

Executive Summary

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A. Background of Project for Coastal Protection Planning

Romania has a territorial coastline extending over about 240 km along the northwestern side of the Black Sea. In the past several decades, however, the Romanian Black Sea shore has been suffering from serious beach erosion problems. The northern unit of the Romanian coastal area, which is designated as the Danube Delta Biosphere Reservation, is most affected, but its southern unit is also in danger where the economical activity is strong, including the tourism industry.

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. A project for the protection and rehabilitation of the southern Romanian Black Sea shore is urgently needed. Upon the request of the Government of Romania, the Government of Japan decided to make a technical cooperation for the Study on Protection and Rehabilitation of the Romanian Black Sea Shore (hereinafter referred to as “the Study”) through the Japan International Cooperation Agency (hereinafter referred to as “JICA”).

The Study was undertaken since March 2005 by a team of experts contracted by JICA and will be concluded in September 2006 by submission of the Final Report. The present Interim Report summarizes the outcome of the Study up to February 2006.

B. Objectives of Coastal Protection Planning

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. The Study by JICA has the objectives of formulating a coastal protection plan aimed at the year 2020 and making a preliminary design on priority projects so that the Government of Romania will be able to implement the coastal protection project with appropriate funding.

The coastal protection plan is to provide a long-term strategy for protection and rehabilitation of the southern Romanian Black Sea shore. Analysis is made of the physical conditions in the area from Cape Midia to Vama Veche (hereinafter referred to as “the Study area”), inclusive of the state of beach erosion and its mechanism, for rational planning of coastal protection measures. Based on the urgency of protection and rehabilitation for various sectors in the Study area, a time schedule of project implementation in various sectors is proposed. Selection is made for the areas that are provided with the earliest project implementation, i.e. priority projects.

C. Physical Conditions of the Study Area

C.1 Geological and Geomorphological Features (Section 3.1)

The Study area is divided into the northern sub-unit and the southern sub-unit with the boundary at Cape Constanța. The beaches in the northern sub-unit are mainly composed of terrigenous fine sand supplied by the Danube, having been transported over 200 km by wave-induced longshore currents. Shell fragments are the secondary source of beach sand. A 13-km long barrier beach of Navodari and Mamaia is present between Cape Midia and Cape Singol. Further south between Cape Singol and Cape Constanța the coast is made of narrow beaches and low cliffs, some of which are in dangerous state of collapse by geotechnical

failure.

The southern sub-unit between Cape Constanța and Vama Veche is essentially a cliff coast with several barrier beaches in front of seaside lakes, which were land-locked by alongshore transport of sediment in the past. Beach sand is made of shell fragments supplemented by fragments of limestone at the base of cliffs. No trace of terrigenous sand from the Danube is found in the southern sub-unit.

C.2 Wind and Wave Conditions (Sections 3.2 and 3.4)

Winds mainly blow from the northern sector in winter and from the southern sector in summer, but they are not consistent in the direction. The mean wind speed in Constanța is about 5 m/s, while the 90% and 99% non-exceedance speed are about 10 and 15 m/s, respectively.

Waves follow the wind direction, but large waves are mainly from the northeastern sector with the secondary sector of the southeast. Waves are highest in December and January, while they are lowest in June and July. The mean height of the significant waves during winter is 1.2 m, while it is 0.8 m in summer. The energy averaged waves, which are used for sediment transport computation, is 1.65 m in height and 6.2 s in period from the azimuth N64°E, and 1.11 m in height and 6.2 s in period from the azimuth N115°E. The 90% and 99% non-exceedance significant wave height are 1.8 m and 3.6 m, respectively.

The waves with the return period of 100 years are estimated as 7.8 m in height and 11.0 s in period. The values refer to those of the significant waves, the height of which is defined as the average of the highest one-third waves. The single highest wave in 100 years may go up to 14 m.

C.3 Tide and Water Level (Section 3.3)

The astronomical tide is very small. The mean amplitude of spring tide (sum of the amplitudes of principal lunar and solar semidiurnal components) is 2.0 cm in Constanța and 2.5 cm in Mangalia. However, the mean water level fluctuates widely: the highest and lowest water levels (daily mean) ever recorded in Constanța are 0.90 m and -0.30 m, respectively. The mean monthly highest water level (HWL) is 0.38 m, while the mean monthly lowest water level (LWL) is 0.13 m. The causes of large fluctuation of mean water level are unknown.

