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CONCLUSIONS

Review on the Terms of Reference

- 1) To a large extent the Environmental Impact Statement (the report, [EIS]) has met the Terms of Reference (TOR) as approved by the Ministry of Policy Planning and Implementation. The impact assessment has however mainly been based on qualitative judgements. The conclusion is therefore that the EIS does not give enough information on essential aspects of the environmental consequences of the landfill proper and of the landfill in a wider context. The extent to which the following aspects represent risk factors in the project design can therefore not be assessed:
 - ! The location of the borrow site may possibly have an impact on coastal erosion. The TOR require prove of conservation of balanced sand budgets in the coastal zone. From the information contained in the EIS, such prove can neither be derived, nor can the risk of change of the sand budgets be estimated.
 - ! Details of the crossing of the beach and the dune area by the pipeline have not been provided in the EIS.
 - ! Description of qualitative and quantitative impacts of establishment of the landfill on the hydrological system of the marsh and lagoon is missing in the EIS.
 - ! The effects of salt delivery from the fill to the surrounding buffer zone and lagoon has not been assessed.
 - ! The effects emanating from the fill and the developments on the landfill to a wider surrounding has not been described.
- 2) Prediction of environmental effects in a quantitative way have only been made in limited cases. Conclusions with regard to the effectiveness of proposed mitigating measures can therefore not be drawn.

These measures include especially those for coastal erosion, flooding, salt water intrusion and effects emanating from the landfill.

Other mitigating measures which have not been covered -also not in a qualitative way- include:
 - ! an operational plan aimed at safety and healthy working conditions for the workforce;
 - ! containment of environmental pollution after the landfill operation and during the stage of industrial and residential use;
 - ! prevention and mitigation of adverse effects on seasonal dynamics of ecological processes (breeding et cetera).
- 3) From the EIS and the Masterplan it has become clear that public participation procedures have been adequately integrated in the Environmental Impact Assessment (EIA) process and in the preceding planning processes.
- 4) Some aspects of the intended activity have not been addressed in the TOR. These relate to landfill procedures and to delivery of fill material from land based borrow sites.

Review on the review framework

- 5) The Commission would have appreciated that in the TOR the initiative would have been placed in a wider planning context. In fact the initiative is a part of a greater project, well described in the Masterplan, that covers the entire wetland. It is expected that the influence of the landfill and the activities on it may influence the surroundings of the fill area and thus may be detrimental to achievement of the objectives of the conservation components of the Masterplan.
- 6) In this respect the Commission would like to detail the envisaged 'pilot function' of the Masterplan. It welcomes the environmental management aspect of this plan, but questions urban development in ecologically sensitive areas.
- 7) The Commission feels that a strong institutional and financial setting is of prime importance for sufficient, effective and credible environmental management. The present EIS does not give convincing information on this institutional and financial setting.
- 8) On the basis of information, contained in the EIS and the additional documentation, it is impossible for the Commission to judge the correctness and effectiveness of proposed mitigating measures nor can it formulate recommendations for additional mitigating measures.

The fact that not all required information can be derived from the EIS does not necessarily mean that the information is not available. Therefore the Commission formulates the following recommendations:

Recommendations

- 1) In order to reduce the project risks as they are mentioned in the conclusions, and in order to assess the correctness and effectiveness of the proposed and additional mitigating measures, the Commission recommends to check whether the studies related to these risks (see appendix 5) have been carried out. If this is not the case the Commission recommends to execute these studies.
- 2) An operational plan aimed at safety and healthy working conditions is recommended.

1. INTRODUCTION

1.1 The initiative: Realisation of a 162 hectares landfill at Kerawalapitiya

The Sri Lanka Land Reclamation and Development Corporation (SLLRDC) intends to implement in the Muthurajawela marsh, 13 kilometres north west of Colombo in Sri Lanka, a project named 'Kerawalapitiya land reclamation project'.

The main objective of the proposed project is to reduce environmental effects of industrial and population pressure in the town of Colombo by establishment of a landfill of 162 hectares of which 80% is earmarked as industrial zone and 20% is destined for establishment of residential areas. The presumed landfill is located in a wetland system with considerable hydrological and ecological functions. In order to govern autonomous developments in the entire wetland area, which is degrading under uncontrolled squatter settlement, a Masterplan based upon an environmental profile has been developed and accepted in parliament. Realisation of the landfill is part of this Masterplan. In the plan 4900 hectares out of a total of 10.000 hectares of wetland and surroundings are declared strict conservation area.

