



SITE SELECTION FOR EFFLUENT DISCHARGE ALONG THE COAST USING USING GIS

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ABSTRACT

Geographical Information System (GIS) is used to select a site for industrial effluent discharge along the coastal region. The system is developed to deal with the behavior of the discharged effluent in the coastal waters and its effects on the coastal environment, especially, off Paradip, Orissa. The system provides the users with various map query and contour visualization interfaces. The GIS based interfaces are very user-friendly and the system can be efficiently used as a powerful tool to synthesize all the data, for comprehensive interpretation and forecasting of marine environmental impact on the study region.

The spatial database is used for mapping to assess the environmental impact at the study region. GIS is the information system in which spatial as well as non-spatial data are important. The marine environmental capacity to accept the industrial effluent depends upon its ability to dilute and disperse the effluent. This environment contains high biodiversity sensitive to water characteristics. These characteristics of coastal waters are mapped and queried the major attribute data to judge the effects of disposal on the environment.

INTRODUCTION

There is a proposal to set up a fertilizer plant near Paradip, Orissa (NIO report, 2000). This plant is expected to generate large amount (13,330 meter³) of effluents every day. It has to dispose the effluents at suitable site. They had requested NIO to provide necessary information about cumulative impacts on water quality and ecology. The Mahanadi riverbank is hardly few meters away from the company. The river is perennial as well as large amount of water flowing towards sea. The river is running through the town and it is utilized for many human activities. So these effluents should be discharged in the coastal areas where pollution will be maintained minimum.

The effluent will be discharged where the maximum water quality criteria were satisfied and distance should be minimum from Effluent Terminal Point. In this paper, this aspect is explained using GIS.