The annual mean water level in Constanța has steadily rising since the start of the water level observation in 1933 with the mean rate of 2.2 mm/year, which is much larger than those at the stations along the oceans. This rate of the mean water level rise is equivalent to the shoreline retreat rate of -0.18 m/year at Mamaia and -0.08 m/year at Costinești.

C.4 Beach Erosion and Its Mechanism (Chapter 4)

The rate of the shoreline position change has been analyzed from the shoreline survey data by the National Institute for Marine Research and Development "Grigore Antipa" and various topographic maps in the past. Examples of the shoreline change rate (average of respective area) are listed below; a negative value indicates erosion.

Mamaia North	-0.4 m/year
Mamaia South	-2.0 m/year
Tomis	-0.2 m/year
Eforie Middle	-0.7 m/year
Eforie Sud	-0.6 m/year
Tuzla	-0.7 m/year
Costinești	±0.0 m/year
Olimp – Venus	-0.5 m/year
Saturn – Mangalia	-0.8 m/year
2 Mai	-0.6 m/year
Vama Veche	-0.7 m/year

The severest erosion is taking place in the southern part of Mamaia, where the shoreline will retreat more than 70 m in the coming twenty years if no countermeasures are undertaken.

The mechanism of beach erosion differs in the northern and southern sub-units of the southern Romanian Black Sea shore. The major cause of beach erosion in the northern sub-unit is the impoundment of terrigenous sand by the north breakwater of Midia Port, which was extended to the depth of -10 m since 1977. Sand transported southwestward by wave-induced longshore currents was stopped at the breakwater and could not move further toward Navodari and Mamaia. Decrease of the sediment discharge of the Danube contributed to deficiency of sediment supply to the northern sub-unit. Along the long beach of Mamaia, the alongshore sediment transport by waves is estimated as 160,000 m³/year northward and 140,000 m³/year southward, which results in the net northward transport rate of about 20,000 m³/year. This net transport of sediment without new supply is the reason of intensive beach erosion at the south of Mamaia. Sediment transported northward is eventually carried away by the cross-shore currents offshore and lost from the shore area.

The coastal erosion in the southern sub-unit is not as severe as that in Mamaia, except for the area of Balta Mangalia and the soft cliff area of Limanu. Most of the cliff coasts are receding with the rate of about 0.6 m/year for many years, which seems to be the natural process of this sub-unit. With recess of cliff lines, adjacent beaches have to retreat, which is beach erosion. Imbalance between the northward and southward sediment transport also causes local beach erosion, and there is a cross-shore loss of sediment.

D. Outline of Coastal Protection Plan

D.1 Strategy of Coastal Protection and Rehabilitation (Section 5.5)

The shoreline of the Study area has been provided with various protective facilities such as seawalls, groins, and detached breakwaters. There were occasional beach fill operations such as that carried out in Mamaia beach fill in 1989. However, the majority of existing protective facilities have been deteriorated and not functioning properly. Most of groins are short and were laid out in close proximity, creating narrow water areas and short beaches. Poor state of water circulation and exchange in these narrow water areas has contributed to the water pollution problems along the beach, even though the culprit is eutrophication owing to insufficient treatment of waste water.

The strategy to remedy the problems of beach erosion and water pollution is as follows:

- 1) Make large-scale beach fills (nourishment) to solve beach erosion and to create new beach areas;
- 2) Protect newly nourished beaches with long jetties and offshore submerged breakwaters (artificial reefs);
- 3) Jetties are extended to the depth of 4 to 5 m so that a major part of longshore sediment transport could be confined within the cell between two jetties.
- 4) Jetties are laid out with wide spacing of several hundred meters so that long beaches are formed and good water circulation would be maintained.
- 5) Submerged breakwaters would restrict the offshore movement of sediment so that the maintenance supply of beach fill sand would be minimized.
- 6) Deteriorated, detached breakwaters in Mamaia, which have lost their wave damping function owing to settlement of their crown, are rehabilitated with backing of rubble mounds, the tops of which are armored with stabilopods.
- 7) Majority of existing groins and submerged breakwater are demolished and removed for safety of beach visitors and aesthetic reasons. The demolished materials are recycled as the core material of new jetties and artificial reefs.