As landfill material medium coarse sand will be used. This sand is to be withdrawn from the sea bed at a borrow site at least 3 kilometres offshore. The material will be dredged and transported directly to the fill site. The sand will be transported in a 20%/80% mixture with sea water through a pipeline. Momentum will be provided by pumps on the Suction Hopper Dredger and by pumps in a booster station. The project ends at delivery of the landfill.

Formulation of an Environmental Impact Statement (EIS) was part of the tender. In order to partly finance the project Dutch ORET¹ funding was sought. A gift of 20 million Dutch guilders has been granted. The tender has been won by Zanen en Verstoep, a Dutch dredging company. Contracts have been signed.

1.2 Motive for and objectives of this review report

By letter dated 24 February 1994 (Appendix 1) the Minister for Development Cooperation in the Netherlands has invited the Dutch independent Commission for the Environmental Impact Assessment (EIA) to perform an advisory review of this EIS.

1 A financial aid facility for projects in developing countries executed by Dutch firms

Objectives of this advice are:

- ! review of the EIS on the basis of international review standards;
- ! appreciation of proposed mitigating measures and the evaluation programme;
- ! formulation of recommendations regarding additional mitigating measures.

This advice, that must be regarded as an independent vision on the quality of the EIS in question, has been prepared by a working group of the Commission. The composition of this working group is presented in appendix 2. The group represents the Commission and will therefore be referred to as 'the Commission'. In the Commission the following disciplines are represented: hydrology, dredging and soil mechanics, sedimentology and physical geography, wetland and marine ecology, institutional development, urban development and its environmental aspects.

1.3 Handicaps experienced and approach adopted

In preparing the present advice the Commission has encountered certain handicaps. The main **handicaps**, in order of importance, are:

- ! **No site reconnaissance**
The Commission did not visit the site and had no opportunity to discuss important issues with parties involved.
- ! **No involvement in the scoping process**
The Commission regrets that she has not been involved in scoping and formulation of the Terms of Reference (TOR).

1.4 Justification of the approach

As the Masterplan and the Conservation Management Plan for Muthurajawela Marsh contain valuable additional information on the setting of the proposed activity, the Commission will consider these plans as essential in the review process. (An additional set of publications used by the Commission, is given in Appendix 3).

The Commission studied the TOR, as they were established by the Central Environment Authority (CEA), the Greater Colombo Economic (GCEC) Commission and the Coast Conservation Department (CCD) and as they were approved by the Ministry of Policy Planning and Implementation. As a first step in the review process, the Commission has reviewed the EIS on these TOR. The findings are presented in chapter 2.

As it was found that some additional aspects are of significance for the EIS, a framework was elaborated in which the TOR were supplemented (see appendix 4).

On a recommendatory basis the Commission will use this framework to review the EIS on headlines. Since no definite criteria for headline selection are available, the present choice is the result of a joint "best professional judgement". Observations regarding this review are presented in chapter 3.

2. REVIEW OF THE EIS ON THE TERMS OF REFERENCE (TOR)

2.1 General observations

The EIS is in accordance with the TOR, formulated by CEA, GCEC and CCD and approved by the Ministry of Policy Planning. However, not all elements required are covered in compliance with the details as requested in the TOR. In this respect the Commission observes that:

- ! the EIS gives the general impression that good use has been made of existing studies. However, with regard to information not provided by these studies and required by the TOR, no additional study seems to have been made;
- ! essential information on the environmental effects of the proposed activity is lacking for some aspects;
- ! a list, quoting sources of data and information as required by the TOR, are absent.

2.2 Detailed review

Considering the TOR, the following elements are missing or not sufficiently covered in the EIS:

The summary

The summary gives a comprehensive review of all the items covered in the EIS. However, it might also have indicated in brief the responses to the issues raised by the public and by other agencies.

Introduction

Instead of extend and scope of the study, a very brief listing has been made of the extend and scope of the project.

Nature aims and scope of project

Not all features of the project have been described under this chapter. The contemplated post-reclamation land use pattern of the landfill and the buffer zone is not described in sufficient detail. Hence, possible environmental spin- off's cannot be identified and quantified.

Methodology of operation

The methodology of operation is described in sufficient detail with exception of the pipeline crossing of the sandstone reef and the beach. The plan anticipates a floating pipeline over the reef crossings (anchorage is crucial), but it does not specify how the beach crossing is achieved. It only states that an interruption of the alongshore littoral transport should be avoided.