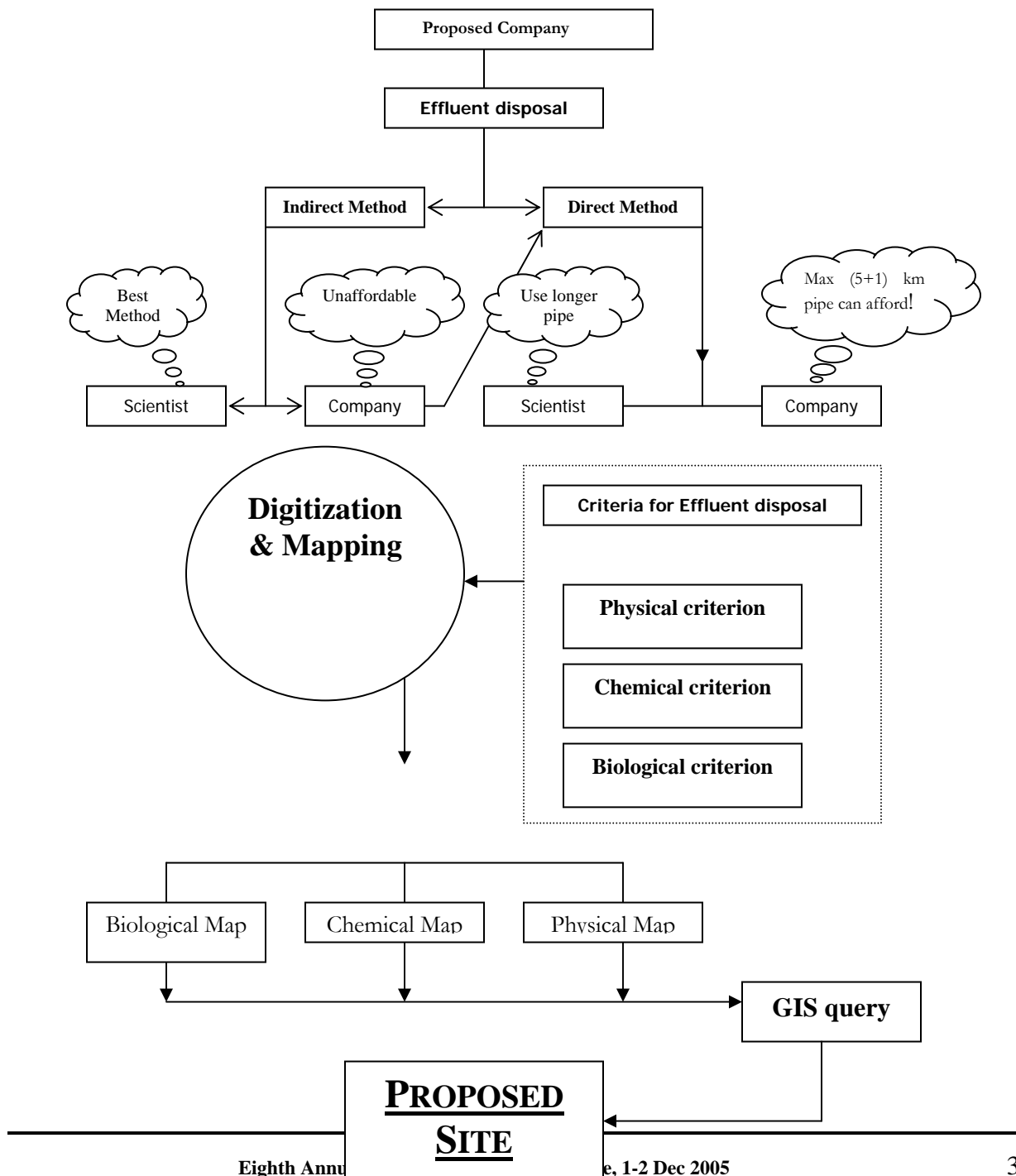
STUDY AREA

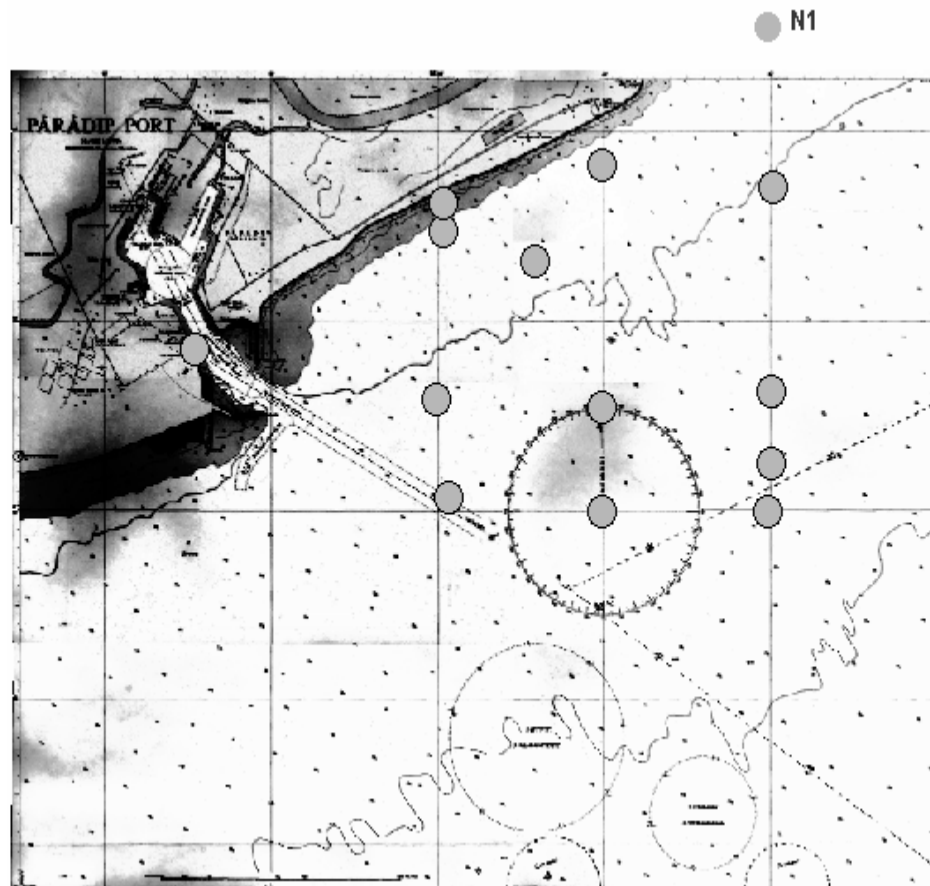
It covers the area from 19° 33'N, 85° 40'00''E to 21° 13' 30''N, 88° 25'30' E the part of East coast of India from Puri to Sand heads of Bay of Bengal.



