

# SELECTION OF SUITABLE SITE FOR THE INDUSTRIAL LOCATION IN THE SAND BAR OF THE BATTICALOA LAGOON BY USING GIS AS A TOOL

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## 1. INTRODUCTION

### 1.1 STUDY AREA

The coastal low land of the Sri Lanka consists of bays and lagoons. In the south eastern part of the coastal low land has a prominent sand bar, 35 km long extending northwards and at its widest part, its width is about 9 km. This sand bar forms the Batticaloa Lagoon which is located between  $7^{\circ}25'34'' - 7^{\circ}46'22''$  northern latitudes and  $81^{\circ}34'05'' - 81^{\circ}49'05''$  eastern longitudes. The area of the lagoon is about 1418 hectares and it is about 56 km long from Eravur in the north to Natpiddimunai in the south. This lagoon is open to the sea in two places. One is at Palameenmadu and the other is at Kodaikkallar.

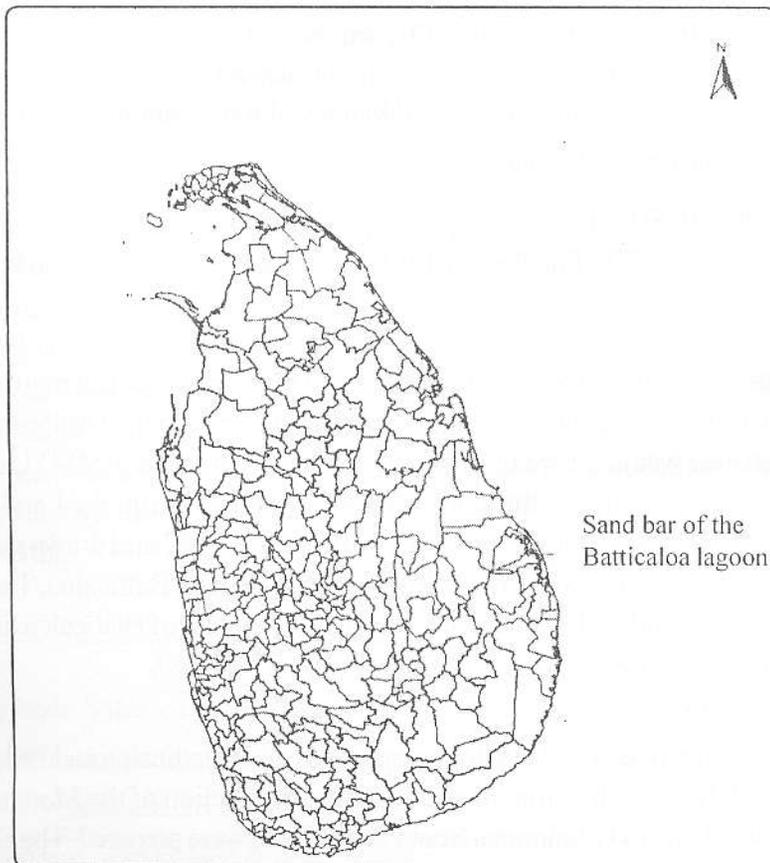


Fig 1. Location of the study area

The eastern coast of the lagoon, mainly the sand bar is a densely populated area and the western coast consists of a wide stretch of paddy fields. In the study area, from ancient times people

were engaged in trade and manufacture. Ancient Tamil settlements at Thirukketheeswaram, Thirukkoneswaram and Thirukkivil were engaged in trade, agriculture and fisheries (Arasaratnam, S., 1964), the Tamil traders established temporary settlements in ports and major towns (Indrapala, K., 1969) and Arabian traders came and settled in Batticaloa by the 8th century A.D (Canagaratnam, S.O., 1921). A large number of industrial establishments are situated mainly in Batticaloa town and Kattankudy, closer to the lagoon and they discharge their waste directly into the lagoon.

## **1.2. IMPACT OF INDUSTRIES ON THE WATER QUALITY**

In the study area, most rice mills are located in the Porathivu Pattu, Manmunai South West and Manmunai West divisional secretary divisions. Out of the 362 mills in the Batticaloa District, 90 are in Porathivu Pattu, 75 are in Manmunai west and another 75 are in Manmunai South West Pattu divisions. In Eravur Town, the rice mills are very close to the lagoon. As these industries are situated along the Batticaloa lagoon, wastes are disposed of directly into the lagoon, resulting in pollution. In Arayampathi, coconut husks are soaked in the lagoon for use in the coir industry. This affects the quality of the water in the lagoon and also allows the breeding of mosquitoes. The prawn farms at Periyaurani and Thirupperunthurai areas, contribute to the water pollution in the lagoon, by discharging untreated farm effluents. Untreated farm effluents lead to increased saltwater intrusion and increasing eutrophication in water sources, caused by the leaching of acidic substances during farm construction (Coast Conservation Department, Ministry of Fisheries and Aquatic Resources Development, 1997). The disposal of animal wastes from the slaughter-house at Periyaurani, pollutes the water and the obnoxious odour and the stagnation of black colour water deteriorates the aesthetic beauty of the lagoon.