D.2 Scope of Coastal Protection Plan (Sections 5.6 and 5.8)

The areas to be provided with beach fill and various shore protection facilities have been selected on the basis of the urgency of coastal protection, the state of coastal utilization, the necessity of environmental preservation, and other considerations. The following areas are to be implemented with projects in due course:

- 1) Mamaia South: beach fill and rehabilitation of two detached breakwaters;
- 2) Mamaia Center: rehabilitation of four detached breakwaters;
- 3) Tomis North, Center and South: beach fill, long jetties and artificial reefs;
- 4) Eforie Nord: beach fill, long jetties and artificial reefs;
- 5) Eforie Middle: beach fill, long jetties and artificial reefs;
- 6) Eforie Sud: beach fill, long jetties and artificial reefs;
- 7) Olimp – Venus: beach fill, long jetties and artificial reefs;
- 8) Saturn – Mangalia: beach fill, long jetties and artificial reefs.

The cliff coasts of Tuzla and 23 August are left without protective measures, because land use behind the cliff seems not productive enough to assure sufficient benefit to balance the project cost. The area from 2 Mai to Vama Veche has a marine natural reserve of 5000 ha between the isobaths of 2 and 20 m, which preserves the richest benthic association in the western part of the Black Sea. Because the wide beaches there can tolerate the present rate of erosion for a certain length of time to come, no shore protection project is proposed in this area. The beach of Costinești has been stable without suffering from any erosional problem, and no project is needed there.

The total quantity of various shore protection and rehabilitation facilities and their estimated net cost of construction works are listed below.

Breakwater rehabilitation:	1,500 m in total	15,000 thousand Euros
Jetties and groins:	6,700 m in total	74,000 thousand Euros
Artificial reefs:	4,100 m in total	65,000 thousand Euros
Beach fill:	3,200,000 m ³ in total	82,000 thousand Euros
Removal of existing facilities etc.:		13,000 thousand Euros
Net construction cost:		249,000 thousand Euros
Total cost of coastal protection plan:		316,000 thousand Euros

The volume and cost of beach fill is based on the condition that the river sand of the Danube can be dredged and utilized for the coastal protection plan. If the sea sand to be mined from the seabed off east of Midia Port is used, the required volume will be increased twice or more, because the sea sand is of fine grain size and the beach fill profile become much milder than the case using coarse river sand.

The total cost of 316 million Euros for the overall coastal protection plan is the net construction cost added with the expenses for feasibility studies, engineering services including detailed designs, operational and maintenance cost, and contingency. The cost is an approximate one based on the price in 2005, and thus it does not include the price contingency.

D.3 Implementation Schedule (Section 5.8)

Originally the coastal protection plan for the southern Romanian Black Sea shore was aimed to be completed by the year 2020. However, in consideration of the required volume of construction materials and the estimated total cost, it is proposed to extend the target year to a later date by dividing the plan into two stages: the first stage from 2007 to 2020 and the second stage after 2021. The first stage is further divided into three phases. The areas to be included in each phase and the project cost are as listed in Table ES-1.

Table ES-1: Implementation schedule

Stage	Phase	Year	Area	Project cost (million Euros)
First	First	2007 – 2010	Mamaia, Eforie Nord (part)	44
	Second	2011 – 2015	Mamaia Center (part), Tomis North, Eforie Middle	64
	Third	2016 – 2020	Mamaia Center (part), Tomis Center, Eforie Nord (part), Eforie Sud (part)	73
	overall	2007 - 2020	Mamaia to Eforie Sud (part)	181
Second	overall	After 2021	Tomis South, Eforie Sud (part), Olimp – Venus, Saturn – Mangalia	135

During the first stage, a certain amount of rehabilitation works for the areas from Olimp to Mangalia should be planned.

D.4 Priority Projects (Chapter 6)

The projects earmarked in the first phase of the first stage are the priority projects that will be implemented in the areas of Mamaia South and a part of Eforie Nord. In Mamaia South, two southernmost breakwaters are rehabilitated with backing of rubble mounds and stabilopods armoring and a beach fill is executed with 180,000 m³ of river sand. A sand-retaining groin of 200 m long and three submerged groins of 100 m long each are constructed. In case of sea sand for beach fill, the sand volume is increased to 460,000 m³ and an underwater dike of 1,200 m long to retain the filled sand must be constructed.

In Eforie Nord, the area with the alongshore distance of 1,200 m at the north side of the marina “Yacht Club Europa” is to be protected with two long jetties, two artificial reefs and a beach fill with 330,000m³ of river sand. In case of sea sand for beach fill, the sand volume is increased to 740,000 m³ and an underwater dike of 1,200 m long must be constructed.

