no	1	-																								
	40	Mobile crane operator	no	1	-																								
	41	Helpworkers	no	-	2																								
	42	Carpenters	no	2	-																								
	43	Concrete finishor	no	4	-																								
	44	Truck driver for stabilopod transportation	no	4	-																								
	45	Truck mixer - driver	no	1	-																								

Works Type	No.	Qualification	Unit	Quantity		Execution Period																			
						1st Year													2nd Year						
				skilled	unskilled	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Rehabilitation of the Existing Breakwaters	46	Truck mixer – drivers	no	2	-																		
	47	Mobile crane – operator	no	2	-																		
	48	Steel works erectors	no	4	-																		
	49	2x300 HP Tugboat crew	no	10	-																		
	50	Divers for geotextile installation	no	3	-																		
	51	Helpworkers	no	-	4																		
	52	Truck drivers for stone transportation	no	10	-																		
	53	Crane operator	no	1	-																		
	54	Operator for barge loading	no	1	-																		
	55	2 x 300 HP Tug boat crew	no	10	-																		
	56	Floating crane – crew for stone installation	no	30	-																		
	57	2x300 HP Tug boat – crew for floating crane transportation	no	10	-																		
	58	Breakwater builder	no	1	-																		
	59	Mobile crane operator for loading stabilopods in the trucks	no	1	-																		
	60	Truck drivers for stabilopod transportation	no	5	-																		
	61	Helpworkers	no	-	6																		
	62	Mobile crane operator for loading of stabilopods on the barges	no	2	-																		
	63	Barge operator	no	1	-																		
	64	2x300 HP Tug boat – crew for barge transportation	no	10	-																		
	65	Floating crane – crew for stabilopod installation	no	30	-																		
	66	2x300 HP Tug boat – crew for floating crane transportation	no	10	-																		
	67	Helpworkers	no	-	2																		
	68	120 HP Launch - crew	no	3	-																		

Fig. E.2.3: Labor mobilization schedule at Mamaia Sud with sea sand

E.3 Project Component “B” at Eforie Nord with River Sand

No.	Description of Activities	Unit	Q'ty	Execution Period																							
				3rd Year															4th Year							
				I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI
1	MOBILISATION OF PERSONEL & EQUIPMENT	l.s.	1																		
2	LAND & WATER SURVEY	l.s.	1																		
3	TEMPORARY WORKS FOR ACCESS	l.s.	1																		
4	REMOVAL OF EXISTING JETTIES AND BREAKWATERS																				
	Removal of existing stabilopodes at the heads	no	85																		
	Removal of existing stone blocks	m^3	5,101																		
	Removal of existing concrete pavement	m^3	371																		
	Removal of existing stabilopodes of submerged breakwaters	no	915																		
5	NEW SUBMERGED BREAKWATERS																				
	"X" blocks fabrication	no	7,787																		
	Sea marks fabrication	no	9																		
	Geotextile installation	m^2	39,690																		
	Rubble stone installation	m^3	93,474																		
	"X" blocks installation	no	7,787																		
	Installation of sea marks	no	9																		
6	REHABILITATION & EXTENSION OF EXISTING JETTY J-1																				
	Stabilopodes fabrication	no	2,242																		
	Removal of existing concrete pavement	m^3	149																		
	Removal and replacing of existing stone blocks	m^3	279																		
	Geotextile installation	m^2	3,866																		
	Rubble stone installation	m^3	6,788																		
	Stone blocks installation	m^3	3,608																		
	Stabilopodes installation	no	2,242																		
	Concrete pavement	m^3	339																		
7	REHABILITATION OF EXISTING JETTY J-2																				
	Stabilopodes fabrication	no	1,370																		
	Removal of existing concrete pavement	m^3	457																		
	Removal and replacing of existing stone blocks	m^3	128																		
	Stone blocks installation	m^3	7,171																		
	Stabilopodes installation	no	1,370																		
	Concrete pavement	m^3	933																		
8	BEACH FILL																				
	Supply of sand	m^3	466,742																		
	Pushing & leveling of sand	m^3	466,742																		
9	AS BUILD DRAWINGS	l.s.	1																		
10	REMOVAL OF TEMPORARY WORKS	l.s.	1																		
11	FINAL CLEANING	l.s.	1																		
12	DEMOBILIZATION OF PERSONEL & EQUIPMENT	l.s.	1																		

Fig. E.3.1: Execution schedule at Eforie Nord with river sand

Works Type	No.	Description of Equipment	Unit	Q'ty	Execution Period																							
					3rd Year														4th Year									
					I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI						
Beach Fill	1	Trucks 25 t	no	28																								
	2	Bulldozer	no	3																								
	3	Excavator for sand loading in the trucks	no	5																								
	4	Barges 1500-2000 t for sand transportation from Oltina to Agigea	no	12																								
	5	Pushing boat	no	3																								
	6	Unloading crane	no	6																								
	7	Dredger 600-750 l	no	1																								
	8	Floating crane with grabs	no	1																								
Rehabilitation of Existing Jetty "J2"	9	Truck mixer	no	1																								
	10	Mobile crane	no	1																								
	11	Hammer-head crane	no	1																								
	12	Grab crane	no	1																								
	13	Truck 16 t	no	1																								
	14	Truck 16 t for stone blocks transportation	no	7																								
	15	Grab crane for blocks installation	no	1																								
	16	Truck 16 t for stabilopods transportation	no	2																								
	17	Mobile crane for stabilopods loading	no	1																								
	18	Crane for stabilopods installation	no	1																								
	19	Truck mixer for concrete transportation	no	2																								
Rehabilitation and Extension of Existing Jetty "J1"	20	Truck mixer 5 m3	no	3																								
	21	Mobile crane for concrete pouring	no	1																								
	22	Tug boat 2x300 HP	no	1																								
	23	Trucks 16 t for rubble stone & stone blocks transportation	no	12																								
	24	Grab crane for stone installation	no	1																								
	25	Trucks 16 t for stabilopods transportation	no	5																								
	26	Crane for stabilopods installation	no	1																								
	27	Hammer-head crane	no	1																								
	28	Mobile crane with grab	no	1																								
	29	Truck mixer for pavement concrete	no	1																								
New Artificial Reefs	30	Truck for "X" blocks concrete transportation	no	5																								
	31	Mobile crane	no	2																								
	32	Tug boat 2x300 HP for geotextile installation	no	1																								
	33	Truck 16 t for rubble stone transport between Sibioara to Constantza Port	no	36																								
	34	Crane for loading the stone on the barge	no	2																								
	35	1000 t barges	no	2																								
	36	Tug boat 2x300 HP for barge transportation	no	1																								
	37	Floating crane 15 tf for rubble stone installation	no	1																								
	38	Tug boat 2x300 HP for floating crane transportation & assistance	no	1																								
	39	Mobile crane for loading "X" blocks on the trailer	no	1																								
	40	Trailers 20 t inclusive tractors for "X" blocks transp.	no	4																								
	41	Mobile crane for loading of "X" blocks on the barges	no	1																								
	42	1000 t barge for "X" blocks transportation and placing	no	1																								
	43	Tug boat for barge transportation	no	1																								
	44	Floating crane 15 tf for "X" blocks placing	no	1																								
	45	Tug boat for floating crane transportation	no	1																								
	45	100 t floating for sea marks installation	no	1																								
	45"	Tug boat 2x300HP for floating crane transportation	no	1																								

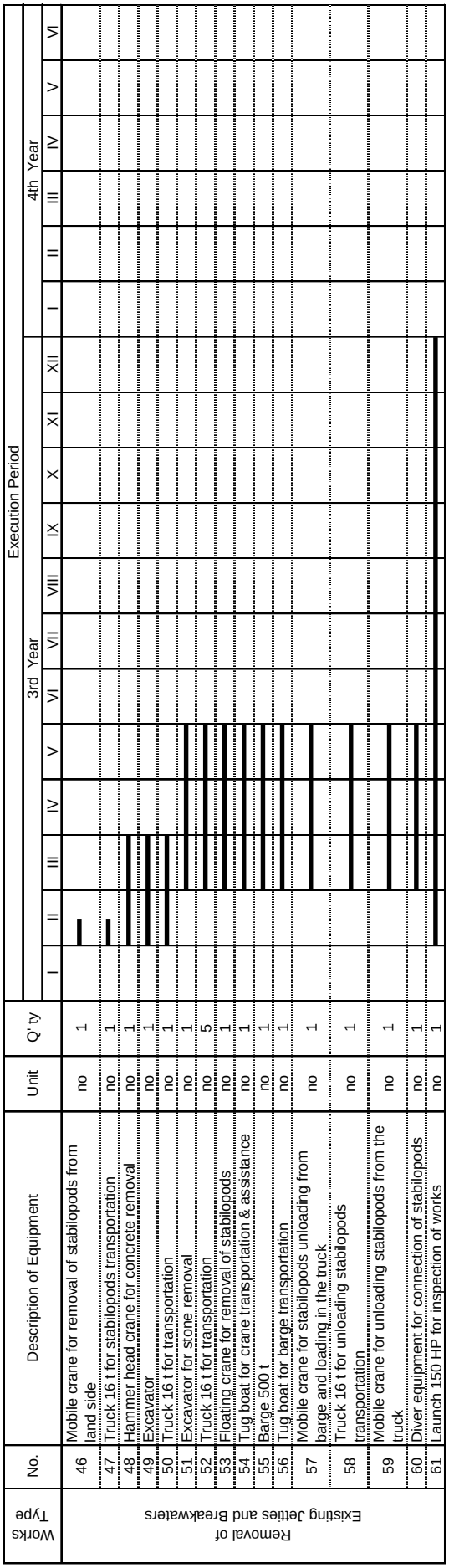

Fig. E.3.2: Equipment mobilization schedule at Eforie Nord with river sand

Works Type	No.	Qualification	Unit	Quantity		Execution Period																							
						3rd Year														4th Year									
				skilled	unskilled	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	V	VI						
Beach Fill	1	Trucks driver	no	28	-																								
	2	Bulldozer - operator	no	3	-																								
	3	Excavator - operator	no	5	-																								
	4	Barges - crew	no	-	-																								
	5	Pushing boat - crew	no	42	-																								
	6	Crane operators	no	6	-																								
	7	Dredger – crew in 3 shifts	no	31	-																								
	8	Floating crane – crew in 3 shifts	no	30	-																								
	9	Traffic Operator	no	2	-																								
	10	Earth digger	no	-	3																								
Rehabilitation of Existing Jetty "J2"	11	Truck mixer - driver	no	1	-																								
	12	Mobile crane - operator	no	1	-																								
	13	Hammer-head crane operator	no	1	-																								
	14	Grab crane - operator	no	1	-																								
	15	Truck driver	no	1	-																								
	16	Truck 16 t driver for stone transportation	no	7	-																								
	17	Grab crane operator	no	1	-																								
	18	Truck 16 t driver for stabilopods transportation	no	2	-																								
	19	Mobile crane operator for stabilopods loading	no	1	-																								
	20	Crane operator for stabilopods installation	no	1	-																								
	21	Traffic operator	no	1	-																								
	22	Track mixer driver for concrete transportation	no	2	-																								
	23	Carpenter	no	2	-																								
	24	Concrete finisher	no	16	-					(12)						(4)													
	25	Help workers	no	-	8					(6)						(2)													
	26	Steelworker erector	no	6	-																								
Rehabilitation and Extension of Existing Jetty "J1"	27	Truck mixer driver	no	3	-																								
	28	Mobile crane for pouring of concrete in "X" block	no	1	-																								
	29	Steel worker erector	no	4	-																								
	30	Concrete finisher	no	8	-																								
	31	Help workers	no	-	4																								
	32	Tug boat 2x300 HP - crew	no	10	-																								
	33	Truck 16 t driver for rubble stone & stone blocks transportation	no	12	-																								
	34	Grab crane for rubble stone & stone blocks installation	no	1	-																								
	35	Truck 16 t driver for stabilopods transportation	no	5	-																								
	36	Crane operator for stabilopods installation	no	1	-																								
	37	Breakwater builder for Jetty 1 & 2	no	2	-																								
	38	Hammer head crane operator	no	1	-																								
	39	Mobile crane with grab - operator	no	1	-																								
	40	Unskilled workers	no	-	3																								
	41	Truck mixer - driver	no	-	1																								
	42	Carpenter	no	-	2																								
	43	Concrete finisher	no	2	-																								
	44	Help workers	no	-	2																								

