

United Nations Office for Project Services (UNOPS)
UNDP-Accra

Environmental Sensitivity Map for
Coastal Areas of Ghana
Volume I – Atlas

October 2004

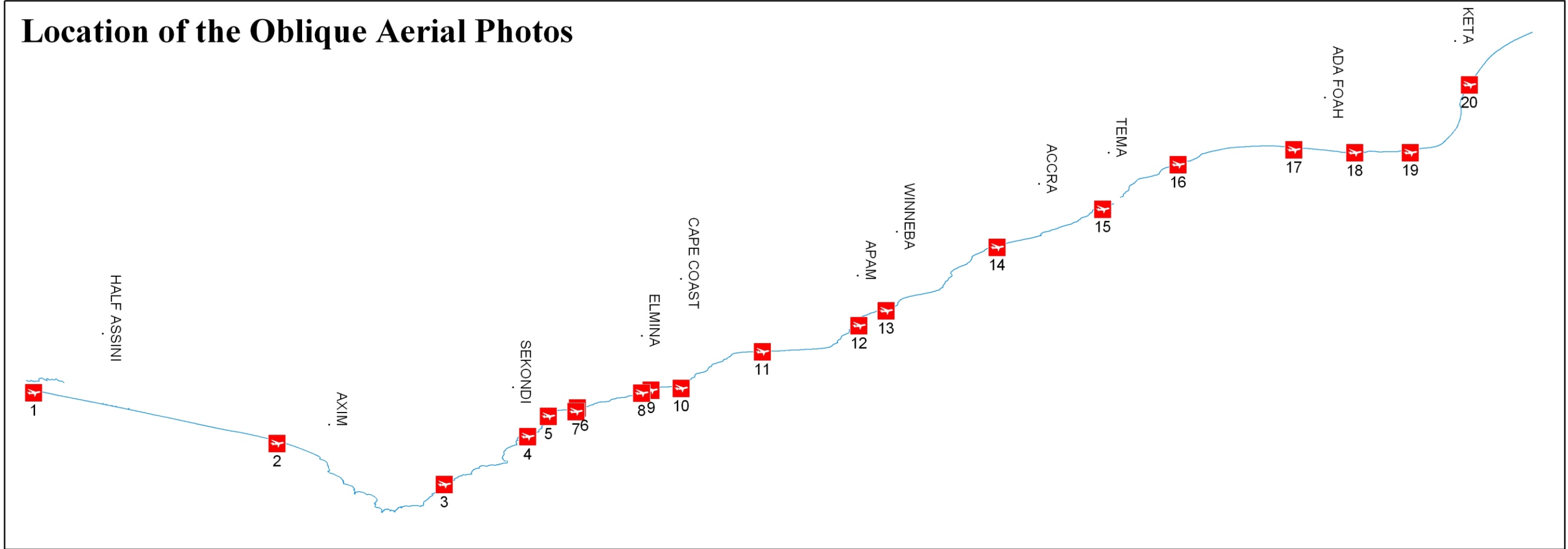


Prepared for Environmental Protection Agency, Ghana
by

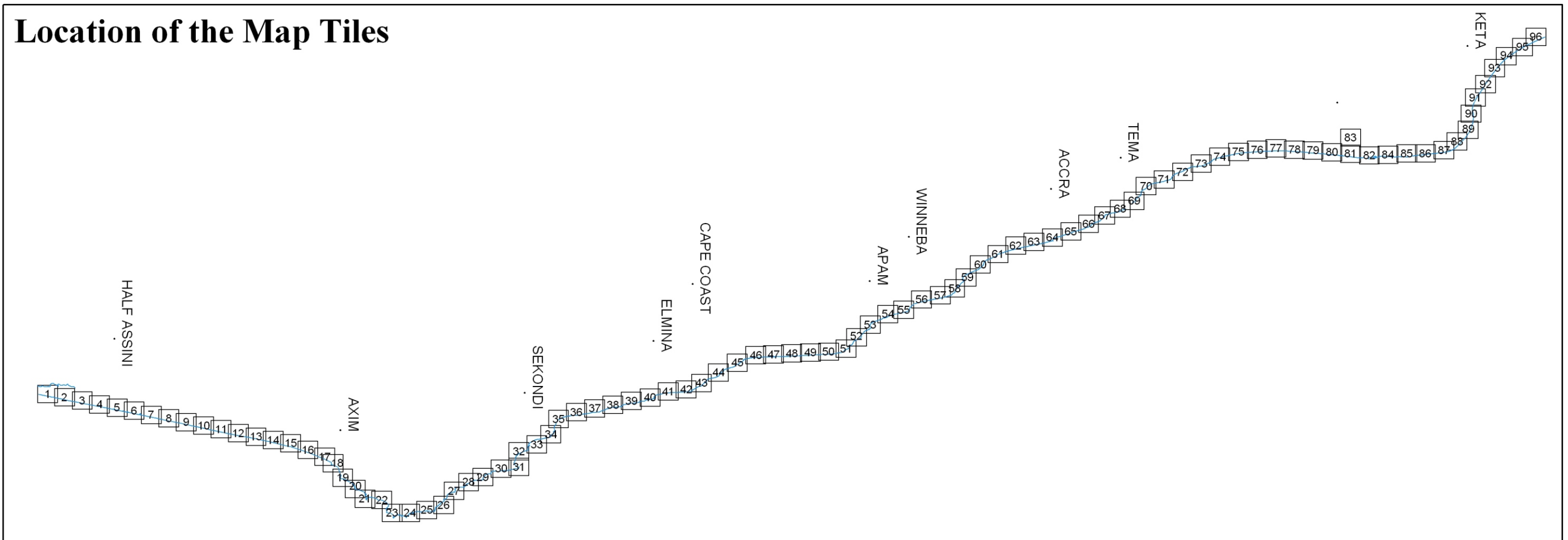
COWI

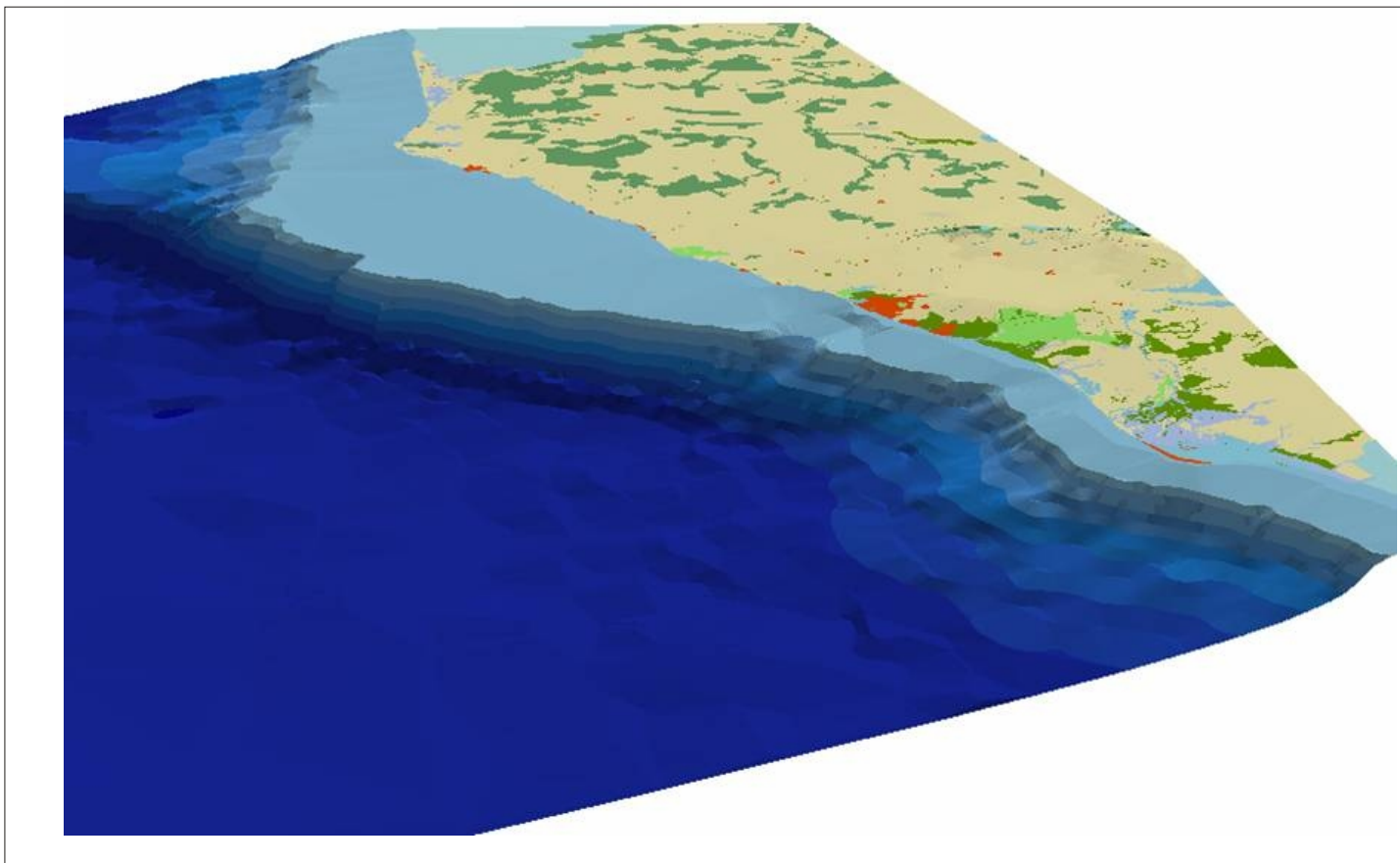
HEDESELSKABET
DDH Consulting A/S 

Location of the Oblique Aerial Photos

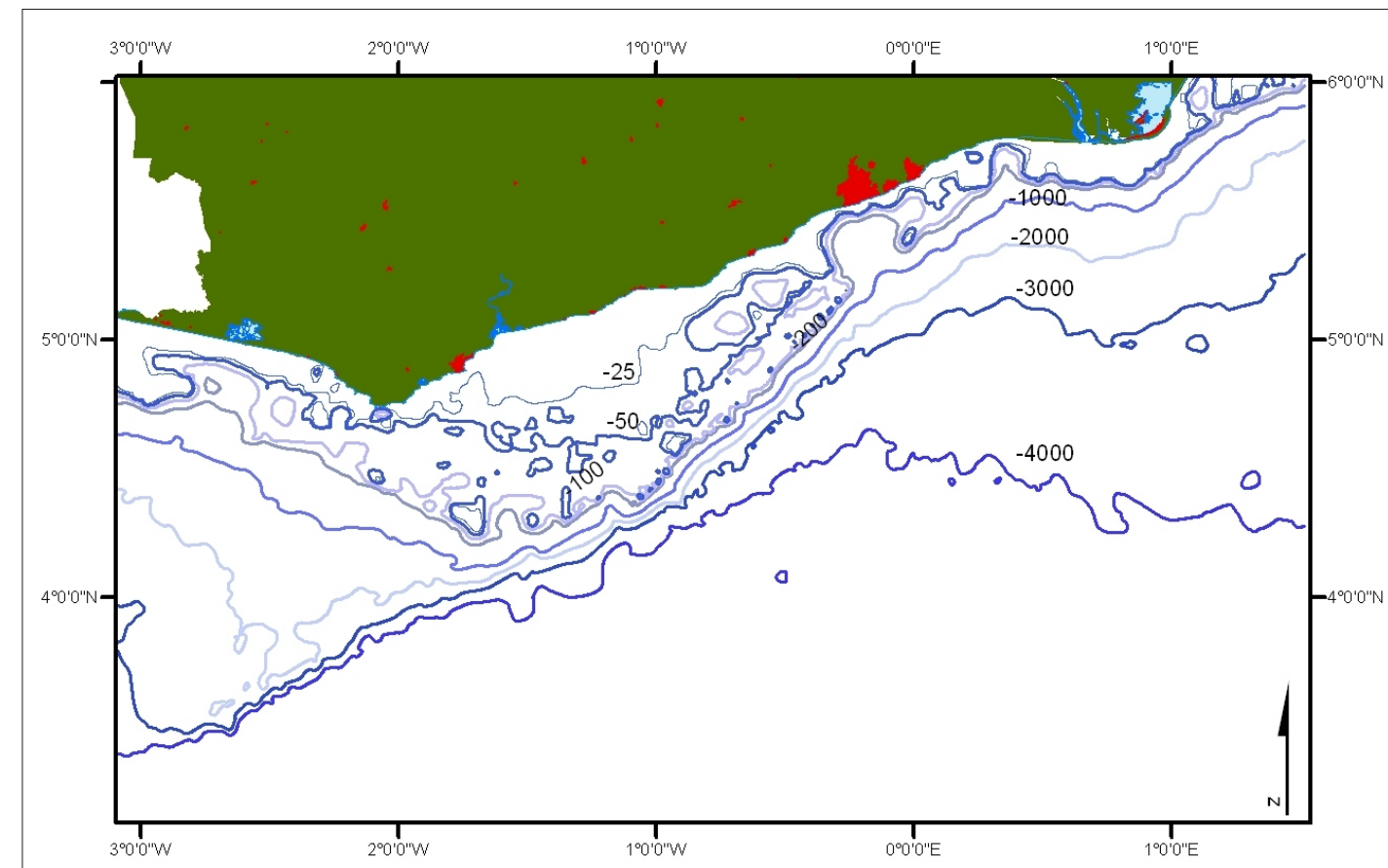


Location of the Map Tiles

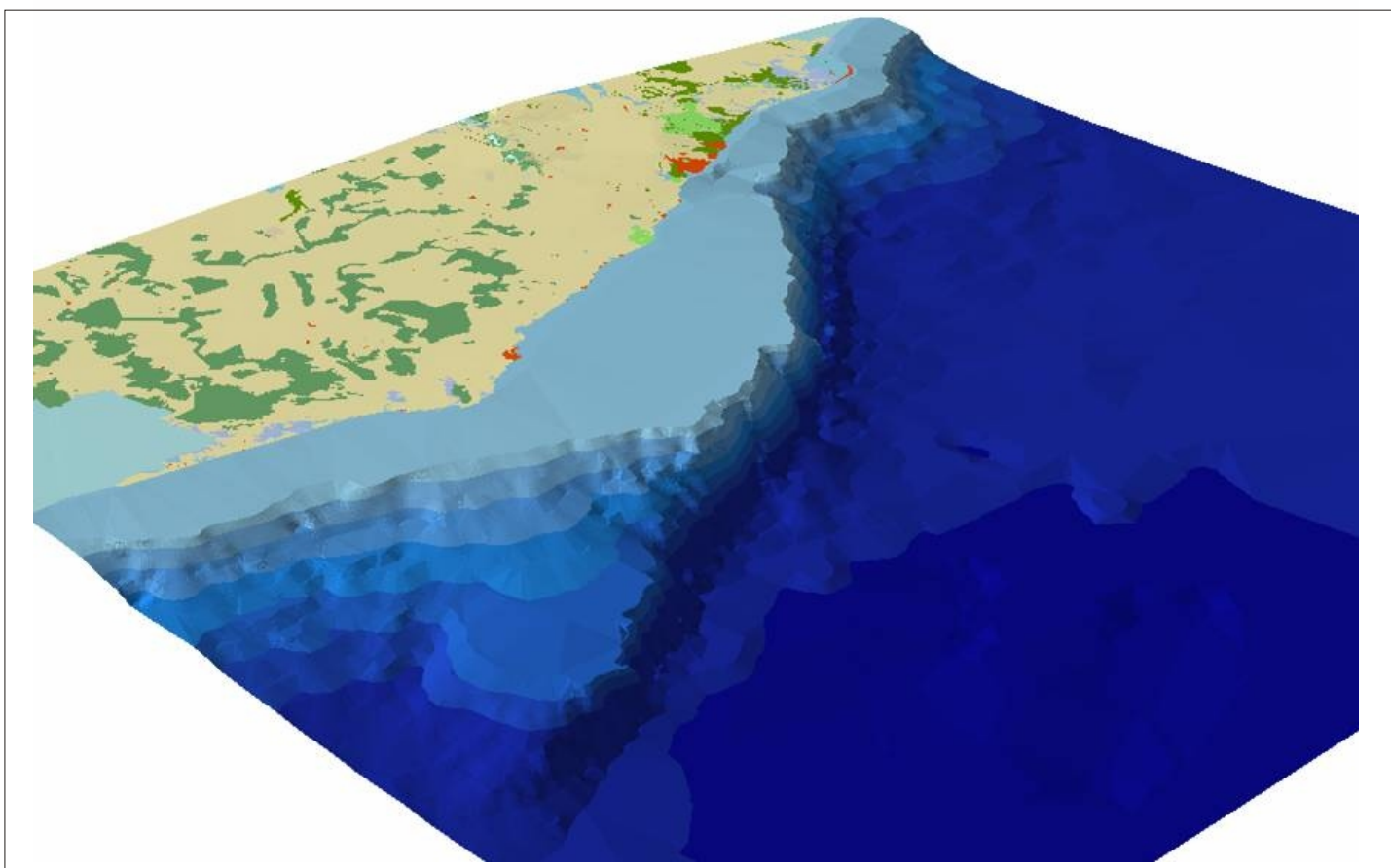




3D-model of the bathymetry in the Gulf of Guinea off the coast of Ghana seen from east