METHODOLOGY

THE RICH PICTURE SCHEMATIC VIEW OF PROBLEM





The hydrographic map 'Puri to Sand-heads' having 1:3,00,000 scale was used for this paper. This map was compared with 1:15,000 and 1:60,000 large-scale maps of Paradip Port and Paradip. It was found that some land mass was missing from small-scale map. To confirm this difference, IRS P6 satellite data was used. The query system was developed based on the input data like, physics, chemistry and biological parameters pertaining to the study area. The system is shown in the following Figs. 1-5.

INTERFACES REQUIRED FOR USER INTERACTION

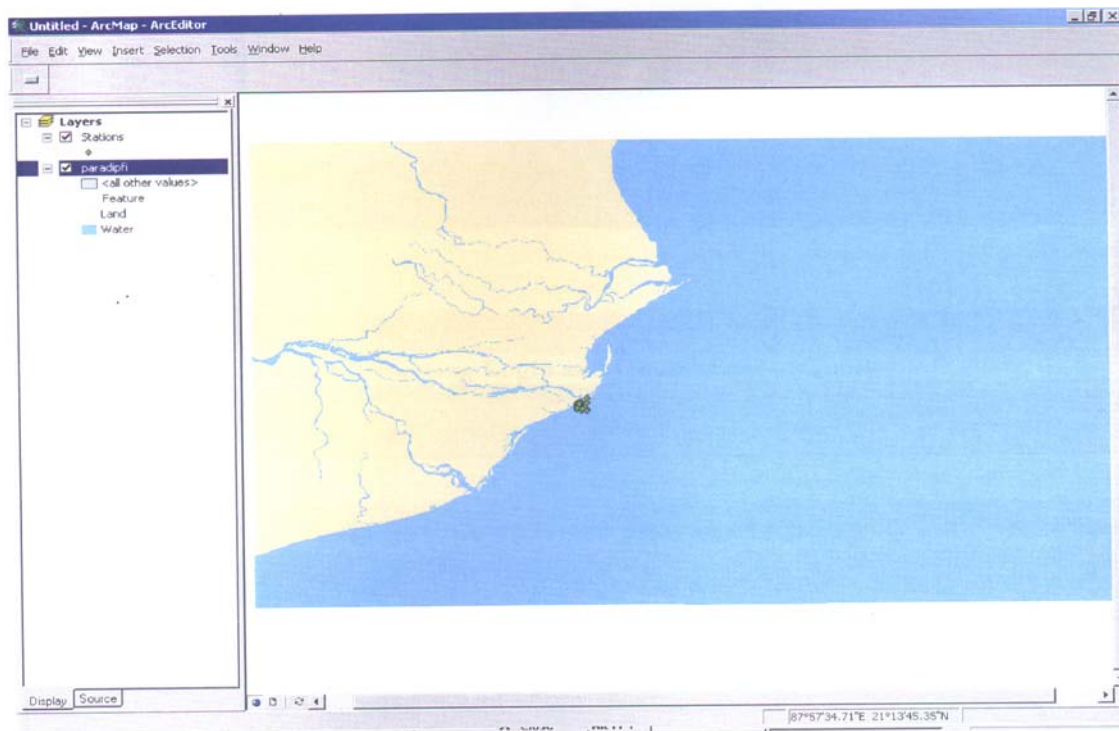
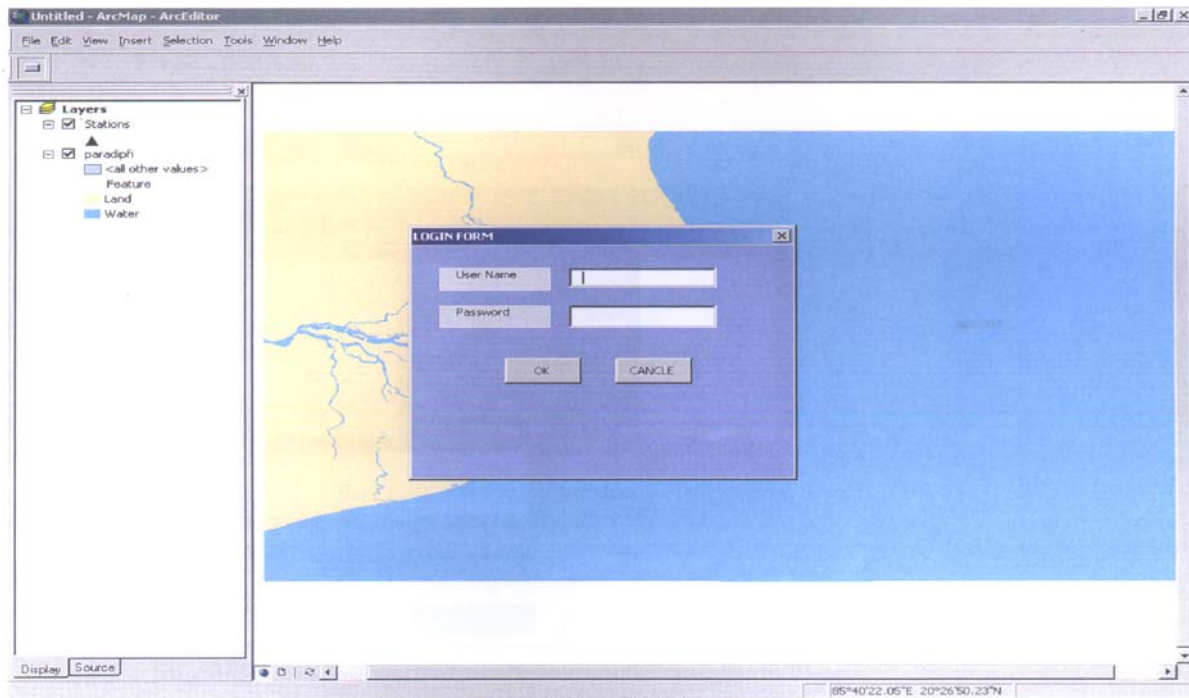
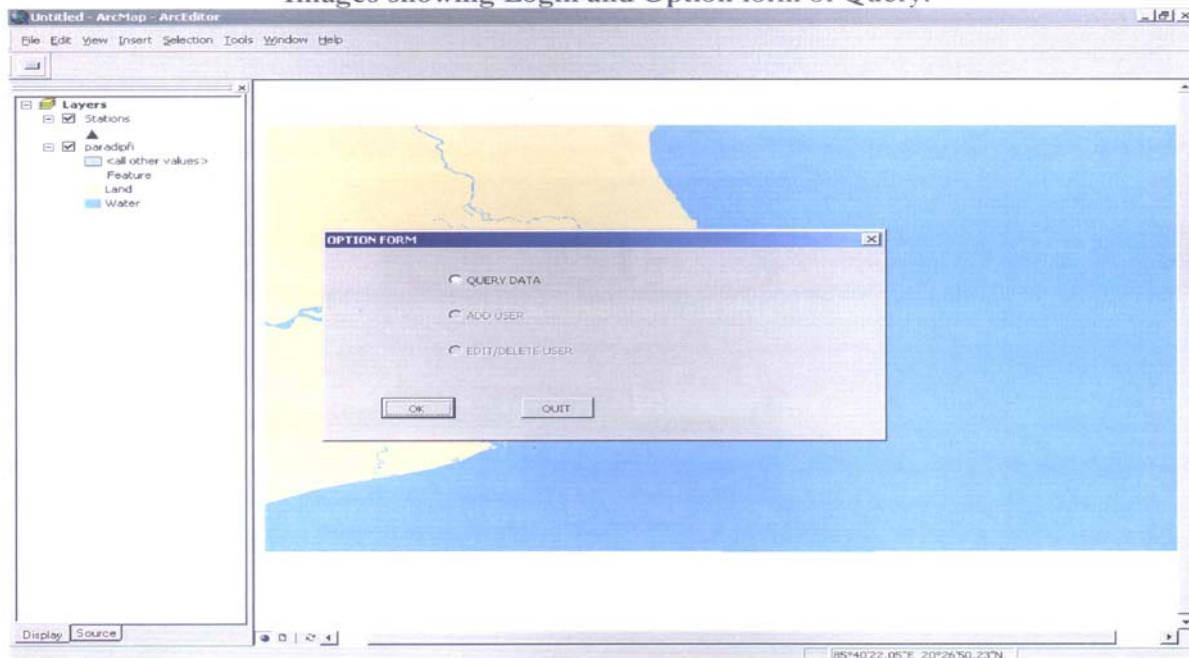