Works Type	No	Qualification	Unit	Quantity skilled	Quantity unskilled
New Artificial Reefs	45	Truck mixer driver for "X" blocks concrete transportation	no	5	-
	46	Mobile crane - operator	no	2	-
	47	Steel workers erector	no	4	-
	48	Concrete finishing	no	12	-
	49	Help workers	no	6	-
	50	2x300 HP Tug boat crew	no	10	-
	51	Divers for geotextile installation for Jetty 1 & 2	no	4	-
	52	Unskilled workers for handling	no	-	2
	53	Truck drivers for stone transportation	no	36	-
	54	Crane operator	no	2	-
	55	Operator for barge loading	no	2	-
	56	2 x 300 HP Tug boat crew for barge transportation	no	10	-
	57	Floating crane – cew for stone installation	no	10	-
	58	2 x 300 HP Tug boat crew for floating crane transportation	no	10	-
	59	Mobile crane – operator for "X" blocks loading & unloading on the trailer	no	2	-
	60	Help workers	no	-	4
	61	Trailer driver for "X" blocks transportation	no	4	-
	62	Operator for barge loading	no	1	-
	63	2 x 300 HP Tug boat – crew for "X" blocks transportation and placing	no	10	-
	64	Floating crane – crew for placing	no	10	-
	65	2 x 300 HP Tug boat – crew for floating crane transportation & assistance	no	10	-
	66	Breakwater builder	no	1	-
	67	Help workers	no	-	2
	67'	50 t floating crane-crew	no.	10	-
	67"	2x300 HP tug boat-crew	no.	10	-
Removal of Existing Jetties and Breakwaters	68	Mobile crane operator for stabilopods removal	no	1	-
	69	Help workers	no	-	2
	70	Truck - driver	no	1	-
	71	Hammer head crane operator	no	1	-
	72	Excavator - operator	no	1	-
	73	Unskilled workers	no	-	3
	74	Truck - driver	no	1	-
	75	Excavator – operator for stone removal	no	1	-
	76	Truck driver for stone transportation	no	5	-
	77	Floating crane – crew for stabilopods removal	no	10	-
	78	Breakwater builder	no	1	-
	79	Help workers	no	-	2
	80	Divers for stabilopods removal	no	3	-
	81	Barge operator	no	1	-
	82	2 x 300 HP Tug boat crew – for barge and floating crane transportation	no	2	-
	83	Mobile crane – operator for unloading stabilopods from barges and loading in the truck	no	1	-
	84	Truck – drivers for stabilopods transportation	no	1	
	85	Mobile crane – operator for unloading the stabilopods in storage	no	1	
	86	Help workers for stabilopods handling	no	4	
	87	150 HP launch for all construction works	no	3	

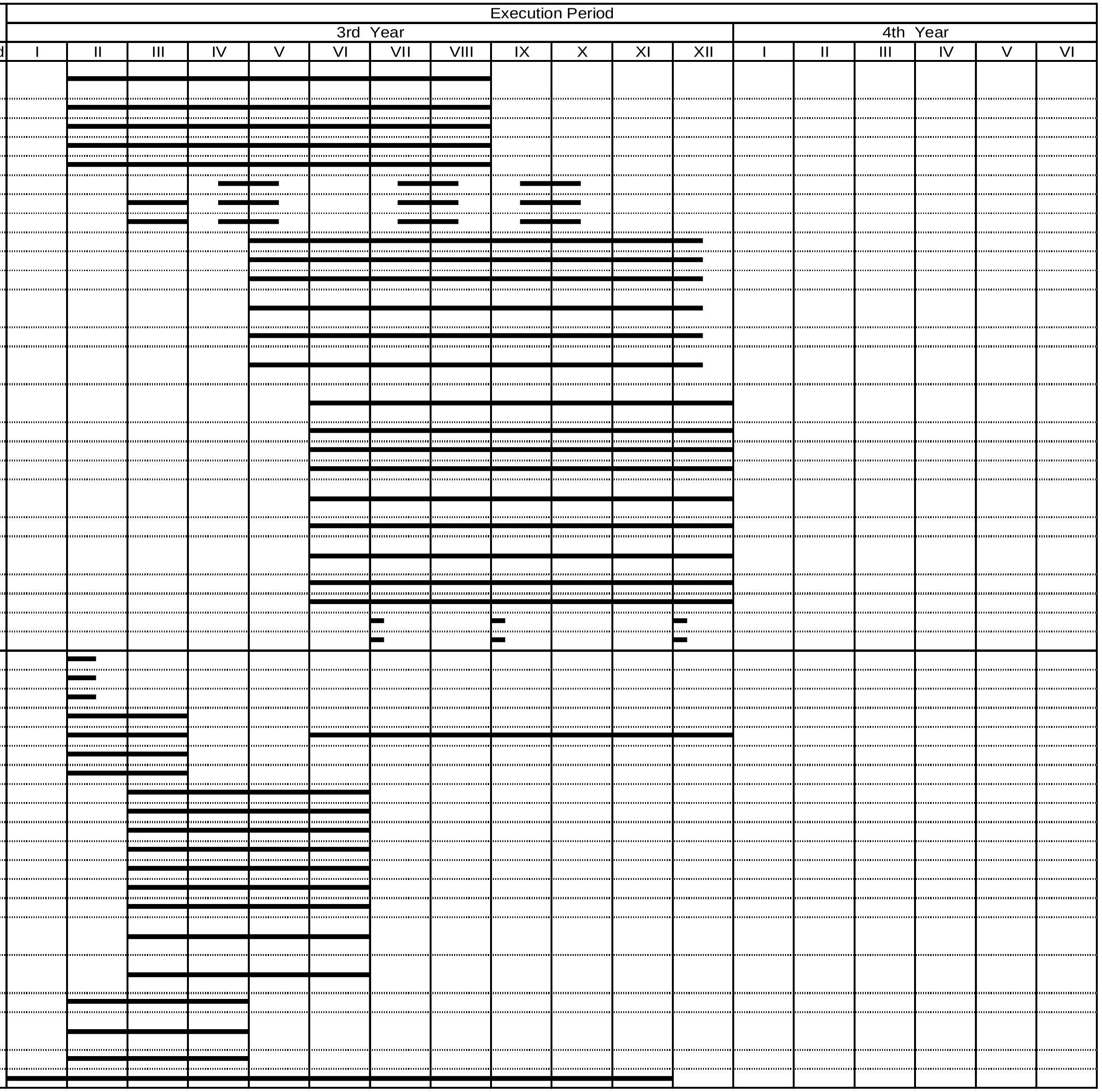

Fig. E.3.3: Labor mobilization schedule at Eforie Nord with river sand

Appendix F: Beach Monitoring Program

F.1 Introduction

The Romanian Black Sea shore has been suffering from the damage by severe coastal erosion. The erosion is great in the northern unit, but the southern unit is also being damaged. The Study on Protection and Rehabilitation of the Southern Black Sea Shore (hereinafter referred to as "the Study") has been conducted since May 2005 by a team of experts dispatched by Japan International Cooperation Agency based on the Scope of Works signed by the representatives of the Romanian and Japanese Governments on 30 July 2004.

The Study has formulated the overall coastal protection plan, which was originally aimed at 2020 but includes the period beyond 2020, and presented the results of a feasibility study for the coastal protection and rehabilitation project at Mamaia Sud and Eforie Nord. Although the project has been expected to be implemented in the autumn of 2007 as a part of the Spectral Operational Program with the EU fund, the acquisition of the project fund seems to be delayed to some extent.

The success of any coastal protection and rehabilitation plan and project is wholly dependent on meticulous execution of the long-term monitoring of beach morphology. Without the data of the morphological changes of the beach shape and bathymetrical features of the nearshore water area, no sound plan can be formulated and no project can be taken care of beach changes after implementation.

The Study has been greatly assisted with the beach profile survey data executed by the staff of the National Institute for Marine Research and Development "Grigore Antipa" over many years as well as the topographic shore maps surveyed several times since 1977. If these data were not available, the numerical model for prediction of future shorelines with or without shore protection facilities could not be calibrated and the reliability of the prediction could not be maintained at an acceptable level.

The present appendix describes the methodology of the beach monitoring program to be implemented by the Water Directorate Dobrogea – Litoral, National Administration of Romanian Waters from 2007 to the indefinite time limit. The expert team for the Study sincerely wishes the successful implementation of the beach monitoring program with a sufficient amount of budget allocation for the program.

F.2 Objectives

The beach monitoring program is to be carried out with the objectives of providing the authorities concerned with the invaluable information and data of the temporal changes of the beach profiles and the nearshore bathymetry. The information and data are indispensable for formulation of the forthcoming coastal protection and rehabilitation projects at various coastal sectors and good maintenance of the beaches that would have been rehabilitated by the project implementation.

F.3 Scope of Beach Monitoring

(1) Categories of monitoring

Three categories of beach monitoring should be planned and executed. The first category is the beach profile survey, the second is the shoreline map survey, and the third is the bathymetric survey.

The beach profile survey is the continuation of the survey that has been conducted by the National Institute for Marine Research and Development "Grigore Antipa" with addition of sixteen (16) new benchmarks in the whole area from Năvodari to Vama Veche.

The shoreline map survey is a successor of topographic surveys intermittently carried out by PROIECT S.A. The survey results will be used for calibration of any numerical model for beach morphology in future studies.

The bathymetric survey is to monitor the evolution of the filled beach areas and neighboring beaches. If an excessive volume of sand loss is found in the filled beach area, the plan for sand re-supply should be prepared and the maintenance supply of sand should be executed.

(2) Duration and frequency of monitoring

The first category of beach profile survey should be carried out twice a year in the same months such as May and November.

The second category of shoreline map survey should be carried out once in every five (5) years.

The third category of bathymetric survey should be carried out once a year in the same month such as October.

The first and second categories of beach monitoring should be continued indefinitely so long as the Government of Romania recognizes the necessity of the good management of the coastal zone.

The third category of bathymetric survey could be terminated when no appreciable change of the isobaths is recognized after the lapse of a certain years since the completion of the project. The first and second categories of beach monitoring will then supplement the role of the third category.