Bathymetry in the Gulf of Guinea off the coast of Ghana.



3D-model of the bathymetry in the Gulf of Guinea off the coast of Ghana seen from west

Bathymetry

The bathymetry of Ghanaian continental shelf is well known. The width of the coastal waters having depth less than 200 m varies from a minimum of about 20 km off Cape St. Paul to about 90 km at the widest portion between Takoradi and Cape Coast. Further off shore the bottom falls sharply and reach a depth more than 4,000 m just 100 km from the coast.

Further details can be obtained from e.g. the Sea Charts Series Africa-West Coast, chart no. 595 'Sassandra to Lagos' in scale 1:1,000,000.



Oblique no. 9

Location: Approx 3 km east of Elmina (Map 40 and 41)

Description: Alternating sandy beaches and exposed rock with low slope near Iture Lagoon.



Oblique no. 11

Location: Approx 6 km east of Saltpond (Map 47)

Description: Sandy beach and the mouth of the Amisa Lagoon.



Oblique no. 10

Location: Cape Coast (Map 42)

Description: Sandy beach with coarse sand and exposed rocks.



Oblique no. 12

Location: The Apabaka Lagoon northeast of Apam (Map 53)

Description: Alternating sandy beaches and exposed rocks.



Oblique no. 5

Location: Approx 15 km north east of Sekondi (Map 35)

Description: Coarse sandy beach near the mouth of Pra River.