It is recommended (page 4-4) that the pipeline may be placed underground as alternative for laying it on the beach. This probably means that a trench has to be excavated in the beach and the nearshore area. Environmental consequences of such a trenching and crossing of the beach and the adjacent dune area have not been addressed in the EIS.

With reference to the rapidity of achievement of the landfill, it is observed that only some of the possible direct and short term adverse effects are mitigated by limiting the duration of the operation. However, for long term effects the opposite strategy – i.e. working slower – may even be better.

Evaluation of alternatives

General remark

Section 2.4 of the EIS does not fulfil the requirement formulated in the TOR, to give recommendations for environmentally suitable alternatives for each of the options mentioned in the TOR.

Borrow sites

The selection of the borrow site is insufficiently underpinned. The correctness of the conclusions cannot be verified. Alternative borrow sites are barely discussed in the EIS. The three alternatives considered are certainly not the only possible alternatives. E.g. deep dredging with a suction dredger is not mentioned as an alternative. Moreover the discussion of the advantages and disadvantages of the three alternatives described, is very superficial. The third alternative is not discussed at all.

Concerning the land based borrow sites it is observed that only two alternatives are discussed. It is obvious that the option of using peat as fill material is not an option at all in this specific case. Other options, such as extracting the fill material from deep borrow pits on land with deep suction dredgers and transport of the material to the filling site by hydraulic means or conveyor belts, might have been considered.

Delivery of the fill material

With regard to the delivery of the fill material to the reclamation area, only the transport of the sea sand has been taken into consideration. In the TOR the question of the transport from land based borrow sites is not raised. This seems to be in contradiction with the requirement (raised under point 2.4.(a) of the TOR) to describe land based sources of fill material and may indicate that the idea of land based borrow sites was already rejected at the time the TOR was written.

The fill site

With regard to the TOR-requirement to describe an alternative for the proposed way of evacuating the seawater in the fill area during the operation, only the proposed solution has been described. Although the description is sufficiently detailed, it does not assess the medium and long term consequences of the salt content of the fill.

In view of this, the adverse effects cannot be considered in the overall comparison of all environmental effects of sea based and land based borrow sites. It is obvious that land based borrow sites do not generate problems with salt water.

Work force

Work Force's occupational health and safety has not been described.

Existing environment and site description

Borrow and mooring site

Evidence of a hydrographic survey of the borrow site nor evidence of representative bottom sampling could be found in the EIS. No study has been reported to evaluate the protective function of the sandstone reefs. The hydrographic detail of the mooring site is missing. Assessment of the existing level of fishing activities is missing. It is simply concluded that the most important fishing grounds are at 1.5 km distance. No evidence of a survey of marine fauna and flora could be found. Especially the location of spawning habitats for anchoveta's and sardinella's and the dynamics and seasonality of fisheries and other biological resources are of great interest.

The Land fill

The landfill, human settlement and land use have been adequately described in the EIS.

Description of environmental impacts

General remarks

The TOR ask for short and long term effects, quantitative evidence if possible and highlighting of uncertainties. On all these points the EIS is very poor (Appendix 5 enumerates the studies missing). Important mitigating measures mentioned in this paragraph, like rehabilitation of the salt exclusion structures, increase of the drainage capacity of Hamilton canal and provisions for mitigating the loss of storage capacity, are deemed necessary but do not seem to be part of the

project. The main long term impacts, the environmental effects of industrial and urban development in a wetland area and their mitigation, are not addressed. The synthesis, required by the TOR, is not made.

The borrow site

It may be deduced from the description of the coastal situation (EIS § 3.1.1.) that the coast is under severe attack. The coastal erosion varies between 1-4 m/year. There appears to be a strong littoral drift. Monsoonal wind-driven currents and occasional severe swell waves apparently are the causes of this drift. It is reported in the EIA that the recreational potential of the beaches in the area is reduced due to the rough sea. Extraction of a substantial quantity of sand offshore of such an eroding coast must be considered with the utmost caution. This extraction is planned three kilometres from the coast line at a water depth of 15 - 30 m.