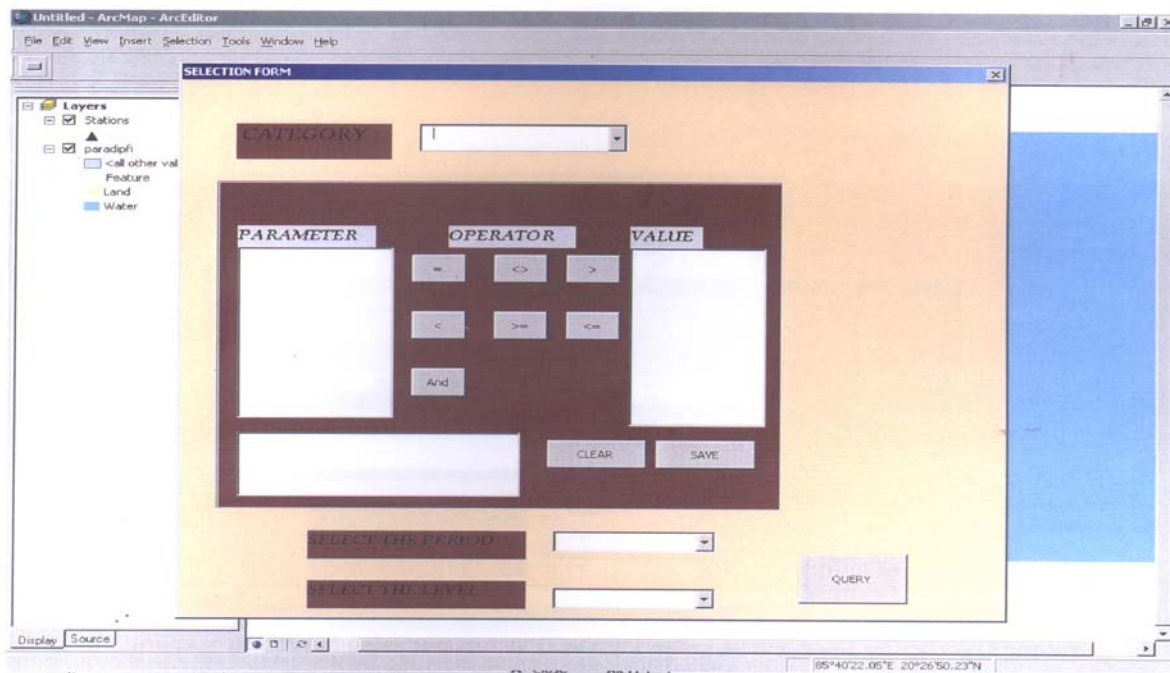
Image showing the both land and water features of Paradip and the stations.