F.4 Methodology of Beach Profile Survey

(1) Benchmarks

There have been established 34 benchmarks in the southern unit of the Romanian Black Sea shore. The approximate locations are shown with red color in Figs. F.4.1 and F.4.2. Sixteen new benchmarks are to be established in the following sub-sectors:

1) Four benchmarks TM-1 to TM-4 in the sub-sectors of Tomis North and Tomis South, because of the deficiency of the data in these sub-sectors.
2) Five benchmarks of EN-1 to EN-5 in the sub-sector of Eforie Nord in which the new project will be implemented.
3) Four benchmarks of EF-8 to EF-11 in the sub-sector of Eforie Sud, because of the deficiency of the data in these sub-sectors.
4) One benchmark CN-4 in the sub-sector of Costineşti at the north side of the newly built breakwater. If the existing benchmark CN-3 has been located within the two new breakwaters, it should be relocated at the south of the southern breakwater.
5) Two benchmarks VV-2 and VV-3 in the sub-sector of Vama Veche to supplement the existing benchmark VV-1.

The new benchmarks are shown in blue color. All the existing benchmarks should be utilized with good care.

(2) Method of beach profile survey

1) Beach profiles are measured by leveling at the cross-shore interval of 5 m. If there are inflection points, their locations and elevations should be recorded.

2) Benchmarks are to be re-established by driving rivets on the surfaces of hard structures near the shore, which will maintain its integrity for many years to come. A supplementary benchmark should also be established on a landward side of the main benchmark so that the coordinates of the latter can be recovered in the case of its possible destruction in future.

3) The mutual relationships of the coordinates of the benchmarks within the seven sectors shown in Figs. F.4.1 and F.4.2 (Năvodari to Mamaia, Tomis North and South, Eforie Nord to Eforie Sud, Costineşti, Neptun, Balta Mangalia to Mangalia, and Vama Veche) should be clarified through plane surveying using an electronic distance meter. Longitudinal leveling should also be carried out to establish the control net of the benchmark elevations within the same sector.

4) A unified format is to be prepared for recording the data of location name, date of survey, weather condition, distance and elevation of each survey point, and others. The data are to be recorded and managed on electronic files.

5) Surveys should be performed with the frequency of twice a year in the same months every year to avoid the influence of seasonal changes of beach profile.

F.5 Methodology of Shoreline Map Survey

1) The shoreline map survey is essentially a kind of topographic survey without leveling, but addition of elevation measurements is welcomed. The coordinate system established in Romania such as Universal Transversal Mercator (UTM) should be employed to guarantee the long-term reference of the shoreline map.

2) The data should be recorded and managed on electronic files.

3) Surveys should be performed in the same month such as October in every five years to avoid the influence of seasonal changes of beach profile.

F.6 Methodology of Bathymetric Survey

(1) Scope of survey

1) Surveys are to be made in the four areas of Mamaia_1 to Mamaia_4 shown in Fig. F.4.1 enclosed with blue dashed-lines and the area of Eforie_1 in Fig. F.4.2.

2) Bathymetric surveys should be complemented by topographic surveys of the foreshore areas from the shoreline to the edge of coastal zone.

3) Each area covers the alongshore distance of 1,600 m and the cross-shore distance of 1,000 m. Survey lines are to be set approximately perpendicular to the shoreline with the interval of 20 m alongshore. The water depth at the interval of 5 m along the above survey lines should be interpolated from the data of depth measurements.

(2) Method of survey and data analysis

1) The foreshore survey is to be made at every 5 m along the cross-shore survey lines in the above by leveling with the reference to the land benchmarks that have been established for this purpose. Where inflection points are found, their locations and elevations are to be measured. All the results of leveling are converted to the elevation above the datum level of Romania designated in 1975.

2) The bathymetric survey is to be made with an echo sounder along the straight lines of the cross-shore survey lines by guiding the survey boat with a transit and land benchmarks or with the RTK-GPS.

3) The echo sounder is to be a Sea Bat (narrow multi-beam echo sounder) or one with the equivalent performance. All the water depths should be expressed with the datum level of Romania.

4) The survey results are to be printed on a paper of A1 size with the scale of 1/2000 and stored as the Auto-Cad data. A unified format on electronic files is to be prepared and used to record and manage the survey data.

6) The first survey should be made immediately after the commencement of the project implementation at Mamaia Sud and Eforie Nord. Comparison is to be made with the survey results obtained in February 2006 commissioned by the JICA Study Team to reveal any change that might be taking place since then. The first survey results should provide the reference data to the future change of beach morphology.

7) Successive bathymetric and foreshore surveys should be made once a year in the same month such as October.

8) Comparison of the plan shapes of the shoreline between the reference data and successive survey data is to be made to reveal the shoreline advance or retreat between the two survey dates. The cross-sectional beach areas are to be calculated along the all survey lines and the total sand volume is to be obtained. Comparison of the beach area and the total sand volume between the reference data and successive survey results should be made for monitoring and control of beach sand volume.

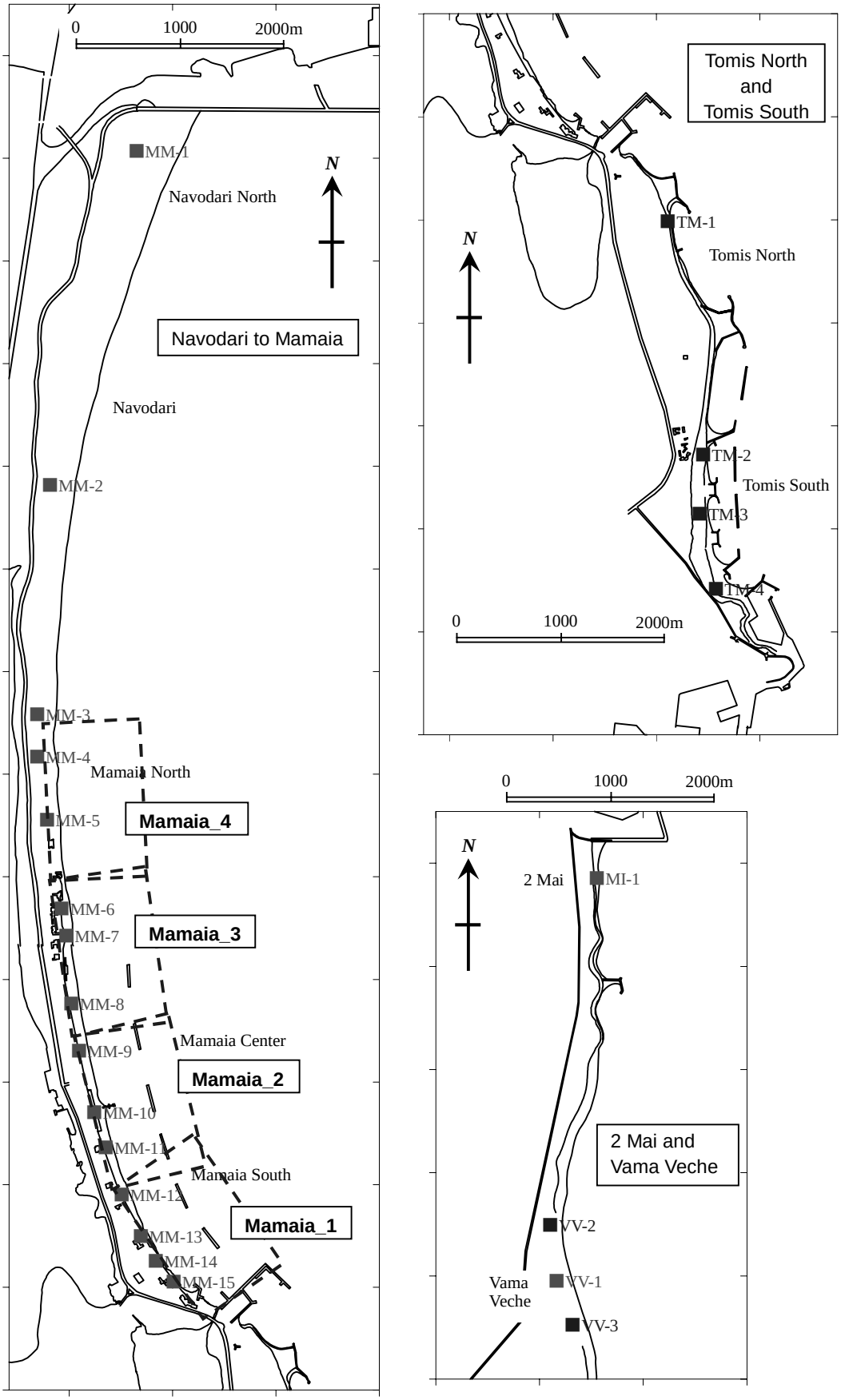

Fig. F.4.1: Map of Southern Romanian Black Sea shore (1)

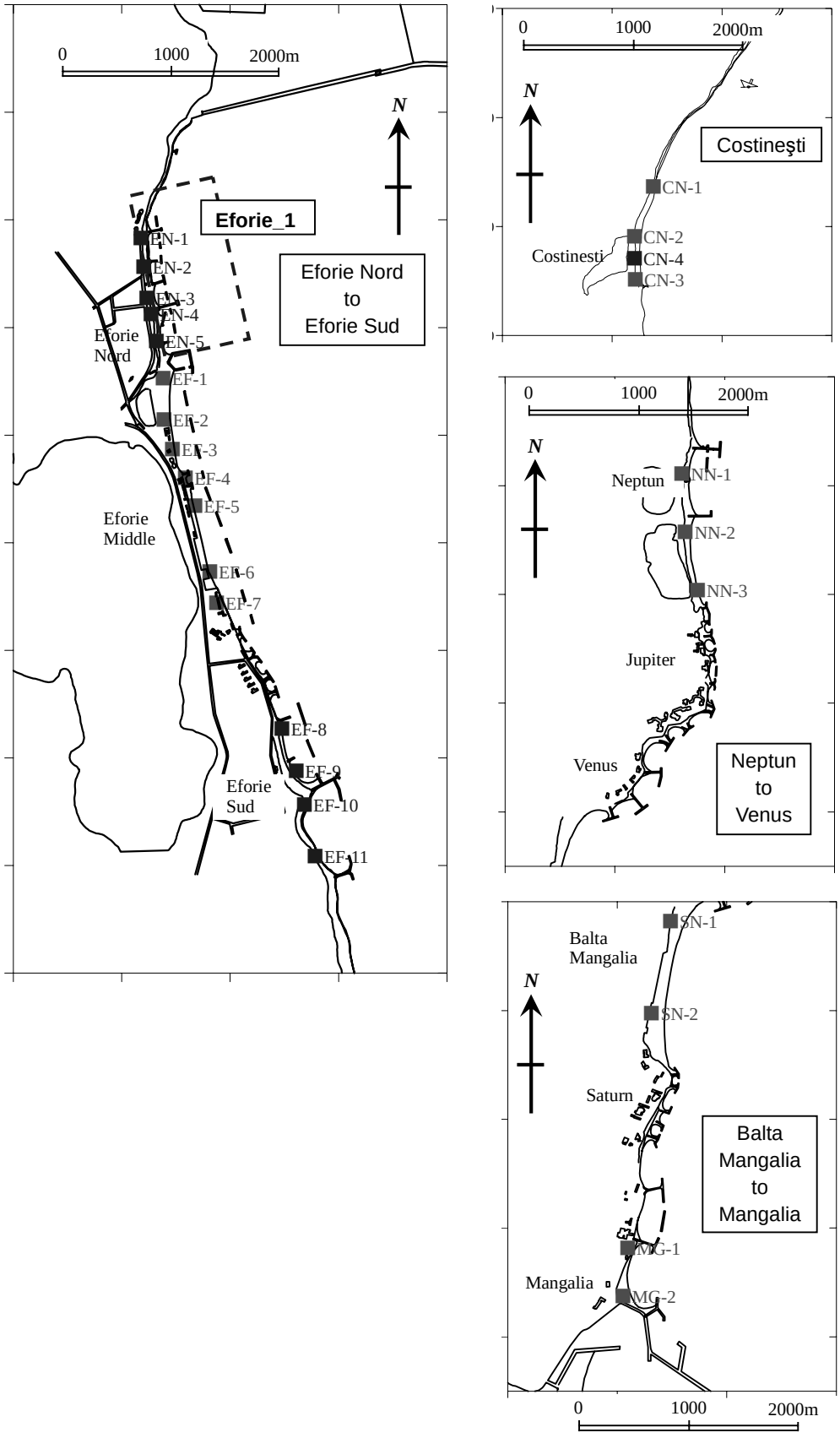

Fig. F.4.2: Map of Southern Romanian Black Sea shore (2)

Appendix G: Wave Measurement Record

G.1 Introduction

The Study team brought two sets of wave measurement devices named "Mulit-Funcitonal Oceanographic Monitor" to Romania for the purpose of carrying out wave measurement programs in the study area and transferring the technology to the Romanian counterparts. The device is placed on the seabed and measures the distance to the instantaneous water surface and the two-directional current velocities. The measured data are recorded on a memory chip inside the device that has the capacity of storing the data for more than three months. The device is recovered by divers on board a research boat and the memorized data are transferred to a computer for analysis. The specifications of the wave measurement device are described in Annex **J.8** of Volume 3.

