

BUILDING UP A TOOL FOR INTEGRATED COASTAL MANAGEMENT IN DA NANG CITY

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ABSTRACT

Marine and coastal areas play an important role in socio – economic development of Vietnam. In the reality revealed Vietnam coastal area is the most eventful economic developing region with series of mineral advantages, for instance, fossil coal, petroleum, gas, iron, mineral sand, and so on. However, marine environment in Vietnam is currently incurring excessive pressures, sea pollution derived from disposal sources of the mainland on the explicit tendency of increase.

To be one of the most dynamic cities of Vietnam, Da Nang possesses the fairly territorial waters with 92 km of seashore and an exclusive economic region well known all over the country on tourism sector, seaport and the dynamic in economic development. Also, similar to various provinces and cities over the country, Da Nang is encountering to several issues relating to resources and environment, in which marine and coastal environment existing. This is production operations leading to the pollution toward coastal area. For the time, several administrative branches and departments took part in carrying out Integrated Coastal Management (ICM) project for Da Nang coastal area. In addition to achieved results, the biggest shortcoming of the the project is the absence of an integrated tool based on the application foundation of GIS technology.

In this report presents the result in respect of building up informatics tool named COAST (Computer prOgrAm for coaStal managemenT for Da Nang city) to support the management mission, monitoring and promptly perform the report of environment assessment on coastal area of Da Nang bay and estuary area of Cu De river, Da Nang City. The outstanding characteristic of COAST is the GIS application, environmental database and mathematical models.

1. INTRODUCTION

Danang city is situated in the coastal region of central part of Vietnam, at the medium location nationwide in geographic co-ordinate range of 15⁰55'19" to 16⁰31'20" of northern latitude, 107⁰49'11" to 108⁰20'20" of eastern longitude. The center of the city is 764 km far from Hanoi capital on the South, 964km far from Ho Chi Minh City. It was the first type urban in 2003 and Danang is vigorously changing to head to the future in the statute of a young dynamic city. Danang's strengths were shown on seaport system, sea travel, and aquatic product export. Hence, in the socio-economic strategy to 2010 of the city, sea economy has been determined as one of spearhead of Danang. Integrated coastal zone management – ICZM for Da Nang City is one of the model projects for national performance in respect of integrated coastal management.

Integrated coastal zone management (ICZM) strategy for Da Nang City has commenced the construction from December, 2000 and completed in November, 2001,

within the framework of regional project on sea environment management of PEMSEA¹ (GEF/UNDP/IMO RAS/98/G33). This is the strategy of management and reasonable usage, gathering natural resources and environment of the coastal area in the outlook of unshakable development. It will be the basis for the building up the specific and reasonable action plans for the common development of the coastal area, suitable to the interest of all branches, organizations, communities and other parties concerned. For the past 5 years, the ICZM strategy for Da Nang City has initially developed and obtained certain results. Apart from gained results, it may narrow down some shortcomings of the project as follows:

- The project scope is too large, relating to various departments and branches while such departments and branches are just responsible or having competence in connection to a certain group of information in their undertaking. Currently, the shortage of assistance tools for services, departments and branches to participate in finding out the common voice in the environment protection problem.
- In the scope of project, a mass of data has been gathered. Presently, recording, access, information sharing and making report are so difficult.
- Although database used for management goal in coastal area as well as estuary is available but uncompleted, there is no regulation on sharing information between departments, branches participating in managing coastal area yet.
- Gathered figures are not matched to the numerical map yet and caused difficulties for accessibility.
- The application of mathematical simulation model integration approach, environmental database for evaluating influences of economic activities over the environment is still limited.
- The lack of monitoring data integration tool, legal documents in line with other environmental databases to help project management task.