Fig.1

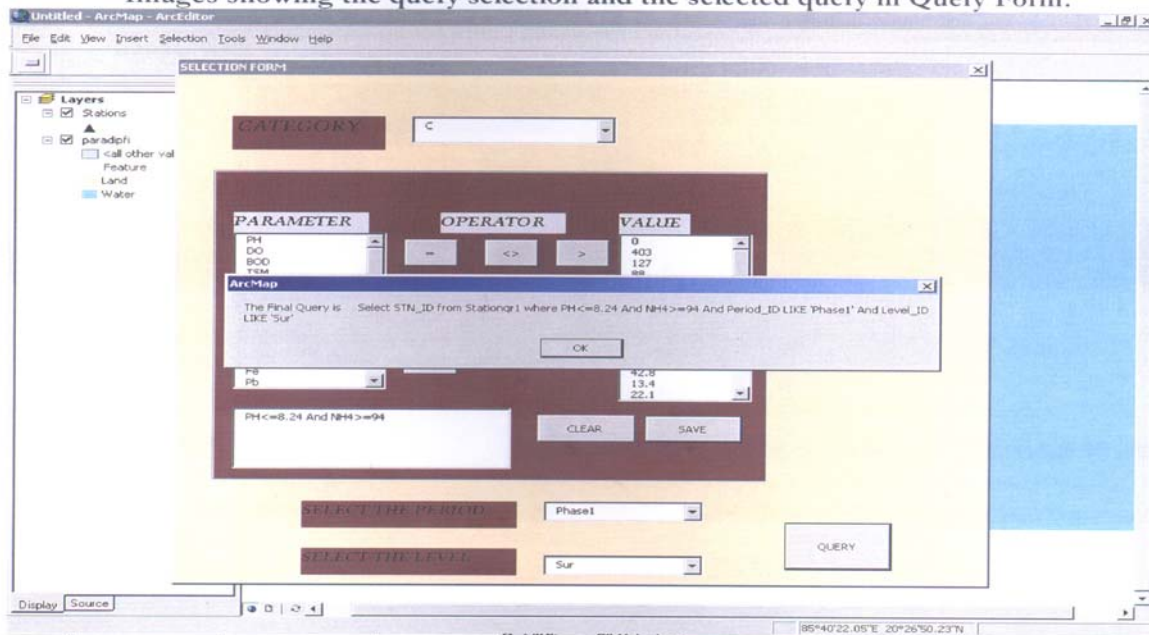


Images showing Login and Option form of Query.