The conclusion, that this extraction from an area at a distance of 3 km from the shoreline "will in no way affect the littoral transport" and that the dredging "will not cause any significant change in the nearshore processes", is based on evidence of which references are not presented. Although the presented wave data are not very conclusive it may be anticipated, that especially during strong swell events sediments may be stirred up from the bed and transported by tidal and especially wind driven currents. The importance of a thorough study of the consequences of the offshore borrowing of sand in relation to the littoral sand balance is stressed here, because the protective dune area for the lagoon behind is rather small and vulnerable at the present time.

Next to a quantitative description of impacts, the risks of calamities need a further elaboration. Elements including failure of the sand transport system have not been elaborated.

With reference to impacts on the ecological environment the EIS makes a distinction in the following impacts:

- areas affected directly by dredging operations;
- areas affected by the results of dredging operations.

With respect to a possible impact of sand excavation on the sea-bottom fauna the report states that turbidity is the most obvious effect of dredging on the quality of water. Increased turbidity caused by the agitation, raising and overflow of dredged material is likely to have an adverse impact on the environment. It can cause clogging of fish gills which leads to suffocation and it can also clog the membranes of filter-feeding organisms. By reducing the amount of sunlight penetration into the water it can also slow down photosynthetic activity of plant life.

The proposed borrow area measures about 2.5 km² and is located at a distance of more than 3 km offshore. It is reported in the EIS (page 3-7) that important fishing grounds are located at least 1.5 km seaward of the site. Moreover the EIS states that nearshore regions will not be directly affected by increased turbidity. Turbidity is assumed to be a transient phenomenon which will affect the environment during the dredging operation. The nearshore areas, however, are potential spawning habitats for anchoveta's and sardinella's and the report provides no factual information on the absence or presence of these habitats. If dredging operations take place during spawning, spawning stocks are likely to be affected.

Dredging will increase the turbidity of the sea water. Without proper study it cannot be excluded that turbidity plumes may reach the fishing grounds and nearshore areas. Plume mobility depends on the coastal water circulation, of which the EIS does not provide any information. No measurement of turbidity plumes are reported. As a result the interest of the fishery sector can not properly be assessed and weighed in relation to the interests of the landfill.

The landfill

The landfill will change the hydrological pattern and properties of the surrounding areas. The EIS (page 4-8) correctly states that "an intervention in any part of this system will affect the whole system. The larger the intervention the more serious the impact". Several important aspects as to the changes in the hydrological regime are mentioned in the EIS: The intervention in the catchments of several rivers or creeks, the possible restructuring of the Hamilton Canal, etcetera. It may be expected that the EIS provides the results of a detailed study as to the quantitative consequences of this changed hydrological system, especially addressing the problems related to flooding frequency, salt, nutrient and pollutant concentrations. The EIS, however, does not contain such a quantitative evaluation. In this respect the effects of the changes of water quantity and quality for the remaining surrounding marshes and ultimately the lagoon are not well described.

The effects of the landfill on the retention capacity of the wetland system will have to be mitigated by rehabilitating the badly neglected drainage system and the associated structures in an attempt to achieve the hydrological conditions of the marsh before land reclamation. Construction of a ring channel around the filling site, as mentioned in chapter 7.2, may counterbalance the loss in retention capacity. No quantitative evidence has been given to underpin this proposal, which is not further worked out.

On page 4-9 of the EIS the adaptation of the Hamilton Canal is mentioned. Two options are discussed: Increase in the canal's drainage capacity and creation of a shortcut channel through the coastline. The consequences for the environmental conditions in and at the mouth of the canal are not addressed. Also, the EIS does not clarify how "these facilities should be designed and used in a manner as not to disrupt the interlinked flow of water and nutrients between the marsh and the lagoon" (page 4-10).

A special problem is formed by the northern bund around the landfill. Construction of this bund requires 625,000 m³ of sand to be pumped to the site with 2.7 million m³ of water, half of which will flow in the northern direction. This, in addition to percolation water, will cause a notable increase in salt content in the buffer zone marsh area and possibly the lagoon. A clear evaluation of the impact of this salt delivery is missing in the EIS.

During and after the completion of the landfill, the drying sand may be caught by the wind, especially the SW wind. The EIS does not treat the environmental aspects of this feature.

The risks of calamities during filling also have not sufficiently been elaborated in a quantitative way. These include amongst others risks of flooding and risks of salt water intrusion into neighbouring areas.