The feasibility study of the priority projects at Mamaia South and Eforie Nord will be carried out in May to June, 2006 and presented in the Final Report to be submitted in September 2006.

D.5 Environmental and Social Considerations (Chapter 7)

The stakeholder meeting has been held thrice in Constanța and twice in Bucharest from June to November 2005. Outline of the Study and the on-going planning of coastal protection and rehabilitation were presented to the participating stakeholders, who were asked to make screening of the items of significant influence on environment and society. Unfamiliarity of stakeholders with the nature of coastal protection works hampered efficient screening processes, but eventually twelve items cited in the JICA guidelines were considered as the class B, having probable impacts.

Based on the screening of the influential items, a study of initial environmental examination of the coastal protection plan was commissioned to the National Institute of Marine Geology and Geo-ecology. The twelve screened items were examined for their nature and degrees of impacts such as those direct or indirect, temporal (during construction) or permanent, local or regional, mitigable fully or partially, and monitoring capable fully or partially. The degrees of impact were assessed for eight coastal units within the study area on the twelve screened items. The report of the initial environmental examination of the coastal protection plan provides the basis of the Strategic Environmental Assessment (SEA), which will be undertaken by the Romanian authority concerned from March 2006.

One item unresolved yet is the influence of sand mining from the riverbed of the Danube on the ship navigability owing to a slight possibility of unfavorable changes in riverbed bathymetry. Examination of any harmful materials that might be contained in beach fill sand from the riverbed and/or the seabed also needs to be conducted during the Environmental Impact Assessment (EIA).

The priority projects at Mamaia South and Eforie Nord require EIA, which will be initiated in March 2006. The terms of reference for EIA are being prepared by the Study team and is scheduled to be forwarded to the Romanian authority concerned.

D.6 Institutional Aspects and Monitoring Plan (Sections 8.1 and 8.2)

The coastal protection plan has to be administered for a long period of time, say more than 20 years, because of the limited financial resources available in Romania and the long coastline to be protected. To ensure the realization of the coastal protection plan, there should be established a special coastal administrative unit within the Ministry of Environment and Water Management (MoEWM) in charge of coastal protection and rehabilitation. At the same time, the corresponding sections should be established in the National Administration Romanian Waters (ANAL) and the Water Directorate Dobrogea Litoral (DADL).

The coastal administrative unit together with the corresponding sections will be charged with the responsibility of effective and efficient execution of the coastal protection plan consecutively year after year. They will also be responsible for preparing and executing the plans for monitoring geophysical, environmental, and structuring aspects of the coastal areas. Undertaking of timely operations for maintenance beach fill is also necessary, because mitigation against beach erosion always requires maintenance works.

D.7 Project Affordability (Section 8.4)

Affordability, that is a successful implementation of the coastal protection plan of the southern Romanian Black Sea shore, entirely depends on the availability of correct amount and timely disbursement of funds needed for the implementation of individual projects contained in the overall plan. Survey has been made of the presently available external resources such as EU and the World Bank, and preliminary analysis has also been undertaken on the budgetary position of MoEWM and financial position of ANAR and DADL. At this moment in time, policy environment for the project affordability both at the macro- and micro-levels could favorably evaluated, but it requires further analysis in the later stage of the Study.

E. Further Issues for Implementation of Priority Projects (Section 8.5)

Key to the successful and efficient implementation of a project is the planning/managerial and operational capacities of the administrative and operational bodies, namely, MoEWM, ANAR Headquarters and/or DADL. The most urgent task is the establishment of the project management unit (PMU) with clearly defined authority and power in procurements and fund management.

To make financial analysis in compliance with the financial and economic guidelines for project analysis of external financing resources, it is definitely in need to examine fiscal capacity of MoEWM to appropriate capital and recurrent budgets to DADL through ANAR or directly to ANAR Headquarters for the foreseeable period of project horizon, say, up to 2040. Budgeting to the project implementing body (or bodies) is the task of the Romanian side, because it is a policy matter beyond the reach of the Study team. With the information supplied by the Romanian side, the Study team will endeavor to make a financial analysis that will be acceptable for external supports.

Last, but not least, the forthcoming feasibility study with a focus on the institutional, financial and economic aspects of the prospective projects on the southern Romanian Black Sea shore will need to expeditiously be undertaken, while considering the indicative timing and schedule of the application for the external funds inclusive of EU. With this in view, the

implementation of the environment-related study (or studies) by the Romanian Government on an efficient and effective basis will be called for.