## **1.3 THE OBJECTIVE OF THE STUDY**

The main objective of the study is to find the suitable location for an industrial site in the sand bar of the Batticaloa lagoon.

## **2. METHODOLOGY**

2.1 Collection of data In this study, the georeferenced 1 :50,000 topographical map of Batticaloa and Paddiruppu were obtained from the GIS branch of the Urban Development Authority, Colombo. The digitized land use map was acquired from the Earth Science Division, EMSO Ltd, Colombo. The data regarding the land values of the study area were gathered from the Land Evaluation Department of the Batticaloa Secretariat and through interviews. The hand drawn map of power lines and substations was received from the Ceylon Electricity Board, Batticaloa. The secondary data was gathered from the Survey Department, Statistical handbook of Batticaloa district and from books, magazines and reports.

## **2.2 PREPARING OF LAYERS**

Using the scanned geo referenced 1 :50,000 topographical map of Batticaloa and Paddiruppu, the D.S division maps and the G.N. division maps of the sand bar section of the Manmunai North, Kattankudy, Manmunai Pattu and Manmunai South Eruvil Pattu were prepared. The D.S. division maps were separately clipped from the base topographical map and from that G.N division maps were prepared. Then the G.N division maps of the sand bar were merged using the geoprocessing

wizard, and a separate layer was created. . Before merging, a copy of each D.S division maps was added as new themes. Power lines were drawn by using line tool and the substations were digitized by using point tool. Water supply tank and land values were spotted by using point digitizing tool.

### 2.3 COMPUTATIONS

For the purpose of union, intersect, clip and merge the themes the Geoprocessing wizard was used. To create buffers, query builder was used to select the features which have to be buffered and then from the theme menu, create buffers tool was selected and used. Calculator was used to calculate area, population density and to give ID numbers and to categorize the suitability of layers.

### 3. OUTPUT GENERATIONS

Out put was generated through seven inventory types, 4 policy analyses and 4 policy making. Inventory layers are;

1. G.N division wise land use of the study area
2. Land values of the study area
3. Population of the residential areas
4. Population density of the residential areas
5. "A class" roads and "Other class" roads
6. Power substations
7. Power lines - Single phase and three phase

### 4. POLICY ANALYSES INCORPORATED IN THIS STUDY ARE :

1. Analysis of the road buffer(According to the Road Development Authority, 17 meters from the "A Class" roads and 13 meters from the "Other class" roads are prohibited for any kind of constructional activities).
2. Analysis of the suitability of the power substations(It was stated by the CEB that 600 meters radius from the substation is suitable and 800 meters radius is moderate for industrial activities).
3. Analysis of the prohibited area around the water supply well(It was stated by the water supply board, that 500 meters from the main water supply well is prohibited for residential or industrial activities).
4. Analysis of coastal buffer(According to the Coast Conservation Act, 300 meters from the coast line is prohibited for any industrial or construction activities).

For the policy making, suitability of land use for the industrial location in the sand bar was identified. For this, the land use map of the Batticaloa lagoon area was used as a base map. In the attribute table a new field was added as "status". With the help of the query builder the suitable land uses were selected and by using the calculator the status marked as Suitable, moderate and not suitable. Table I shows this.

**Table 1. Status of the land use types**

Types Of Land use	Status
Scrub lands. Salinized paddy lands & Sand	Suitable
Coconut land, garden, other cultivation, cashew lands, forest & vegetable cultivation	Moderate
Built up land, marshy land & water bodies	Not suitable

To find the suitable population density of the study area water bodies, marshy land, forest, paddy lands, cashew cultivation area and scrublands were selected as non-residential area. Then with the help of the geoprocessing wizard, the land use of the study area and the non residential area were made to union and the residential area was identified. Then the population density of this area was calculated and classified as low, medium and high density areas. Table 2 shows this.

**Table 2. Population density of residential area**

Label	Value
Low	300 – 2700
Medium	2701 – 8200
High	8201 - 16900

If the industry needs high labour input then the G.N (Grama Niladari) divisions with high population density will cater this need. If the industry doesn't need high labour input, then the G.N divisions with low population density will be suitable. This is analysed by using query builder and calculator by identifying the suitable density of population in each G.N divisions.

For the suitable selection of the industrial site., the land use, population density and power substations were ranked with the help of the calculator. The ranks given are explained in Table 3.

**Table 3. Selection by land use population density and power supply**

Land use	Ranks		Category
	Population density	Power supply	
1	1	1	Most suitable
2	1	1	Suitable
1	2	1	Moderate
2	2	1	Less suitable

The most suitable category was selected with the help of the query builder and it was converted to a new shape file and named as the "Accepted industrial Area". From this shape file to find out the most suitable industrial location, the large extent of area with low population density was selected from the attribute table by using query builder and it was converted to new shape file and was named as the "Suitable industrial location of the study area". This is shown in figure 2.