Thence, the imperativeness of this research project is:

- Currently, Danang VNICZM project has still not proposed an optimal management model, namely, competent services, departments and branches participating in the project have not got any tool to help them in a good cooperation and thereby building up an assistance tool is essential.
- In order to step by step integrate with region and internationality, Danang is needed to build up an infrastructure of information satisfying regional and international criteria of which the coastal information system is an integral part.

Accordingly, the goal of this research is to build up an informatics tool aiming to support management assignment, supervision and making reports in terms of evaluating environment in coastal range of Danang bay on the basis of GIS and database technology application.

2. SOME URGENT ENVIRONMENTAL ISSUES AT COASTAL AREA OF DANANG BAY

At present, water quality of Danang bay is also one of the concerning worthy issue. At Danang bay, there are 4 monitoring stations – the one lies on Phu Loc estuary and the other 3 stations near Cu De estuary, 500m, 1000, 1000m far from the estuary respectively.

According to the result of the pilot general environmental monitoring program, the seawater quality of Danang bay valued at BOD₅ lower than Vietnamese standard value but its change scope is wide (2-8mg/l). It is needed to prevent the risk of BOD₅ pollution in the future. Microorganism pollution is the problem needed to take into account, thus a method is needed to be put forward aiming to reduce living wastes and fertilizers from discharge

¹ Partnership in Environmental Management for the Seas of East Asia,

source. Though other parameters are not in excessive of stipulated standard but their changes are relatively strong, it really is needed to take into consideration.

Cu De river area under Danang bay is the sensitive ecological area due the natural aquatic system exists here, including fish and benthos freshwater, brackish water and salt water animals; artificial ecosystem includes shrimp farms, freshwater and brackish water fish farms. In addition, there is also the existence of sea grass in Cu De estuary area under direct impact of wastes from the shore discharged into the sea and corals allotted at rock banks along with the edge of Hai Van Pass' base.

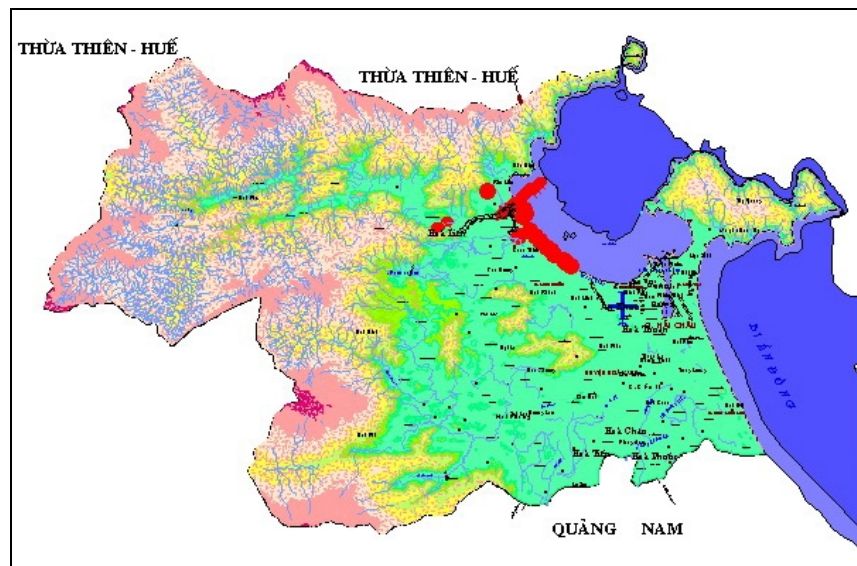


Figure 1. Coastal zones of DaNang bay – object of study

Currently, the water source of Cu De river is seriously contaminated due to the wastes from industrial zones, sand and grit exploitation, deforestation, waste from wards and communes at Danang coastal area that directly affected water source, gulf area ecosystem and health of inhabitants residing in the coastal area. Discharge sources from the shore run into Cu De river including industrial wastes from Hoa Khanh and Lien Chieu; waste water from shrimp farms and agricultural waste water from paddy fields and vegetable fields in the southern bank of Cu De river; rainy water overflows and sweeps away contaminations into Cu De river. Waste water from Hoa Khanh and Lien Chieu industrial zones also converge on this river in the range of 500m far from the estuary. Further to the upper source of the industrial waste water discharge floodgate, there are shrimp farms and sand exploitation places along the riverbank. Furthermore, Cu De river also is the intake door of industrial waste water from paddy fields with area of 25 hectares and waste water from households along the both banks of the river.