The first installation of the wave measurement device was made on November 30, 2005 by the staff of the Dobrogea Litoral Water Directorate (DADL) with the research boat "Mariana." Figure G.1.1 indicates the general location of wave measurement, and Fig. G.1.2 shows the detailed location of the measurement site, which is off North Mamaia Beach at the water depth of about 10 m. Since the first installation, the staff of DADL replaced the wave measurement device at the interval of about three months, recovered the wave and current data, and analyzed them with a special software dedicated for the device. The present appendix summarizes the results of wave measurement for the period between December 2005 and March 2007.

G.2 Procedure of Data Analysis

Measurements have been made for 20 minutes at 2 hour interval continuously at the rate of 20 Hz (0.5 s interval), which contain the information of the distance from the wave measurement device to the water surface and the two-directional components of current velocities. The distance to the water surface is measured with the travel time of ultrasonic pulses emitted and received by the device. The current velocities are measured with the electromagnetic sensors set in two orthogonal directions.

The distance to the water surface is resolved into the mean distance (i.e. water depth) and the instantaneous fluctuation of surface elevation. The latter fluctuation is analyzed with the so-called zero-up crossing method to identify individual waves. When the instantaneous water surface crosses the mean water level (zero-line) upward, it is set as a starting point of one wave. The water surface will rise and fall irregularly and will come down below the zero-line. When the water surface crosses the zero-line upward next time, it is the ending point of the first wave and the starting point of the second wave. By repeating this procedure of wave counting, we may recognize several tens to a few hundred individual waves in a record of 20 minutes.

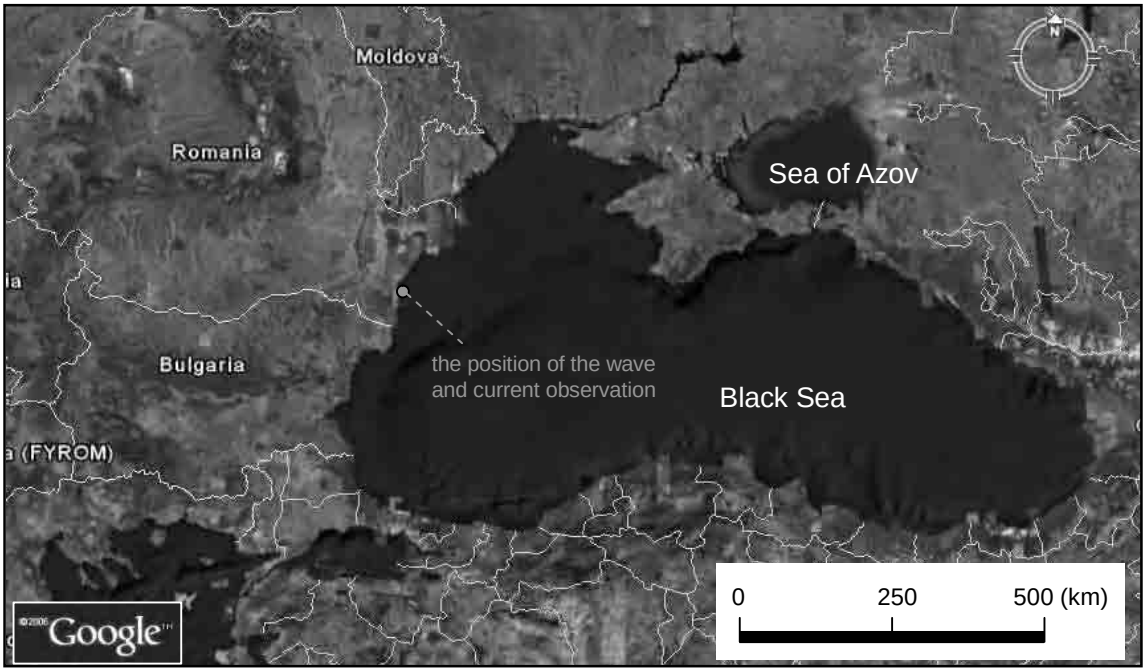

Fig. G.1.1: General location of the position of the wave and current observation

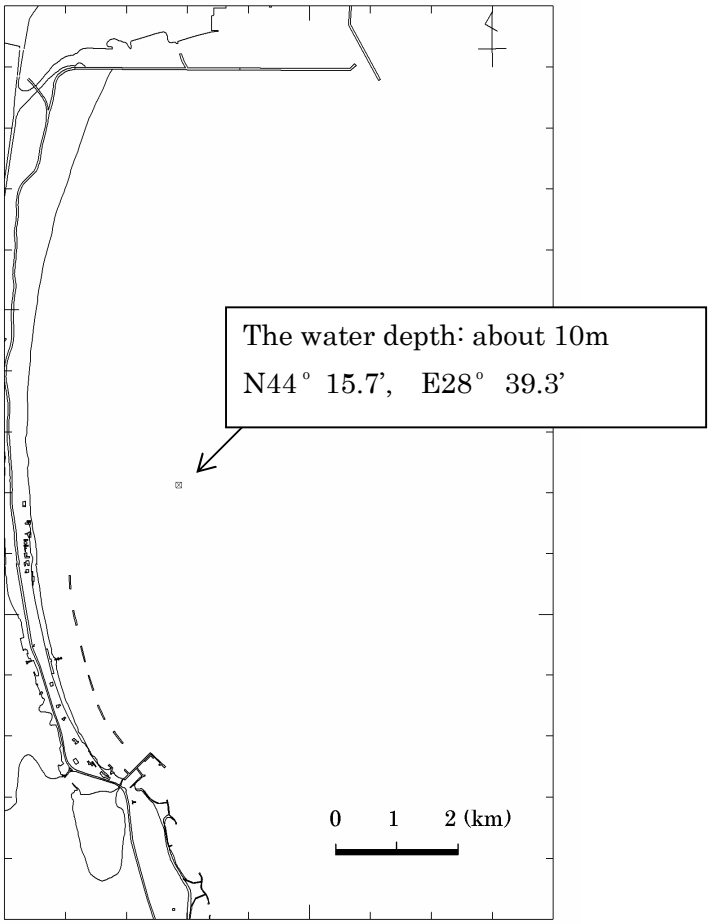

Fig. G.1.2: Detailed location of the measurement site

For a set of zero-up crossing individual waves, their heights and periods are measured. Then, individual waves are sorted in the descending order of the wave height from the highest to the lowest. By selecting the upper one-third waves and taking the averages of their heights and periods, we define the so-called significant wave height $H_{1/3}$ and the significant wave period $T_{1/3}$, which represent the wave condition during the wave measurement of 20 minutes. In the following, all the measurement results are presented with the significant wave height and period, $H_{1/3}$ and $T_{1/3}$.

The records of the two-component current velocities are also resolved into the mean current parts and the instantaneously fluctuating parts. The mean current parts yield the information on coastal currents, but it has not been analyzed in the present Study as a part of wave measurement program. The instantaneously fluctuation parts represent the orbital velocities of water particle under wave action. From that record, the mean wave direction can be evaluated; the details of the analysis are omitted here.

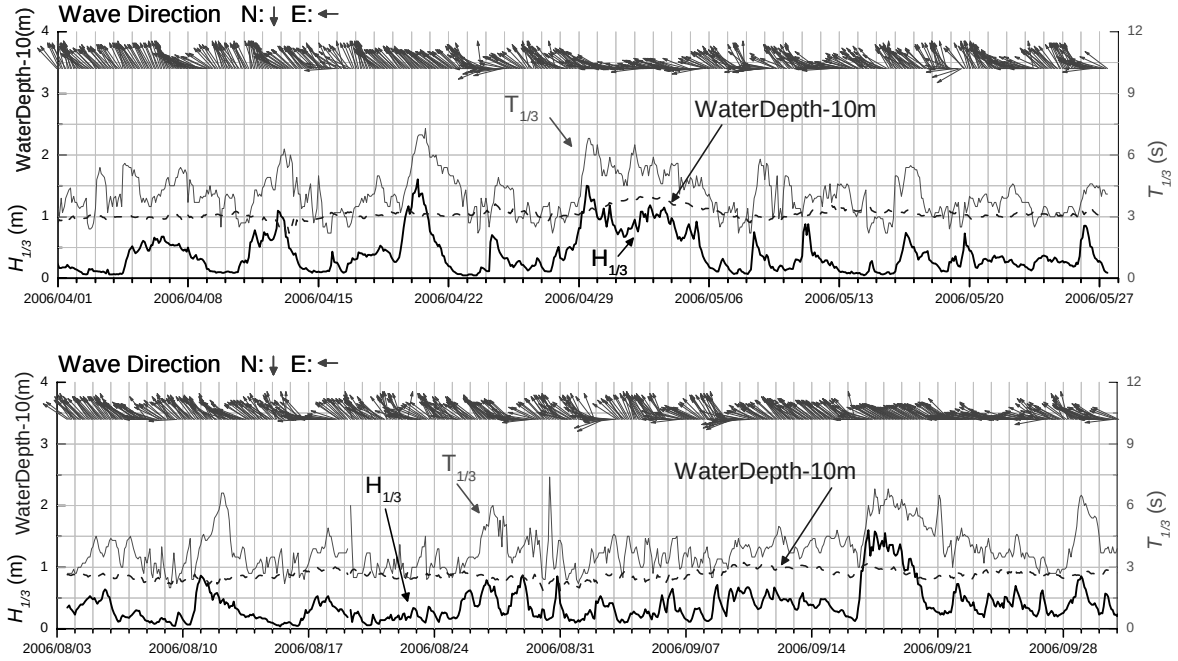

Fig. G.2.1: Examples of temporal variations of mean water level, significant wave height and period, and wave direction

Figure G.2.1 shows examples of temporal variations of the mean water level, the significant wave height and period ($H_{1/3}$ and $T_{1/3}$), and the wave direction (indicated by arrows) during two periods: one from April 1 to May 27 and another from August 3 to September 30. The mean water level is shown in the form of the water depth having been subtracted by 10 m. It was high at 1.3 m on May 2 and low at 0.8 m on August 11. Such irregular fluctuations of mean water level have been pointed out in **3.3** (5) of Volume 1 in connection with the tide gauge measurement at the Ports of Constanța and Mangalia.