With reference to impacts on the ecological environment of the fill site the EIS states that the proposed landfill will imply the loss of 162 ha. of wetland ecosystems. It is also concluded that loss of flora and fauna resources will be negligible, because the proposed landfill site, being closest to the capital city, is no longer in positive condition as a result of centuries of human influence. The vegetation has been altered by various human uses and impacts, and especially through introduction of exotic plant species which tend to encroach upon indigenous species (i.e. *Annona glabra*).

The EIS concludes that the landfill site does not form an essential habitat for mammals, reptilians or fish. It observes that the area still provides habitat for birds but concludes that it would be exaggerated to say that the 162 hectare are very important in this respect. None of the listed species depend uniquely on this part of the marsh. More important bird habitats are found in the transition zone to the north and in the Negombo lagoon and its fringing vegetation.

However, the loss of 162 hectares of wetland ecosystem is not the only consequence of the landfill. Associated with the landfill is the buffer zone, where also an increase of human activities may be envisaged. The proposed golf course means landscaping and fertilising of the soil and disturbance of some habitats. In addition salt water (surface and/or ground water) from the fill may penetrate the former fresh or brackish environment of the buffer zone, thus altering the ecological conditions.

Urbanisation and industrialisation on the landfill will have a radiating effect on the ecosystems. The Commission admits that an overall quantification of these effects and their interactions is impossible in this stage. The EIS may, however, have contained more outcomes of detailed studies, giving a better overview of the predicted consequences towards the important wetland areas in the transition zone to the north and in the Negombo lagoon than the very generalised statements on page 4.11 and 4.12. This secondary impact of the landfill could be considerable.

Mitigating measures

General remarks

Apart from mitigating measures, forming an integral part of the intended activity and described under **Methodology of operation**, a set of mitigating measures are given in the form of proposals and recommendations. The way and context in which these measures are to be effectuated is not described. As quantitative data is not included in the EIS, the appropriateness of the mitigating measures described cannot be evaluated.

Reef crossing

Mitigating damage at reef crossing is not described in sufficient detail.

Retention capacity of the wetland system

In chapter 7.3 it is concluded that construction of a ring channel around the site and dredging of the existing channels is required to minimize the impact of reduced flood buffer capacity by land reclamation. In chapter 5.2.1 only rehabilitation of the existing drainage system is mentioned.

Monitoring programme

Components for a monitoring programme are given. The institutional context, responsibilities and funding are, however, not specified. Moreover the proposed actions are only foreseen for the period of project execution. As the main environmental effects of the project will certainly occur after this period (as a result of urban and industrial development on the landfill) the monitoring programme must preferably extend to that period as well.

2.3

Conclusions

- 1) To a large extent the Environmental Impact Statement (the report, [EIS]) has met the Terms of Reference (TOR) as approved by the Ministry of Policy Planning and Implementation. The impact assessment has however mainly been based on qualitative judgements. The conclusion is therefore that the EIS does not give enough information on essential aspects of the environmental consequences of the landfill proper and of the landfill in a wider context. The extent to which the following aspects represent risk factors in the project design can therefore not be assessed:
 - ! The location of the borrow site may possibly have an impact on coastal erosion. The TOR require prove of conservation of balanced sand budgets in the coastal zone. From the information contained in the EIS, such prove can neither be derived, nor can the risk of change of the sand budgets be estimated.
 - ! Details of the crossing of the beach and the dune area by the pipeline have not been provided in the EIS.
 - ! Description of qualitative and quantitative impacts of establishment of the landfill on the hydrological system of the marsh and lagoon is missing in the EIS.
 - ! The effects of salt delivery from the fill to the surrounding buffer zone and lagoon has not been assessed.
 - ! The effects emanating from the fill and the developments on the landfill to a wider surrounding has not been described.
- 2) Prediction of environmental effects in a quantitative way have only been made in limited cases. Conclusions with regard to the effectiveness of proposed mitigating measures can therefore not be drawn.

These measures include especially those for coastal erosion, flooding, salt water intrusion and effects emanating from the landfill.

Other mitigating measures which have not been covered – also not in a qualitative way – include:
 - ! an operational plan aimed at safety and healthy working conditions for the workforce;
 - ! containment of environmental pollution after the landfill operation and during the stage of industrial and residential use;
 - ! prevention and mitigation of adverse effects on seasonal dynamics of ecological processes (breeding et cetera).
- 3) Some aspects of the intended activity have not been addressed in the TOR. These relate to landfill procedures and to delivery of fill material from land based borrow sites.

3.