The monitoring figures from 3 stations at Cu De river / [4] / indicate environment is seriously polluted here now. Concentration of parameters in Cu De river increases in comparison with previous years.

Monitoring figures taken from places /figure 2/: station S2 (Cu De 1) 1000m far from Cu De estuary on the upper source (intake waste water from aquatic cultivation), station S3 (Cu De 2): 500m far from Cu De estuary on the upper source (place where intakes industrial waste water). The table below shows the actual status of environment in Cu De estuary area.

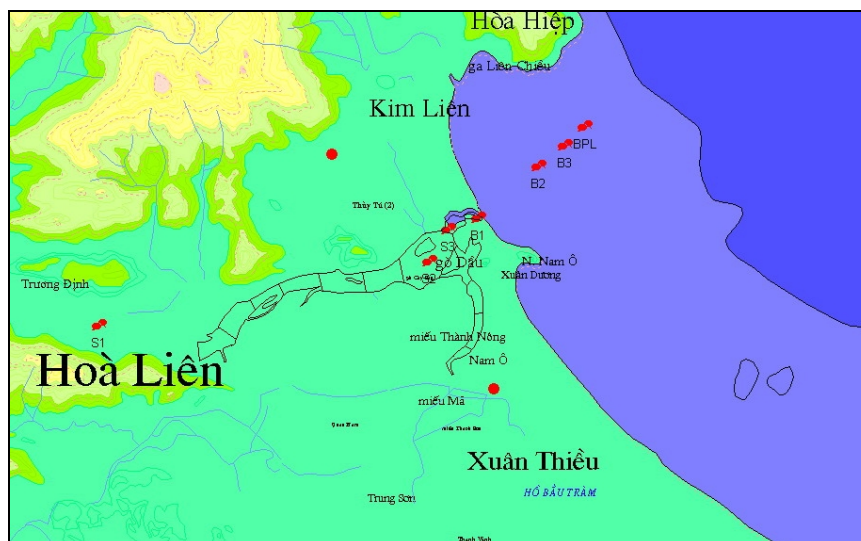


Figure 2. Monitoring sites for water quality coast for Danang bay

It may draw some conclusions as follows:

- COD content (phase 2, 3) is in excessive of standard at 1.48 times. Solid hanging on Cu De river (Nam O bridge) is seriously contaminated, it is place where intakes water from Hoa Khanh industrial zone, and thus the SS content is so high and in excessive of regulated standard at 1.9 to 5.4 times. At the lower section of Cu De river is heavily polluted in coliforms, result measured is in exceed of Vietnamese standard 5942-1995 is 24 times, such figure is larger than that of previous years.
- Other parameters are under allowable limit but still higher than that of previous years.

According to assessment of Danang service of resources and environment in 2005, currently, environment at Danang bay area is specialized in issues as follows [4]:

- At Cu De river, there are hot spot of 4 norms BOD₅, N-NH₄, Coliforms, As. At Danang bay, there are hot spot in terms of 4 norms of DO, BOD₅, Zn and Phenol.
- In the dry season, lack of freshwater due to the erosion of saltwater deep into the mainland, current from cultivation and irrigation areas, aquatic environment leading to the infection of water source.
- The rapid urbanization, industrialization in line with aquatic cultivation leading to the freshwater shortage and additional increasing of infrastructure to satisfy such demands.
- Unpredictability of natural phenomenon such as quantity and quality of freshwater flow, intensity and length of storms, speed and scope of natural process, for example erosion and extension of coastal line, ecological evolutions and the earth rising.