G.3 Wave Climate off Mamaia

The record belong to the season of Spring to Summer in which the sea is generally calm, but April of 2006 had two occasions of the significant wave exceeding 1.5 m and 7 s. To express the general statistical nature of wave conditions, the joint frequency table of wave height and period and another of wave height and direction are often utilized. Table G.1 is such frequency tables between significant wave height and period, while Table G.2 is one between significant wave height and wave direction for the period from December 2005 to March 2007. It should be cautioned that the wave measurement had two long downtimes of nearly three months each, as will be explained later.

The wave climate represented in Tables G.3.1 and G.3.2 has three features. One is the absence of the wave period longer than 9 s, which indicates the wave climate being dominated by wind waves without swell. This feature has already been noticed through the analysis of ECMWF and NIMRD data as discussed in **3.4.1** of Volume 1.

The second feature is a mild wave climate during the recorded period. The largest significant wave height was in the class of 2.5 to 3.0 m. As shown in Fig. 3.4.1 and Table 3.4.3 of Volume 1, the wave climate estimated on the basis of ECMWF and NIMRD data indicates the 1% exceedance height of 3.5 m, but the observed waves did not reach this exceedance level. The winter of 2005 to 2006 was very cold and the nearshore water areas were covered by sea ice, while the winter of 2006 to 2007 was unusually warm. Such climatic abnormality must have produced low intensity of wave activities. In fact, the beach of Mamaia gained some accretion in the winter of 2006 to 2007 in contrast to usual erosion during winter.

The third feature is a shift of the predominant wave direction toward ESE in contrast to the data of ECMWF and NIMRD shown in Fig. 3.4.3 of Volume 1, which indicate the predominant direction being NE to E. A general shift of wave direction toward S might be a characteristic of the wave climate during the measured period. There are some data coming from the direction S, from which no wave can arrive because of the presence of the coast of Tomis Sector and Constanța Port. There may be a possibility of disorientation of the magnetic compass installed inside the device, although a check has been made when the device was temporally brought back to the manufacturer in Japan.

In anyhow, clarification of wave climate at a particular locality requires the measurements over several years long. The present data seems to represent a specially mild climate, and continuation of wave measurements is earnestly requested for establishment of reliable wave data for future planning and design of coastal protection and rehabilitation projects in the Southern Romanian Black Sea Shore.

Table G.3.1: Joint distribution of wave height versus wave period
based on the data observed on Black Sea (Dec. 2005 – Mar. 2007)

周期(s) / 波高(m)	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11	11 - 12	12 - 13	13 - 14	14 - 15	15 - 16	合計
0 - 50			352 9.3	939 24.8	660 17.4	264 7.0	47 1.2	6 0.2									2268 59.8
50 - 100			4 0.1	188 5.0	404 10.7	279 7.4	99 2.6	9 0.2									983 25.9
100 - 150				1 0.0	80 2.1	164 4.3	110 2.9	29 0.8	2 0.1								386 10.2
150 - 200						35 0.9	56 1.5	23 0.6	12 0.3								126 3.3
200 - 250							5 0.1	10 0.3	11 0.3								26 0.7
250 - 300								1 0.0	1 0.0								2 0.1
300 - 350																	
350 - 400																	
400 - 450																	
450 - 500																	
500 - 550																	
550 - 600																	
600 - 650																	
合計			356 9.4	1128 29.8	1144 30.2	742 19.6	317 8.4	78 2.1	26 0.7								3791 100.0

Upper figures: Number of contents
Lower figures: Percentage of occurrence

Number of no measurement
or no good measuremen 2053

Table G.3.2: Joint distribution of wave height versus wave direction
based on the data observed on Black Sea (Dec. 2005 – Mar. 2007)

波向 / 波高(m)	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	SSW	W	合計
0 - 50							9 0.3	116 4.3	276 10.3	465 17.3	255 9.5	37 1.4					1158 43.2
50 - 100							19 0.7	193 7.2	320 11.9	254 9.5	169 6.3	28 1.0					983 36.7
100 - 150							6 0.2	71 2.6	217 8.1	77 2.9	13 0.5	2 0.1					386 14.4
150 - 200								17 0.6	92 3.4	16 0.6	1						126 4.7
200 - 250								2 0.1	13 0.5	11 0.4							26 1.0
250 - 300									2 0.1								2 0.1
300 - 350																	
350 - 400																	
400 - 450																	
450 - 500																	
500 - 550																	
550 - 600																	
600 - 650																	
合計							34 1.3	399 14.9	920 34.3	823 30.7	438 16.3	67 2.5					2681 100.0

Upper figures: Number of contents
Lower figures: Percentage of occurrence

Number of Calm Condition : 1110
Number of no measurement
or no good measuremen 2053

G.4 Temporal Variations of Wave Conditions off Mamaia

In addition to the joint frequency tables such as listed in Tables G.3.1 and G.3.2, the monthly charts of temporal variations of wave height, period, and direction are often used to visually display the wave climate conditions. Figures G.4.1 to G.4.3 are the charts of the monthly variations of the significant wave height and period and the mean wave direction in 2005 to 2007. Figure G.4.1 for the year 2005 has only one chart of December, because the wave measurement program began from December 1, 2005.

In the records of the year 2006, two occasions of downtime appeared. Recovery and re-installation of wave measurement devices were carried out smoothly, but the recovered memory chip did not respond correctly. It might have been caused by some incorrect setting or removal procedures. It is hoped that no repetition of such incidences will occur in the continued wave measurement program from now on.

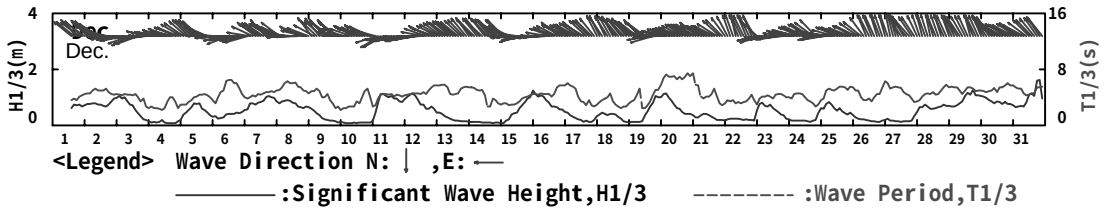

Fig. G.4.1: Monthly variations of wave height, period, and direction in the year 2005

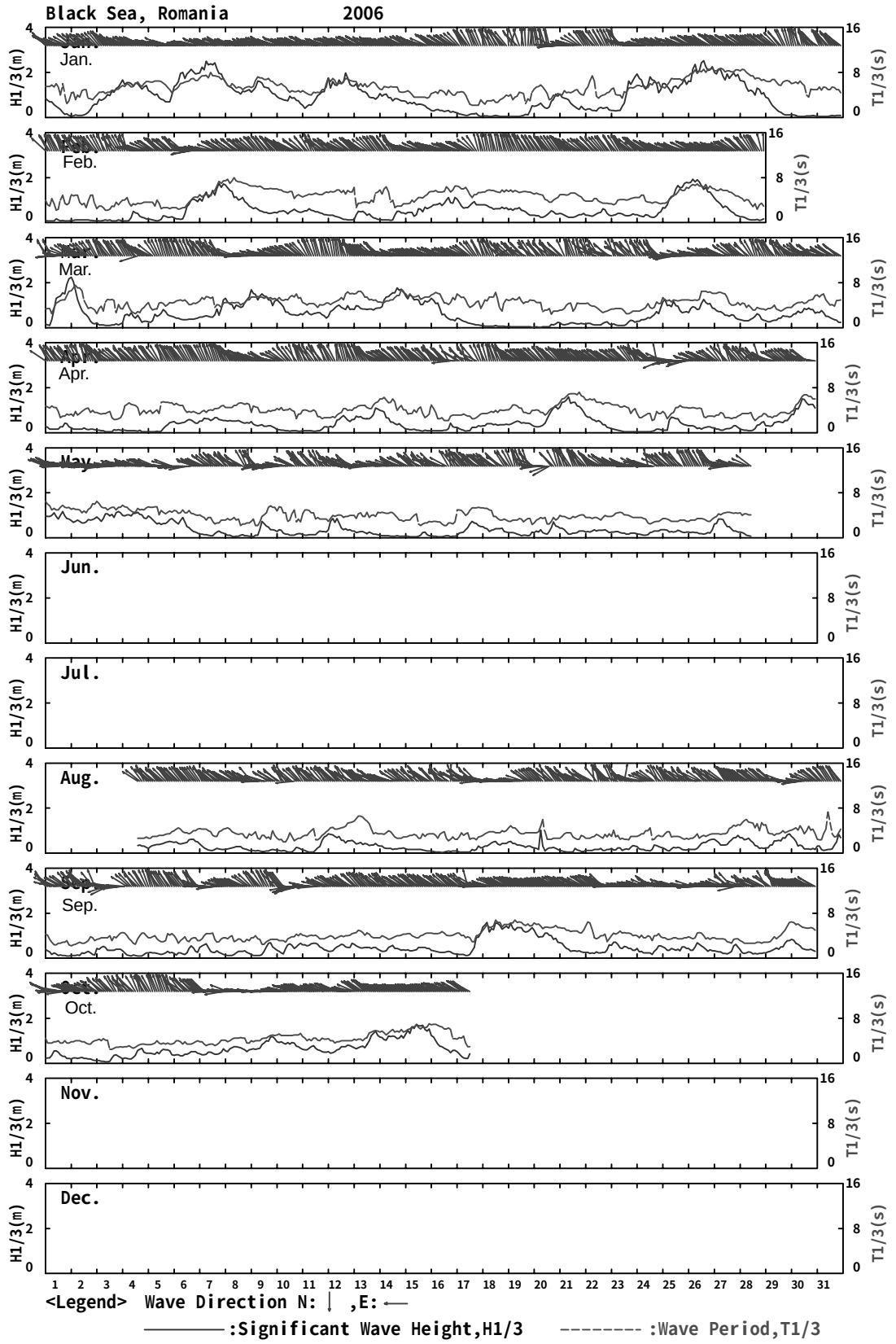

Fig. G.4.2: Monthly variations of wave height, period, and direction in the year 2006

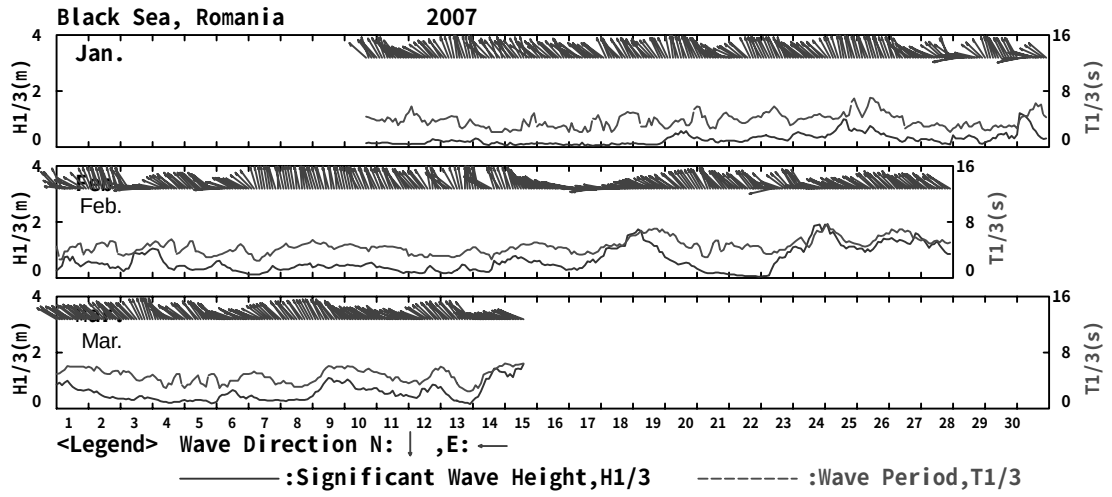

Fig. G.4.3: Monthly variations of wave height, period, and direction in the year 2007