REVIEW ON HEADLINES ACCORDING TO THE REVIEW FRAMEWORK

3.1 General remarks

Apart from the observations based on the review of the EIS on the TOR, an additional review is made on the basis of the review framework. Observations made in chapter 2 also apply in this review but will not be repeated. The numbers of the chapters refer to the chapters of the review framework.

3.2 Review

1. Points of departure, problem-analysis, objectives and decision making

Above mentioned aspects of the EIS are fully placed within the context of the Masterplan of Muthurajawela and Negombo Lagoon. This Masterplan has been approved by the Government of Sri Lanka and is clearly not a subject for review within this framework. The points of departure on which the project is based, however, are closely linked to the elements of the Masterplan.

The general objective of the Masterplan is the development of Muthurajawela marshes on an environmentally sound and sustainable basis. The recommended land conservation and development model for Muthurajawela includes the proposed land reclamation project.

It is the intention to use the reclaimed land for the purpose of urban development such as housing and industry after completion of further infrastructure.

This is the first time in Sri Lanka that a development and management plan is being implemented for a coastal wetland where the natural values including biodiversity and the interest of existing resource users have been given serious consideration. At present the wetland system is under intense population pressure for settlement which is related to the population growth of Colombo in the south and Negombo in the north. The unplanned settlement and resulting consequences associated with such growth could contribute to the progressive destruction of the wetland system. A proper management plan for wetlands is therefore strongly required.

The Commission would, however, like to emphasize that alleviation of the problems associated with population pressure in wetlands might also be seen in the context of proper development of regional growth patterns.

It is stated in the Environmental Management Strategy for Colombo Urban Area (CUA) that new growth patterns for Colombo should be developed that relate to the natural context of the region.

From an environmental perspective, the building of new development nodes or town centres, in the outer suburbs, or even beyond the current CUA boundaries, is a better choice than infilling on marginal and environmentally sensitive land within CUA. In this context the Commission feels hesitation to support the pilot-like character of the Masterplan. To her opinion, wetlands must preferably be kept apart from any industrial, urban or other development. However, the Commission welcomes the initiative of environmental management of sensitive areas and in this respect supports the pilot like character of the Masterplan.

2. Intended activity, secondary effects, alternatives, mitigating measures

Possible alternatives in addition to the intended activity have been discussed in the Masterplan, mainly within different development scenarios for the Muthurajawela marshes.

Land use for urban/industrial development in the outer suburbs, or even beyond the current CUA boundaries (see 1) has not been discussed as an alternative for industrial and urban development in the marsh.

Within the project itself alternatives have been evaluated considering:

- Borrow site selection
- Delivery of fill material
- Location and type of booster station
- Methodology of pumping sea water back into the sea

Considering the resource use conflicts for the region, the intended activity as part of the Masterplan clearly will improve the present situation. The land fill project covers 5% of Muthurajawela area (surroundings excluded), whereas 56% of this area is allocated for strict conservation.

In the EIS insufficient attention has been paid to the institutional setting of project during its execution and during the following phases of implementation of the Masterplan (secondary effects of the project). Recommendations on Institutional set-up are given in this Masterplan but implementation of these recommendations and funding has not been properly addressed. The Commission feels that a strong institutional setting is of prime importance in order to control secondary effects, which are amongst others related to the various uses of the land, once it will be reclaimed. With regard to these secondary effects no clear picture is given. In environmental terms pollution by specific activities (industry, public utilities like treatment plants) may be considered as a risk factor for the survival of wetland ecosystems. In the EIS this risk factor is insufficiently addressed.

2.1 The preparatory stage

Baseline data are given in a general conclusive way. Reliability cannot be sufficiently judged. A long term vision on the hydrological functions of the wetland in the hydrology of the catchments of the Ya Ela, the Dandugama Oya and the Kalu Oya is not provided. A long term preview of effects of scheduled industrial and urban development in the wetland are not given. The EIS does not elaborate on the institutional and financial framework in which the intended activity and subsequent activities will be managed.

The EIS does give adequate information with regard to public involvement and participation in the EIA process.