Images showing the query selection and the selected query in Query Form.



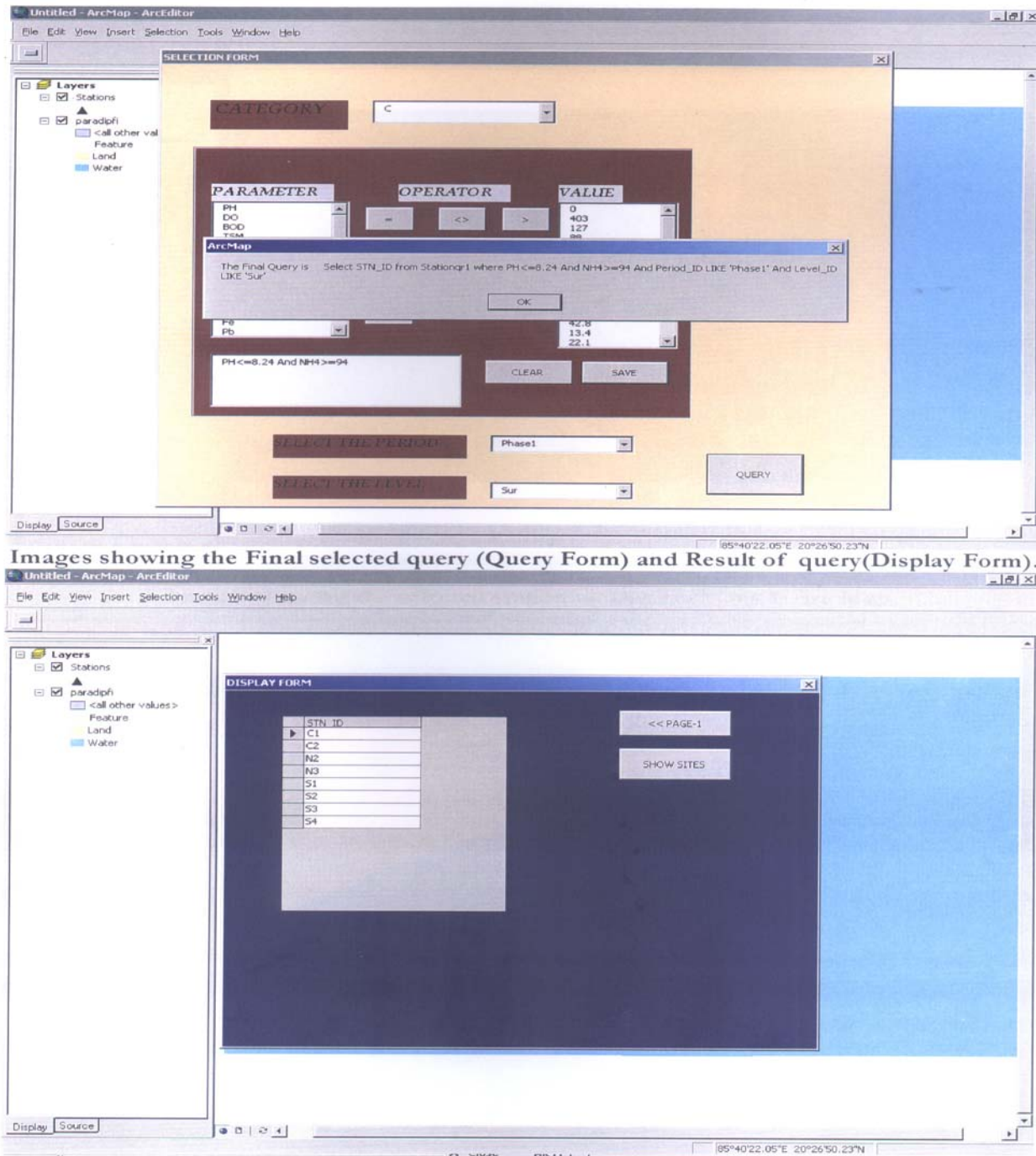
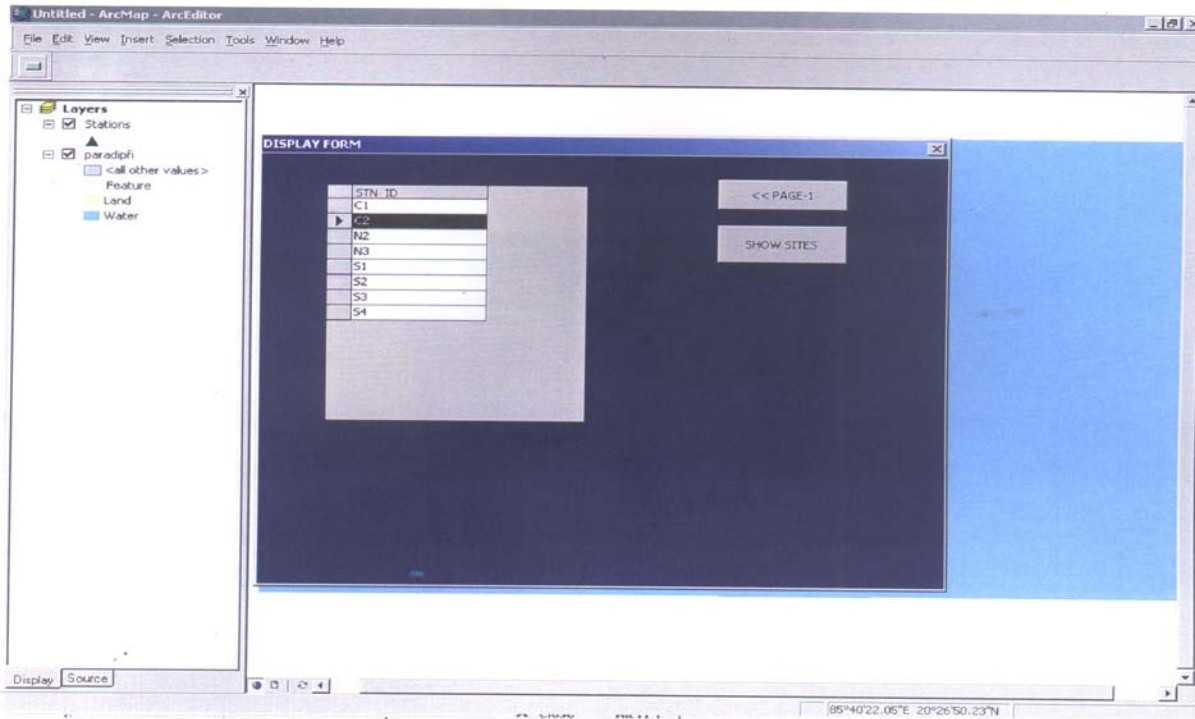