Appendix H: Discussion on Economic Internal Rate of Return of Environment Sector Project

H.1 Background and Objective

The estimate of the economic internal rate of return (EIRR)[1] for the Component "B" of the Coastal Protection and Rehabilitation Project at Mamaia Sud and Eforie Nord under the auspices of the Japan International Cooperation Agency (JICA), is figured out at 7.4 percent by the long-run marginal cost (LRMC) pricing method as presented in **7.2.5** of this volume. There may arise some question whether this figure is justifiable for undertaking of any development projects. The underlying "lemma" as perceived by people who raised question in this light is that the guidelines for economic analysis in use at the international financing institutions inclusive of the World Bank (WB) and the Asian Development Bank (ADB) intuitively set forth the universal EIRR at 10 to 12 percent as a cut-off rate for economic viability of public intervention measures, regardless of the sectors[2]. Same is the overall cut-off rate in use for allocative efficiency of scare resource presumably in the manual of the Japan Bank for International Cooperation (JBIC)[3]. It would be appropriate to discuss the applicability of the above universal figure to the Component "B" at Eforie Nord of the Coastal Protection and Rehabilitation Project at Mamaia Sud and Eforie Nord.

With the above in view, this Appendix J is prepared in a bid;

(i) To look into whether or not there is a kind of benchmark EIRR figure specifically applied to "environment sector projects" by the international financing institutions and/or bi-lateral aid agencies, and
(ii) To provide quantitative and substantial information to the extent possible on the possible rationale for the lower EIRR estimation for the sub-project in concern in Romania.

Regarding the theoretical background of the applied welfare economics against which the current EIRR analysis has been carried out, detailed information is given in Annex H of Volume 3.

H.2 Methodology

Published documents of the World Bank (WB), the Asian Development Bank (ADB), the Japan International Cooperation Agency (JICA), the Japan Bank for International Cooperation (JBIC) and others of relevance have closely been reviewed. In tandem, the WB loan projects categorized as "coastal protection" on the web-site have also been reviewed to overview the way of quantitative and qualitative analysis of economic viability undertaken by WB, while

[1] By definition, the EIRR, a measurement index of allocative efficiency in the economy, is the rate of discount at which the cost and benefit streams over the project life are equalized with.

[2] The Asian Development Bank (ADB), *Guidelines for Economic Analysis of Projects*, 1987, p.21, ADB, Guidelines for the Economic Analysis of Projects, 1997, p.37, *The Guidelines for Preparation of Performance Evaluation Reports for Public Sector Operations*, January 2006, p.14,

[3] The Japan Bank for International Cooperation (JBIC), *The IRR Manual* (in Japanese), 2002, p.27

focusing on the EIRR estimates of the projects wherever of avail. Further, interview hearing to an evaluation expert at JBIC has taken place by asking the current issue and practices of the quantified economic analysis in place in the Bank as well as other international financing institutions/bi-lateral aid agencies of close relevance, with the EIRR benchmark estimates specifically in view.

H.3 Result

JICA, WB, ADB, JBIC, and/or other institutions do not have in their guidelines or manuals any specific benchmark figure of EIRR cut-off rate for resource efficiency for "environment sector projects" thus far. Against the line of efficiency criterion of EIRR at 10 to 12 percent commonly in place, the World Bank defines "inefficient" thereby "unsatisfactory projects" as those with less than six (6.0) percent of EIRR[4]. The figure of three (3) percent of social discount rate (SDR)[5], which is a cut-off rate of economic feasibility for human life, is now commonly in place in the evaluation of the health sector projects[6]. The *ADB Guidelines* (1987) is quoted as saying that those with the EIRR less than 10 percent may be supported only if there is strong socioeconomic justification for it[7].

Meanwhile, difficulties have been encountered by the Bank-financed projects in quantitatively estimating the benefits attributable to public intervention, owing to a paucity of rationale logic (sequency) and reliable information for quantification of intangible benefits in pecuniary terms. This has lead to the situation where most of the quantified economic analysis and sequential outturn as borne out by the EIRR did not come in place to loan processing at the Bank. Likewise, JBIC does not have much experience in undertaking quantitative analysis of economic viability of "environment protection projects" for the same reason as given immediately above[8].

On the practical front of project processing and study by WB, ADB, or else alike, no loan and/or technical assistance (TA) projects under the finance of these institutions for coastal protection with the project description (TOR) almost similar with that of the present Study have been found on the web-site project lists. Some of the WB projects that would be relevant to the present JICA project (coastal protection and rehabilitation) are enlisted in Table H.3.1, with their results of the economic analysis[9].

[4] The Operations Evaluation Department (OED) currently the Independent Evaluation Group (IEG), *Project Evaluation Criteria Guidelines* (internal document), 2000, p.8

[5] Social discount rate (SDR) is equivalent to social opportunity cost of capital (SOCC), and the criterion used for resource allocation efficiency to estimate the Economic Net Present Value (ENPV). In a sense, SDR is as par EIRR.

[6] Pioneering work in this light is that of Christopher J. L. Murray and Alan D. Lopez, *The Global Burden of Disease*, 1996, p. 9, followed by many research works inclusive of, for instance, Australian Institute of Health and Welfare, *The Burden of Disease and Injury in Australia*, 1999, The Ministry of Health, New Zealand, *The Burden of Disease and Injury in New Zealand*, 2001, and so forth.

[7] ADB, *ibid*, 1987, p.21; Note that environmental consideration did not take place so seriously as is nowadays.

[8] Source: Interview hearing to Mr. Atsutake Hashida, a former ADB manager at the Evaluation Department, and a special advisor to JBIC on project/program evaluation.

[9] While the web-site survey on the economic analysis of "coastal protection" has been carried out with care and time, there would be a kind of leakage of other projects left enlisted herewith due to somewhat complicated structure of the Bank web-site.

Table H.3.1: World Bank projects related to coastal protection aspects

Project	Country	EA/EIRR
Integrated Coastal Management Project	Georgia	X
Coastal and Marine bio-diversity Management Project	Mozambique	X
Coastal Pollution Control and Water Supply Project	Lebanon	X
Supporting the Development and Implementation of Integrated Coastal Area Management (ICAM) Project	Sub-Saharan countries	X
Vulnerability of Sub-Saharan Coastal Zones to the Different Impact of Climate Change (Prevention of Coastal Erosion)	Sub-Saharan countries	X
Espirito Santo Water and Coastal Management Project	Brazil	X
Coastal Resources Protection Project	Tunisia	X
Azov Black Sea Corridor Bio-diversity	Ukraine	X
Marine highway Development and Coastal and Marine Contamination Prevention Project	West Indian Ocean	X
Special Program on Adaptation to Climate Change Project (Protection of bio-diversity and prevention of coast land degradation)	Dominica, St. Vincent	X
Coastal Embankment and Reconstruction Project	Bangladesh	6.6%
Integrated Coastal Zone Management and Clean-up Project	Albania	16%
Coastal Cities Pollution Control and Coastal Water Monitoring Project	Croatia	11.2%

Note: "X" denotes no numerical information on economic analysis (EA)/EIRR

It should be noted that the project components (TOR) of the Albanian ICZM project with the EIRR of 16 percent are quire different from the present JICA project. The major part of the project components in Albania is construction and rehabilitation of the infrastructure including, among others, solid waste management, water supply and sewerage system, and transformation of the existing port facilities for easier access of expatriate resort tourists[10]. With this, associated with the country's baseline economic condition of heavy reliance on tourism, economic benefit as borne out by incremental tourists would have been somewhat optimistic. Because the present JICA project aims only at coastal protection and rehabilitation, it is not appropriated to make a direct comparison between the two projects.

H.4 Discussion

The present JICA study is most likely to be one of pioneer projects that have thus far been in place in support of coastal protection and rehabilitation for the environmental and socioeconomic development of coastal region in developing economies. The EIRR figure of 7.4 percent associated with the Component "B" at Eforie Nord would be considered as an acceptable one where the baseline cut-off rate of economic viability is presumably set at 3 to 6 percent as reflected in the preceding section.

It would further be noteworthy to draw attention that JICA does not impose application of a uniform cut-off rate of 10 to 12 percent EIRR for the efficiency criterion for all of the projects under the auspices of JICA[11]. Therefore, it would not be appropriate to focus and discuss

[10] The World Bank, Project Appraisal Document (PAD), The Integrated Coastal Zone Management and Clean-up Project, Albania, 2005, pp. 7-8

[11] JICA's *Study on the Methodology of Economic Analysis* for the specific 14 sectors (Japanese, 2002) does not

solely on the EIRR estimates elicited for the Project Component "B" at Eforie Nord. As the ADB Guidelines notes, the EIRR will be estimated in general for the project as a whole where projects consist of a multiple interrelated components[12]. This guiding principle and practices on the front of socioeconomic development in developing economies will also do to the present one-package project, *namely*, the Coastal Protection and Rehabilitation Project at Mamaia Sud and Eforie Nord. The attribute of the present JICA study as a sector-approach-type project for regional development and coastal (national territory) protection will also justify the methodological approach for the economic analysis of the project.

Last but not least, it would be noteworthy to address and discuss "the logic (sequencey)" of the economic analysis in place of specific EIRR figures estimated, as regarding the economic efficiency coherently attributable to development projects. It is to highlight the eliciting process of economic benefits in monetary terms rather than to scrutinize the resultant figure of EIRR: the process includes background theories, practices used for projects alike in the past, the variables and parameters considered, and so forth. The description and conclusions of **7.2.5** of this volume concerning calculation of EIRR for the Component "B" of the Coastal Protection and Rehabilitation Project at Mamaia Sud and Eforie Nord should be read in this context.

insist of setting EIRR at 12 percent as an economic viability criterion. p.23

[12] ADB, *op. cit.*, 1987, p.22

Appendix I: Indicative TOR for PIU and FIDIC Contracting Method

It would be too early at the time of feasibility study to precisely devise the terms of reference (TOR) for PIU because of administrative and managerial uncertainty that would constrain further discussions on the issue. By consequence, this Appendix provides the baseline framework for PIU management and operation so that the issue could be further elaborated by the time when the political decision on PIU will be made sometime in the days that come. In addition, the outline view of the contracting methods of *The Federation Internationale de Ingenieurs-Conseils* (*FIDIC*) is introduced herewith for reference.

I.1 Responsibilities of PIU

I.1.1 General

Project Implementation Unit (PIU) is an autonomous body under the coordination of the Water Directrate Dobrogea Littoral (DADL), and responsible for overall project implementation activities inclusive of technical designing, procurement, fund management and financial reporting, progress monitoring and reporting, and others of relevance.