To solve foregoing issues, it is needed to:

- Building up tool that may evaluate the influence of elements such as: hydrography, tide, loading the pollution over water quality of Cu De river and Danang bay area;
- Promptly discovering the reasons caused pollution to find out violating agent in respect of environment and measures for timely handling.
- Building up management tools to satisfy requirement of the information technology age.

3. BUILDING UP INTEGRATED TOOLS FOR GENERAL COASTAL WATER ENVIRONMENT MANAGEMENT – TAKING DANANG CITY AS A CASE STUDY.

Environmental information system (EIS) is defined as a system based on computer for archiving, management and analyzing environmental information and relevant data [1]- [3]. Based on the practical analysis basis of general coastal management project for Danang, in this article proposes a environmental information system aiding general coastal management mission for Danang. This software is called COAST (Computer prOgrAm for coaStal managemEnt for Danang). Structural outline of COAST 1.0 shown on the picture....

Structure of COAST software 1.0 includes main modules as follows:

- GIS
- Environment monitoring data management
- Model
- Relevant environmental information management
- Statistical report module

3.1. Environment monitoring data management module

COAST Software 1.0 proposed here figures out a conjugated solution between GIS and standard data management system MS access.

Following data groups under the management of COAST:

- Monitoring figures of Cu De river water quality;
- Monitoring figures of Nam O estuary water quality;
- Figures on industrial waste water along Danang coastal area.
- Figures related to discharge and elimination from Hoa Khanh and Lien Chieu industrial zones.

COAST provides functions on data exploitation as shown on the figure 3

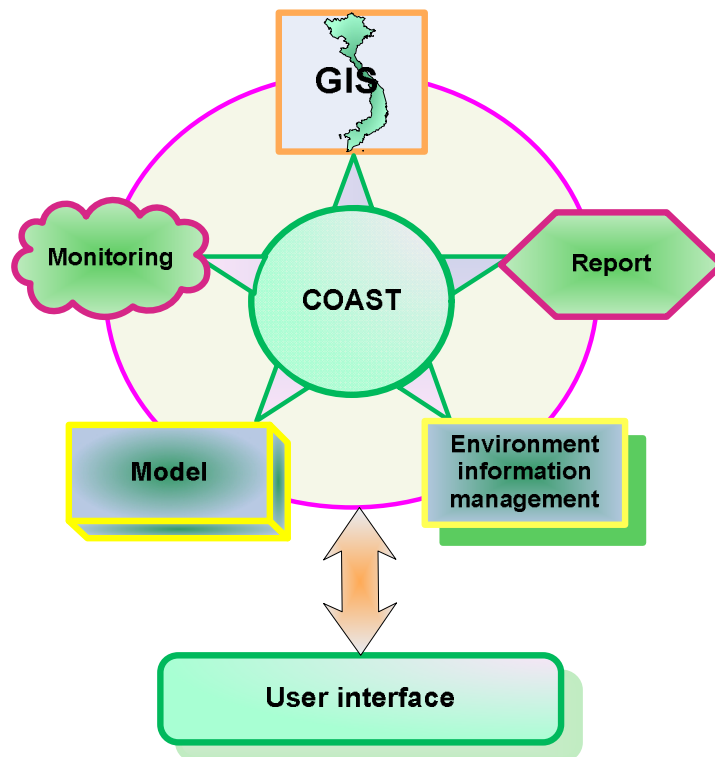


Figure 3. General schematic structure of COAST

3.2. Model module

Environment management on coastal and estuary area in current phase requires a must on evaluating environmental consequences caused by the impact of production over the adjacent area. Hence, the role of model is so important here.

Some authors in previous themes combined mathematic model with GIS and environmental database aiming to help evaluating relationship between economy and environment. In COAST integrated good Segmented Estuary Models (SEMs), Risk Analysis Model (RAM), working outline of this model shown on the picture...these models aid users

on evaluating influences of economic activities over water quality of Cu De estuary area (Danang).