Fig.4



Images showing the selected station on Display Form & Arc Map.

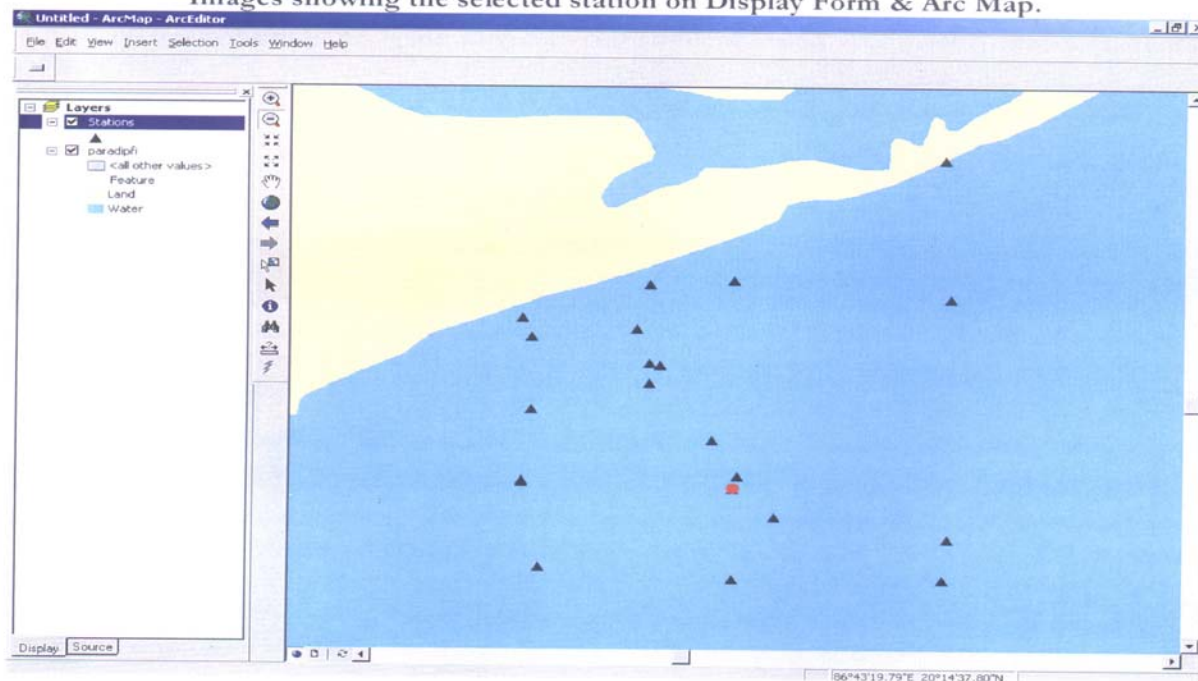




Fig.5

RESULTS AND DISCUSSION

The study region experiences moderately high tide and wave action. The water mass characteristics such as temperature, salinity, density indicates stable stratification of coastal waters. The currents are parallel to the coast. Relatively weak current near coast and gradual intensification towards offshore is conspicuous feature of the structure of coastal currents in area. The tides appeared to have significant role in the local currents dynamics. The oscillatory flows in east-west direction with reversing tide may affect the efficiency of the system to the disperse pollutant. Besides the bottom currents are relatively weaker than the surface currents thus producing a vertical velocity shear, which may not efficiently flush the heavy pollutants. This immediately means an efficient diffuser should be placed to disperse the pollutant at discharge point. Any discharge beyond 1km from the coast may be adequately disperse as surface and bottom currents are stronger than their near shore magnitudes. The currents towards offshore and in the northeast direction in post monsoon shall carry the effluent discharge away from this region (near to coast).

This area is well oxygenated and pH and DO variation indicates that the coastal environment is well mixed and less stratified the BOD5 values are within the primary water quality criteria and do not possess any threat environmental conditions. The nutrients (Phosphate & Nitrates) are well within the limits and comparable with clean tropical coastal environment. No significant variation was noticed between surface and bottom level. High concentrations of nutrients were noticed during pre monsoon then post monsoon, indicating involvement of nutrients in bio-chemical cycling in coastal environment. Low concentration of organic constituents showed no threats to marine biota as concentration observed were low. The wastewater effluent will undergo dilution and dispersion after release. The range of observed concentrations are well within acceptable limits.

In coastal segment marine water is subjected to several types of uses. Depending of the types of uses and activities, water quality criteria have been specified to determine its suitability for a particular purpose. Among the various types of uses there is one use that demands highest level of water quality/purity and that is termed a "designed best use" in that stretch of the coastal segment. Based on this, primary water quality criteria have been specified for following five designated best uses:



**[Table 1 Primary Water Quality Criteria for Class SW-V Waters
(For Navigation and Controlled Waste Disposal)]**

S.NO.	PARAMETER	STANDARDS	RATIONALE/REMARKS
1.	pH range	6.5-9.0	As specified by New England Interstate Water Pollution Control Commission.
2.	Dissolved Oxygen	3.0 mg/l or 40 percent saturation value, which ever is higher.	To protect aquatic lives
3.	Colour and Odour	None is such concentration that would impair any usages specifically assigned to this class.	As specified by New England Interstate Water Pollution Control Commission.
4.	Sludge deposits, Solid refuse floating oil, grease & scum.	None except for such small solids, amount that may result from discharge of appropriately treated sewage and/or individual waste effluents.	As in(1) above
5.	Fecal Coliform	500/100 ml (MPN)	Non exceeding 1000/100 ml in 20 percent of samples in the year and in 3 consecutive samples in monsoon months

Using the above criteria for water quality of the study region, the query system was developed on GIS map which includes the station locations also. Wherever our input data matches with the standard water quality parameters that will be the location for discharge of effluent.

ACKNOWLEDGEMENT

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REFERENCE

1. NIO Report (2000): Comprehensive EIA of marine activities for the proposed plant at Paradip, Orissa.