I.1.2 Specific TOR for PIU

Specifically, PIU *will be liable, but not limited, to the following activities*:

(1) Administrative responsibilities

- Ensure adequate conditions for the operation of PIU
- Procure, in close consultation with DADL Human Resources Department, qualified staff for the Unit
- Properly maintain all of the goods and equipments under the project finance physically and administratively;
- Organize archive and ensure audit trail in compliance with relevant rules and regulations that come;
- Organize technical library, as necessary, resulting from the project (standards, norms, leaflets etc), and
- Others of close relevance

(2) Managerial responsibilities

- Devise a project implementation plan including a system for cash flow reporting to reflect planned and actual cash-flow projections;
- Prepare procurement procedure in due process in close consultation with the consultant team to be employed;
- Prepare, in close consultation with the consultant team, contract awarding and/or final concurrence and approval from supervising authorities and external financier(s);

- Comply with the Romanian public procurement laws and contracting guidelines attached to financier(s);
- Monitor and evaluate project performance in implementation and public relations;
- Prepare and submit the project implementation, as well as financial and fund management reports to supervising authorities, through DADL, REPA/LEPA, for final approval from external financier(s);
- Keep in mind the implement fund management and financial reporting on a timely and accountable basis;
- Establish adequate quality control procedures in reviewing and endorsing payment certificates received from consultants; and
- Keep DADL management fully abreast of development of project implementation and performance.

(3) Technical and engineering aspects

- Devise and update as necessary, in close consultation with the consultant team, the technical plan for project implementation inclusive of goods and services, equipment and machineries in need and the trimming for procurement;
- Undertake and supervise consultants in day-to-day technical operations including supervision of construction and maintenance works;
- Comply with procurement rules and regulations as agreed upon amongst the stakeholders and external financier(s) and stipulated in any forms of guidelines and/or manuals;
- Prepare and submit technical progress reports timely and sufficiently in substance; and
- Devise medium- and long-term coastal protection plans and specific investment measures that will follow the Mamaia Sud and Eforie Nord projects currently in place.

(4) Project Closure

- Ensure consultant's performances in line with contractual responsibilities and tasks;
- Ensure all of the financial settlements in personnel and contractual management;
- Maintain proper inventory system of all engineering and office equipment / machineries/goods;
- Transfer expeditiously the property right of equipment/machineries in accordance with implementation documents;
- Devise, in consultation with the consultant team, technical drawings and operation manuals to the parties of close relevance, inclusive of DADL, REPA/LEPA and/or MoEWM; and
- Prepare and submit final report for final approval and clearance of PIU at the end of project implementation.

(5) PIU limits of competence

- Limit of competence of PIU will be set in compliance with the Romanian laws of relevance and approved by stakeholder parties inclusive of DADL Management,

Board/REPA/LEPA, MoEWM, and/or MoPF;

- For decisions outside the limit of competence, PIU Project Manager (PM) will first obtain the Steering Committee/Beneficiary authorized decision prior to communicating with requesting party for PIU decision;
- MoPF (CFCU) will be a certifying authority in all of the phases of procurements and financial settlements, while PIU will hold authority in withdrawals of budget proceeds from the project bank accounts, through the approval of DADL and MoEWM, and payments provided that PIU receives invoices from contractors. Consultants will verify procurement procedures; and
- PIU will all the time maintain documents and reports as appropriate in the light of fund management inclusive of bill of bank accounts, invoices, and statements of expenditures (SOPs).

I.2 Indicative TORs for PIU Specialists[1]

While specific clauses of the terms of reference (TOR) specifically applied to each of the prospective experts in PIU largely depend on discussions between the Government of Romania and external financier(s), an indicative TOR for specialists is provided for elaboration and specification hereupon. As suggested and depicted in Chapter 8, professional staff required for the Unit comprises in aggregate eleven (11) members, and by expertise those include: 1) Project Manager (PM), 2) Deputy PM, 3) Internal Auditor, 4) Administration, 5) Finance and Accounting, 6) Procurement, 7) Performance Monitoring and Evaluation, 8) Environment, and 9) Engineering – Civil and Hydro-technical[2].

I.2.1 Project Manager (PM) and Deputy Project Manager (DPM)

Tasks and responsibilities of PM and DPM may include, but not limited to, the followings:

- Administrate and coordinate all aspects of the activities prior to and during project implementation;
- Facilitate activities carried out by PIU professional and supporting staff in their needs;
- Devise the Project Implementation Plan for approval and submit to MoEWM, MoPF, and eventually the prospective external financier(s) through DADL and REPA/LEPA,;
- Supervise procurement and financial management, in close consultation with internal auditor and consultant team as necessary, in due process;
- Administrate expenditures of project fund proceeds on an accountable and transparent base
- Devise the Project performance monitoring system with a set of performance indicators as agreed upon among the stakeholders;

[1] References: MoEWM, *Regulations and Functions of the PMU "Agricultural Pollution Control Project"*, 2004, MoEWM, *TOR for Project Implementation Unit, Instrument for Structural Policies for Pre-Accession*, 2003

[2] Unlike other professional sections, three (3) technical experts comprise this site supervision and engineering section, thus totaling to the number of 11 professionals.

- Prepare progress and financial reports to MoEWM, MoPF, and eventually to financier(s) through DADL and REPA/LEPA;
- Endorses all procurement contracts and ensures the full compliance with procurement procedures and submit eventually to MoPF for authorization (PM); and
- Devise and prepare, in collaboration with MoEWM and DADL, the medium-term implementation plan for coastal protection

I.2.2 Internal Auditor (Compliance and Performance Auditing)

Tasks and responsibilities of the internal auditor may include, but not limited to, the followings:

- In close consultation with PM and Performance Monitoring and Evaluation specialist, and the consultant team, help to devise the project performance monitoring system with a set of performance indicators as agreed upon among the stakeholders;
- Supervise and audit expenditures of project fund proceeds on an accountable and transparent base;
- Prepare and submit audit report(s) to MoEWM, MoPF, and eventually to financier(s) through DADL and REPA/LEPA, and
- Liaise with external auditors, and advise PM/DPM, as necessary, of measures on the issues of financial and performance management, as appropriate;

I.2.3 Administration

Tasks and responsibilities of the administration may include, but not limited to, the followings:

- Assist PM/DPM and professional/supporting staff members of PIU in ensuring efficient and smooth implementation of day-to day activities;
- Keep records of all project documents for supervision and verification;
- Coordinate all aspects of the administrative matters while ensuring logistic supports as appropriate;
- Prepare and submit project Administration Reports as agreed upon among stakeholders;
- Prepare seminars and meetings connected with all aspects of Project activities, prepares the schedule and the minutes of such meetings as a secretariat;
- Ensure the technical maintenance and control of the communication means and devices;
- Ensure proper book keeping, filing, and reporting system within PIU for external concurrence and authorization; and
- Liaise with DADL, consultant team, REPA/LEPA, civil society, ministries, and external financier(s) as necessary, in such a way that the project expeditiously be implemented.

I.2.4 Finance and Accounting

Tasks and responsibilities may include, but not limited to, the followings:

- Takes part in the preparation of Financial Plan and budgeting in consultation with consultant team;
- Undertake day-to-day funding operations as financial manager cum controller, and keep transaction records as appropriate;
- Assist PM/DPM in the settlement of project expenses while securing due process of payments as agreed upon between MoPF/MoEWM and external financier(s);
- Keep records of statements of expenditure (SOPs) as requested by supervising authorities within Romania and external financier(s);
- Sign endorsement documents of project bank accounts for payments
- Administrate project fund proceeds in the bank accounts and keeps financial records as appropriate; and
- Prepare, in close consultation with Internal Auditor, periodical audit reports in time in due process for approval and authorization from MoEWM, MoPFP, and eventually external financier(s).

I.2.5 Procurement

Tasks and responsibilities may include, but not limited to, the followings:

- Devise, in close consultation with PM/DPM/Engineering experts as appropriate, and update Procurement Plan;
- Prepare, in close consultation with engineering experts, tenser documents, technical specifications, and other administrative papers for procurement in compliance with procurement guidelines and internal laws;
- Undertake procurement procedure inclusive of public notification, preparation of selection committee, selection guidelines;
- Undertake the role of Secretariat to Procurement Selection Committee, as necessary;
- Prepare contract documents in compliance with the operational framework that is agreed upon between the government of Romania and external financier(s);
- Ensuring procurement in due process in the basis of transparency and accountability;
- Prepare documents for periodical revision of procurement plan;
- Prepare Procurement Monitoring Reports and verifies the achievements of the sub-contractors;
- Submit Procurement Reports on time to MoEWM/MoPF and external financier(s) through DADL, REPA/LEPA;
- Keep procurement records in accordance with the categories of expenses; and
- Liaise with external auditors, and advise PM/DPM, as necessary, of measures on procurement issues.

I.2.6 Performance Monitoring and Evaluation

Tasks and responsibilities may include, but not limited to, the followings:

- Devise, in close consultation with PM and Internal Auditor as well as oversighting agencies, a project performance and monitoring system with which all of the ensuing monitoring and evaluation operations should comply;
- Undertake project performance monitoring and evaluation in due process, and prepare reports for verification and authorization;
- Assist Project Environment specialist in preparation of Environment Management Plan;
- Verify, in close consultation with the internal auditor and procurement specialist, the needs for procurement of goods and services, while taking in view environment protection;
- Assist REPA/LEPA, civil society and other agencies of close relevance in publicly disseminate information on project implementation and socio-economic impacts on the region; and
- Coordinate, in close consultation with PM/DPM, the consultant team, and other professional staff as appropriate, in the preparation of seminars, training sessions and study tours for PIU members and civil society.

I.2.7 Environment

Tasks and responsibilities may include, but not limited to, the followings:

- Devise and prepare Environment Management Plan which complies with the Romanian environmental protection laws in force;
- Assist, together with PM, DADL in administration of the environmental monitoring program, record and analyze the monitoring results, and prepare the monitoring reports at a prescribed interval;
- Administer, in close consultation with PM, Performance Monitoring and Evaluation and relevant authorities, the training program for the personnel involved in the operation on the environmental facilities and monitoring system;
- Prepare synthetic reports on the environmental status in and around the project sites at a prescribed interval and submit them to REPA/LEPA; and
- Direct, together with PM, appropriate measures in case of environmental accidents such as spilling of oils during construction works.

I.2.8 Site Supervision and Engineering

Tasks and responsibilities may include, but not limited to, the followings:

- Devise and update as necessary, in close consultation with the consultant team, the technical plan for project implementation inclusive of goods and services, equipment and machineries in need and the trimming for procurement;
- Undertake and supervise consultants in day-to-day technical operations including supervision of construction and maintenance works;

- Assist Procurement in preparation and updating of Procurement Plan which complies with procurement rules and regulations as agreed upon amongst the stakeholders and external financier(s) and stipulated in any forms of guidelines and/or manuals;
- Prepare and submit, in close consultation with PM, technical progress reports timely and sufficiently in substance;
- Assist, together with PM, DADL for administration of the geophysical monitoring program;
- Review and analyze the results of beach monitoring program for detection of the changes in the beach volume and shoreline position at a regular interval;
- Review and analyze the wave and water level measurement data for preparation of the medium-term implementation plan for coastal protection; and
- Assist PM for devising and preparing the medium-term implementation plan for coastal protection.