3.3. Relevant environmental information management module

Environmental situation is assessed by several binding parameters and such binding is under the influence of regular changes, thus caused numerous difficulties for the problem of assessing and forecasting adverse impact toward environment. Besides, it is aim to adopt a basic environment decision, managers need a lot of different kinds of information. This enhances the necessity of different information integration in relation to problem to be taken in consideration.

In COAST, following information groups are combined:

- Information about Hoa Khanh and Lien Chieu industrial zones, objects discharge contamination into Cu De river.
- Information pertaining to environment management authorities
- Information about waste water outlet sluices (coming out to the river, sea).
- Information about Vietnamese standard in relation to quality of water environment of river, lake and sea.

3.4. Statistical report module

On environmental management assignment in current stage, environmental report is an integral work. The report is carried out upon the request of managerial authorities aiming to assess environment quality of the object in concern.

As to foregoing practice, in COAST is integrated with tools making automatic report upon request of PEMSEA and environment management agency. COAST enables to conduct report types based on temporal changing figures as follows:

- Water quality at monitoring spots (one or more spots), the content of report is carried out on requirements of managerial assignments.
- Analyzing tide from tide forecast figures provided by Hydrometeorology station located at the middle central part of Vietnam.
- Result of risk analysis model proposed by PEMSEA.
- Computation result from SEM – Evaluating effect of Hoa Khanh and Lien Chieu industrial zones over water quality of estuary area.

3.5. SEM (Segmented – Estuary Model)

In recent years, at Nam O estuary area where Cu De river runs into Danang bay has occurred complicated issues relating to water source infection. In several previous years, this area always supplied various types of aquatic products such as fishes, shrimps, etc. Presently, due to organic pollution occurred fairly serious, so fish and shrimp amount declined distinctly. On the other hand, as for available computation tools still have not any quantitative assessment yet for the pollution picture on surface water of this area. In this work, SEM model was initially applied that presented in [6], [7], [8]. Steps needed to be carried to run this model including:

Step 1: Entering figures of discharge and elimination at Hoa Khanh and Lien Chieu industrial zones. Parameters needed to be entered into this model presented in Error! Reference source not found...

Step 2: Running the model:

Although, computation result is just imitative due to the lack of practical survey figures, certain following conclusions could be drawn out:

- High BOD₅ pollution occurs at the time of ebbing tide and that may be in double.
- Concentration of contamination in waste water gives a big impact to water quality of Nam O estuary area, Cu De river. It is said that some aquatic product processing plants directly discharged into the river. As a result, such induces Nam O estuary area being drastically infected by organic substances.
- At present, Hoa Khanh industrial zone is place where gives more pollution to Nam O estuary area than Lien Chieu.
- If it fails to pay attention to discharge sources being out of control along Cu De river, certainly, BOD₅ infection will reach the level greater than 7-8mg/l at Nam O estuary area.

4. CONCLUSION

In this article proposed a model of conjugated environmental information together with GIS named COAST that aiding the general managerial assignment on quality of coastal water environment in Danang, taking Nam O estuary, Cu De river and Danang bay area as a case study.

COAST includes main functions such as: GIS, environmental monitoring data management, relevant environmental information management and building up statistical reports. In addition, COAST is integrated with Segmented – Estuary Model (SEM) for simulation the spreading of organic infections. This model focuses on the impact of ebbing tide over the spreading. Model enables imitative computation on effect of Hoa Khanh and Lien Chieu industrial zones over the water quality of Nam O estuary area, Cu De river.

Applying Risk Assessment Model (RAM) for Cu De river. This model is taken into COAST aiming to help the automatic computation and making report of risk measurement result for Cu De river.

Some statutory documents were integrated in COAST. These documents help automatic computation and environmental report making as well.

5. REFERENCES

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