2.2 The stage of landfilling and establishment of the project infrastructure

The EIS does not specify in sufficient detail the landfilling procedures and methods. It states that, after bund construction the sand will be spayed on the surface of the peaty soil. No information is included with regard to the thickness of the peat layers that will be covered, their resistance and the working sequences to be adopted. It is probable that the strength of the peat is very low. Consequently, there is a real risk that local failure of the peat will occur and that the peat will be pushed aside. This is an uncontrolled phenomenon which has to be avoided. This implies that the thickness of the peat layers need assessment by rough analysis on the basis of the soil strength. In addition it may be expected that the peat layer may be compacted during and after the filling. This may have two consequences: Firstly the volume of sand, necessary to meet the negotiated level of the fill after completion, will increase and secondly non-uniform lowering of the surface may occur. The EIS gives some information on this issue but it is not very conclusive.

On the basis of information contained in the EIS, no recommendations can be formulated with respect to the filling procedures. It is, however, emphasized that a well defined plan on all filling activities, including those for the bund, is recommended to be available before the beginning of the filling work. This plan must include measures in case local failure is observed during the filling.

Important elements missing in the EIS are the occupational health and safety issues for the work force and security arrangements to prevent calamities.

2.3 The stage of evaluation of performance

A monitoring plan during and after dredging, transportation of sand and landfill operation is described in chapter 6. This plan however only includes a recommendation on issues like salinity levels, water levels, subsidence of the existing peat layer. A detailed monitoring and evaluation programme has not been given.

2.4 Secondary effects

Eventual secondary effects of the initiative relate amongst others to the various uses of the reclaimed land. As a detailed allocation of uses has not been made, no effects have been elaborated. Possible secondary effects of the alternatives within the initiative have been described in chapter 2.4: Evaluation of alternatives. Mitigating measures have been recommended for various activities in the offshore and nearshore environment (chapter 5.1) and the landfill environment (chapter 5.2). A specific methodology was in some cases lacking. A selection of methodologies is in most cases still to be made.

2.5 Alternatives

In the system of environmental impact assessment, as applied in the case of the Kerawalapitiya Land Reclamation Project, alternatives are but briefly discussed in a separate chapter. In other chapters of the EIS rejection of these alternatives is not further underpinned. This implies that alternatives are not compared to one another in a balanced and grounded manner and that one of the main objectives of EIA remains inachievable.

The 'alternative most friendly to the environment' and the 'no action' alternative have not been described in the EIS.

2.6 Mitigating measures

In the system of environmental impact assessment, as applied in the case of the Kerawalapitiya Land Reclamation Project, an essential part of the mitigating measures is not described as integral part of the initiative but is discussed in a separate chapter. These measures are formulated as recommendations and propositions. The Commission observes that in doing so there seems to be no guarantee that they will be effectuated.

3. Description of the prevailing environmental conditions and its evaluation in case no activity would be undertaken

The landfill project can not be seen out of the context of the Muthurajawela Masterplan. During the recent past there has been visible degradation of the ecological complex, stemming from inadequately planned settlement, industrial and municipal pollution, intensification of fishing pressure and general habitat destruction.

The project, as part of the Masterplan, contributes to a balanced and controlled development in the area, as it takes into consideration the development and multiple uses of the wetland ecosystem.

The prevailing environmental conditions and site description are given in chapter 3 of the EIS.

The autonomous development as such, however, has been given limited attention in the EIS. With respect to future autonomous developments around Muthurajawela marshes and Negombo lagoon, the EIS concludes that the existing environment will continue to deteriorate causing further problems to the unauthorised residents of the marsh.

It is evident that there exists a strong and urgent demand for planned development of the Muthurajawela marsh and in this respect the proposed project must be considered as the first

phase of engineering and environmental management of a deteriorating wetland system. Hence the project itself can be identified as a mitigatory measure to prevent further deterioration and to conserve a threatened wetland system. It also incorporates the relocation of unauthorised residents to a more favourable location at which they will be exposed to improved living conditions.

The Conservation Management Plan for Muthurajawela marsh/Negombo lagoon is to be considered as a set of actions, aiming at mitigation. The implementation of this CMP is foreseen as part of a second phase of the Wetlands Conservation Project, presently implemented by a consultant.

For the conservation area the aspects described in 3.3 of the review framework have been covered to a large extent.

Ecological environment of the borrow site

The EIS concludes that no established fishing grounds exist in the proposed borrow site. Important fishing grounds are indicated to be located at least 1.5 km further seaward from the site.

In addition the report indicates that the area in which the borrow site is situated is no longer in prime habitat condition:

- i) the prevailing water turbidity caused by the river sediment limits species variety and density, because of reduced light penetration, and consequently, lower primary production, and because of clogging of respiratory organs and reduced visibility;
- ii) the prevailing use of trawl nets leading to frequent disruption and destruction of sea bed communities, causing turbidity causing further impacts - see (i).