I.3 FIDIC Contracting Method (Outline View)

The outline view of contracting arrangement within the framework of the *Federation Internationale de Ingenieurs-Conseils, FIDIC*) will be provided in this section, while holding some reservations on citing the clauses contract methods at this moment in time[3]. It would be more appropriate to specifically design and proceed with contract methods, when the project will have commenced and the managerial issues that arise for consideration also become evident. It would also noted that each of financiers, inclusive of EU, WB, and/or others of relevance, has their own procurement guidelines that also defines the institution's basic policy on procurement and contracts. These guidelines normally supercedes the laws, regulations, and practices that in place in fund-recipient country, thus making it commendable to discuss contracting methods on a case-by-case basis with financier and MoPF in the days that come.

(a) *Dredging and reclamation works – "Dredgers Contract"*

The aim of this book has been to produce a straightforward document which includes all the essential commercial provisions, and which may be used for all types of dredging and reclamation works and ancillary construction with a variety of administrative arrangements. Under the usual arrangements for this type of contract, the Contractor constructs the Works in accordance with design provided by the Employer. The General Conditions are expected to cover the majority of contracts. Thus, the users will be able to introduce Particular Conditions if they wish, to cater for special cases or circumstances. The General Conditions and the Particular Conditions will together comprise the Conditions governing the rights and obligations of the parties. To assist in the preparation of tender documents using these Conditions, Notes for Guidance are included.

[3] While contracting methods within the framework of FIDIC was suggested by MoEWM officials, difficulties in elaboration of this issue was encountered by the Study team because of non-free publications of these FIDIC Guidelines. With this in view, discussions would be further detailed and substantiated at the time of the preparation of proposal documents to be prepared for EU, should the occasion arise.

(b) *Employer design – "Red Book"*

The Fourth Edition of the Conditions of Contract for Works of Civil Engineering Construction is for the purpose of construction of such works where tenders are invited on an international basis. The Conditions are also suitable for use on domestic contracts. The Conditions comprise some Clauses which will be generally applicable as well as some Clauses which must necessarily vary, to take account of the circumstances and locality of the Works.

i) Construction contract

FIDIC is publishing First Editions of the new standard forms of contract:

(i) Conditions of Contract for Construction, which are recommended for building or engineering works designed by the Employer or by his representative,

(ii) Conditions of Contract for Plant and Design-Build, which are recommended for the provision of electrical and/or mechanical plant, and for the design and execution of building or engineering works.

Conditions of Contract for EPC/Turnkey Projects delineate the case of one entity taking total responsibility for the design and execution of an engineering project. Under the usual arrangements for this type of contract, the entity carries out all the Engineering, Procurement and Construction: providing a fully-equipped facility, ready for operation (at the "turn of the key"). This type of contract is usually negotiated between the parties: Short Form of Contract, which is recommended for building or engineering works of relatively small capital value. Depending on the type of work and the circumstances, this form may also be suitable for contracts of greater value, particularly for relatively simple or repetitive work or work of short duration. The forms are recommended for general use where tenders are invited on an international basis. Modifications may be required in some jurisdictions, particularly if the Conditions are to be used on domestic contracts.

In the preparation of these Conditions of Contract for Construction, it was recognized that, while there are many sub-clauses which will be generally applicable, there are some sub-clauses which must necessarily vary to take account of the circumstances relevant to the particular contract. The sub-clauses which were considered to be applicable to many (but not all) contracts have been included in the General Conditions, which will facilitate their incorporation into each contract. The General Conditions and the Particular Conditions will together comprise the Conditions of Contract governing the rights and obligations of the parties. It will be necessary to prepare the Particular Conditions for each individual contract, and to take account of those sub-clauses in the General Conditions which mention the Particular Conditions. For this publication, the General Conditions have been prepared on the following basis:

(i) Interim and final payments will be determined by measurement, applying the rates and prices in a Bill of Quantities,

(ii) If the wording in the General Conditions necessitates further data, then (unless it is so descriptive that it would have to be detailed in the Specification) the sub-clause makes reference to this data being contained in the Appendix to Tender, the data either being prescribed by the Employer or being inserted by tenderers, and

(iii) Provided that sub-clause in the General Conditions deals with a matter on which different contract terms are likely to be applicable for different contracts, the principles applied in writing the sub-clause are; (a) users would find it more convenient if any provisions which they do not wish to apply could simply be disregarded or deleted, than if additional text has to be written (in the Particular Conditions) because the General Conditions do not cover their requirements or (b) in other cases, where the application of (a) is thought to be inappropriate, the sub-clause contains the provisions which are considered applicable to most contracts.

ii) Tendering procedures

"*Tendering Procedure*" presents a systematic approach to the selection of tenderers and their evaluation. In order to clarify the sequence of Contract activities, reference may be made to the Sub-Clauses listed below (some Sub-Clause numbers are also stated in the charts).

- 1.1.3.1 & 13.7: Base Date
- 1.1.3.2 & 8.1: Commencement Date
- 1.1.6.6 & 4.2: Performance Security
- 1.1.4.7 & 14.3: Interim Payment Certificate
- 1.1.3.3 & 8.2: Time for Completion (as extended under 8.4)
- 1.1.3.4 & 9.1: Firsts on Completion
- 1.1.3.5 & 10.1: Taking-Over Certificate
- 1.1.3.7 & 11.1: Defects Notification Period (as extended under 11.3)
- 1.1.3.8 & 11.9: Performance Certificate
- 1.1.4.4 & 11.9: Final payment Certificate

Meanwhile, the terms of *the Conditions of Contract for Construction* have been prepared and are recommended for general use for the purpose of the construction (excluding most of design works) of building or engineering works where tenders are invited on an international basis. Modifications to the Conditions may be required in some legal jurisdictions, particularly if they are to be used on domestic contracts. Under the usual arrangements for this type of contract, the Contractor constructs the works in accordance with design details provided by the Employer or his representative, the Engineer.

In the preparation of *the Conditions of Contract* to be included in tender documents, the following text can be used:

> *The Conditions of Contract comprise the "General Conditions", which form part of the "Conditions of Contract for Construction" First Edition 1999 published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC), and the following "Particular Conditions", which include amendments and additions to such General Conditions.*

(c) *Consultant agreement – "White Book"*

The terms of the Client/Consultant Model Services Agreement (*The White Book)* recommends the general use of pre-investment and feasibility studies, designs and administration of construction and project management, where proposals for such services are invited on an international basis. They are equally adaptable for domestic agreements. FIDIC has published the "White Book Guide" which includes comments on clauses in the Model Services

Agreement and notes towards the preparation of Appendices A, B and C ("Scope of Services," "Personnel, Equipment, Facilities and Services of Others to be Provided by the Client" and "Remuneration and Payment").

(d) *Electrical and mechanical work – "Yellow Book"*

FIDIC's First Edition on the above includes the following four new standard forms of contract:

- Conditions of Contract for Construction, which are recommended for building or engineering works designed by the Employer or by his representative, the Engineer. Under the usual arrangements for this type of contract, the Contractor constructs the works in accordance with a design provided by the Employer. However, the works may include some elements of Contractor-designed civil, mechanical, electrical and/or construction works.
- Conditions of Contract for Plant and Design-Build, which are recommended for the provision of electrical and/or mechanical plant, and for the design and execution of building or engineering works. Under the usual arrangements for this type of contract, the Contractor designs and provides, in accordance with the Employer's requirements, plant and/or other works; which may include any combination of civil, mechanical, electrical and/or construction works.
- Conditions of Contract for Engineering, Procurement and Construction (EPC) Turnkey Projects, which are recommended where one entity takes total responsibility for the design and execution of an engineering project. Under the usual arrangements for this type of contract, the entity carries out all the Engineering, Procurement and Construction: providing a fully-equipped facility, ready for operation (at the "turn of the key"). This type of contract is usually negotiated between the parties.
- Short Form of Contract, which is recommended for building or engineering works of relatively small capital value. Depending on the type of work and the circumstances, this form may also be suitable for contracts of greater value, particularly for relatively simple or repetitive work or work of short duration. Under the usual arrangements for this type of contract, the Contractor constructs the works in accordance with a design provided by the Employer or by his representative (if any), but this form may also be suitable for a contract which includes, or wholly comprises, Contractor-designed civil, mechanical, electrical and/or construction works.

The forms are recommended for general use where tenders are invited on an international basis. Modifications may be required in some jurisdictions, particularly if the Conditions are to be used on domestic contracts.

In the preparation of these Conditions of Contract for Plant and Design-Build, it was recognized that, while there are many sub-clauses which will be generally applicable, there are some sub-clauses which must necessarily vary to take account of the circumstances relevant to the particular contract. The sub-clauses which were considered to be applicable to many (but not all) contracts have been included in the General Conditions, which will facilitate their incorporation into each contract. The General Conditions and the Particular Conditions will together comprise the Conditions of Contract governing the rights and obligations of the parties. It will be necessary to prepare the Particular Conditions for each individual contract, and to take account of those sub-clauses in the General Conditions which mention the Particular Conditions.

(e) *Design-build, turnkey type of contract – "Orange Book"*

There are no universally accepted definitions of the terms "design-build" and "turnkey," except that both involve the Contractor's total liability for design. For the Employer, such single-point responsibility may be advantageous, but the benefits may be offset by having less control over the design process and more difficulty in imposing varied requirements.

The Conditions are also intended for use on turnkey contracts, under which the Employer's requirements usually include provision of a fully-equipped facility, ready for operation (at the turn of the "key"); such contracts are often contractor-financed. Turnkey contracts typically include design, construction, fixtures, fittings and equipment, the scope of which would be defined in other contract documents. In addition, the contract may impose a requirement for the Contractor to operate the Works, either for a few months' commissioning period, or for some years' operation on a build-operate-transfer contract. Advice on turnkey arrangements is included in Part II of the Orange Book, together with sample wording for contractor-finance.

(f) *Representative agreement*

The terms of the FIDIC Model Representative Agreement is for Consultants wishing to enter into a contract with a Representative for the provision of services in a foreign country.

Following the Agreement, the clauses of general application have been grouped together in this publication and are referred to as General Conditions. They are intended for incorporation as printed in the documents comprising the Agreement.

The General Conditions are linked with the data given in the Particular Conditions, identified by the corresponding numbering of the sub-clauses, and Appendices, so that General Conditions and Particular Conditions (with Appendices) together comprise the conditions governing the rights and obligations of the Parties. Given as Appendices to the Particular Conditions are Scope of Services, Basis for Remuneration, Consultant's Code of Conduct and Consultant's Business Integrity Policy Statement.

(g) *Tendering procedure*

The FIDIC *Tendering Procedure* applies to the *1992 Yellow Book* and the *1978 Red Book* Contracts. These have been replaced by *the 1999 Design-Build and Construction Contracts.* The *FIDIC Contracts Guide* for these new 1999 contracts gives advice on tendering procedures for users of these contracts.

In view of wide acceptance and acknowledged usefulness of the first edition, it was further decided to retain, as far as possible, the basic layout and format in order that users of the document would still be familiar with the procedures described. Much of the up-dating work has involved modification of terminology and procedures to make the document equally applicable in respect of both civil works and electrical and mechanical projects. In addition, the document more closely reflects the procedures recommended by international financing institutions (IFIs), and draws attention to those areas where IFIs' provisions are mandatory.

The document provides a freedom and flexibility which is not found in all similar documents. This means that the procedures described can be adapted and used in conjunction with, for example, procedures normally adopted by employers or required by international financing

institutions. Users should however be aware of prevailing requirements and/or restrictions introduced when using parallel procedures and ensure that all mandatory provisions of such procedures are properly incorporated.