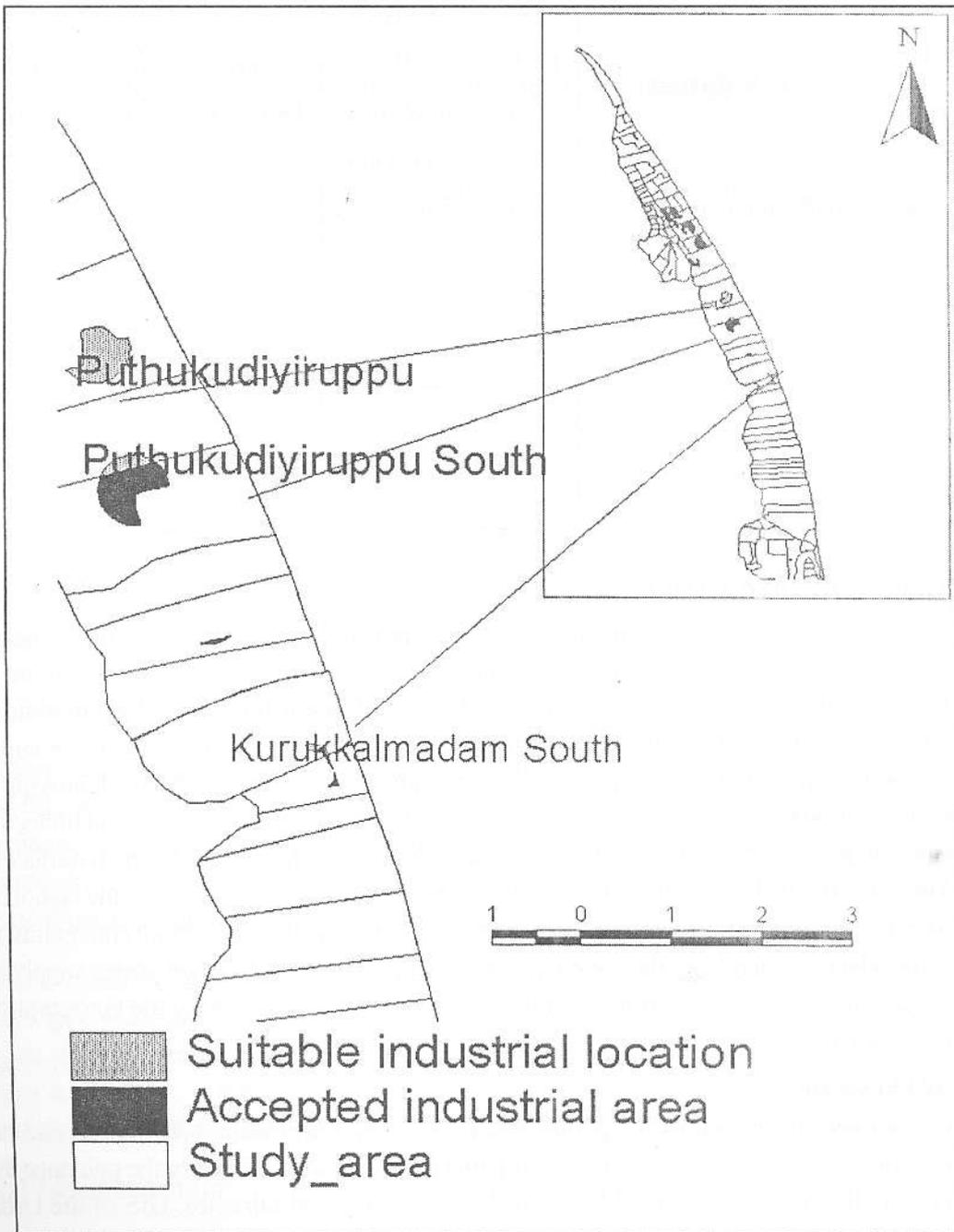


Fig 2. Suitable industrial location of the study area

**Table 4. Suitable industrial locations selected according to the criteria**

The selected G.N divisions are Puthukkudiyiruppu, Puthukkudiyiruppu South and Kurukkalmadam South. Extent of area of these divisions are more than 500 acres and the population density is less than 300/sq.km.

DSD names	GN names	Land Use	Power buffer distance (Meter)	Population Density/Sq.km	Area (Acre)
Manmunai Pattu	Puthukkudiyiruppu	Scrub	600	359	701
Manmunai Pattu	Puthukkudiyiruppu	Scrub	600	319	607
Manmunai South Eruvil Pattu	Kurukkalmadam South	Scrub	600	395	529

## 5. CONCLUSIONS AND RECOMMENDATIONS.

In this study we use the GIS tools to identify the most suitable industrial location. With the help of the geoprocessing wizard, the themes were made to union, intersect and merge to create the wanted themes. The tool query builder was used to select the attributes and the calculator to calculate the parameters. The data on road accessibility, land use, land values, power supply substations, power supply lines, population density of residential area were useful in identifying the most suitable location for industrial sites. The policies on ground water pollution, coastal protection, accessibility and power supply also helpful for the identification of the industrial site. To reduce the pollution level the waste disposal must be treated well before they were drained into the lagoon. As this is not done in the study area as well as in most parts of Sri Lanka due to financial constraints, the industries must be relocated from the coastal area to inland areas where they get power supply and transport accessibility. The selection of suitable site can be easily done by the Geographical Information Systems.

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