Finally it is concluded that it is most unlikely that the area is of great importance to coastal fisheries production. It is also stated in the EIS that it is very unlikely that the area contains unique habitats, rare or endangered species, or economically important marine resources, i.e. considering the small size of the borrow site as compared to the vastness of the coastal ecosystem of which it forms part.

The Commission observes that no information is included with regard to the possible importance of the area as a spawning habitat for fish species like anchoveta's and sardinella's. These species show strong seasonal migration and spawning patterns. Additional information on local spawning areas and the seasonality of spawning is required to determine the possible impact of dredging. No evidence is found of field surveys, including interviews with local fishermen, to examine this seasonality and the seasonality of other biological resources. In addition the absence of sea grass meadows must preferably be confirmed by studies covering both wet and dry seasonal dynamics of in particular intertidal meadows of *Halodule uninervis*.

Ecological Environment of the Fill Site

The EIS concluded that with the abandonment of Muthurajawela as cultivatable land, squatters have moved in. The families now living in this area are again altering it through the utilisation of the land for having sewage and waste disposal, home gardens, fuel wood, mat weaving (sedges), et cetera. The type of natural vegetation which sprung up in these poorly drained typical marsh wetland areas was determined by the hydrological regime, water quality and quality of the substrate. Consequently, the vegetation of Muthurajawela marsh is not pristine; it has undergone several changes in the past and this process still continues. Nevertheless, over large areas the vegetation survives in varying stages of naturalness. Past introductions and extermination of certain plants including woody species and aquatic plants, have further altered the vegetation, in particular in the proposed landfill site closest to the capital city.

The EIS provides an inventory of the presence of mammals, reptiles, amphibians, fish and invertebrates and thus provides an appropriate overview of the ecological resources in the area.

4. Environmental impact of the intended activity and its alternatives

Environmental impacts are described in chapter 4 of the EIS. Although various issues are covered, most impacts are described in a qualitative way, e.g. increase in water turbidity at the borrow site, changes in salt water intrusion and water quality (ground water, and surface water) at the landfill site.

The Commission observes that description of the effects of the intended activity is limited to the areas where activities take place. Effects on a somewhat greater distance are insufficiently addressed in the EIS.

5. Comparative screening of the intended activity and the alternatives

In the Masterplan various scenarios have been discussed. The intended activity i.e. Kerawalapitiya landfill is part of the selected and approved development scenario. Three alternatives have been given for land use of the Kerawalapitiya landfill in the Masterplan. The environmental impacts of these alternatives (maximum residential-medium income, mixed development-high/medium income, maximum industry-medium income) have however not been estimated. It is emphasized here that containment of pollution by planned industrial and residential use is one of the prerequisites in minimizing the environmental effects of the selected development scenario. This element has not been dealt with in the EIS as a subject for discussion.

As a result of the chosen procedure of handling alternatives (see under § 2.4) a thorough comparison of alternatives is impossible.

6. Gaps in knowledge

Description of Gaps in knowledge and their relevance for the information given in the EIS is part of the EIA procedure. Gaps in knowledge, however, have not been addressed in the EIS. The Commission observes that the gaps in knowledge in this EIS are so important that it is impossible to judge the relevance of the information that is contained in the EIS.

3.3 Conclusions

- 1) This review on headlines underpins the conclusions of the review of the EIS on the TOR (chapter 2).
- 2) The Commission would have appreciated that in the TOR the initiative would have been placed in a wider planning context. In fact the initiative is a part of a greater project, well described in the Masterplan, that covers the entire wetland. It is expected that the influence of the landfill and the activities on it may influence the surroundings of the fill area and thus may be detrimental to achievement of the objectives of the conservation components of the Masterplan.
- 3) In this respect the Commission would like to detail the envisaged 'pilot function' of the Masterplan. It welcomes the environmental management aspect of this plan, but questions urban development in ecologically sensitive areas.

- 4) The Commission feels that a strong institutional and financial setting is of prime importance for sufficient, effective and credible environmental management. The present EIS does not give convincing information on this institutional and financial setting.
- 5) On the basis of information, contained in the EIS and the additional documentation, it is impossible for the Commission to judge the correctness and effectiveness of proposed mitigating measures nor can it formulate recommendations for additional mitigating measures.