Oblique no. 7

Location: West of Abrobeano (Map 37)

Description: Coarse sandy beach west of Abrobeano Lagoon



Oblique no. 6

Location: Abrobeano (Map 37)

Description: Coarse sandy beach and the Abrobeano Lagoon



Oblique no. 8

Location: Elmina (Map 40)

Description: Alternating rocky and sandy beaches and the Benya Lagoon.



Oblique no. 1
Location: New town/Half Assini (Map 1)
Description: Beach with fine grained sand and low slope near New Town



Oblique no. 3
Location: East of Busua (Map 27)
Description: Sandy beach at Butre with coarse sand and exposed rocky flats. Butre estuarine and wetland.



Oblique no. 2
Location: West of Axim (Map 15)
Description: Beach with fine grained sand and low slope near the mouth of Amansure Lagoon.



Oblique no. 4
Location: Approximately 5 km east of Sekondi (Map33)
Description: Alternating sandy beach and exposed rocks.

Legend

Landing Sites

- No. canoes
- 0 - 9
 - 10 - 29
 - 30 - 49
 - 50 - 100
 - 101 -

Beach Seine

- No. nets
- <5
 - >5

Aquaculture

- Aquaculture

Fish traps

- Fish traps

Tourism

- Public/bathing beach
- Eco-tourism
- Water sports
- Camping
- Recreational fishing

Hotels Waterfront

- No. Rooms
- <20
 - >20

Historical monuments

-

Cultural Points

- Church
- Hospital
- Mosque

Other Human Use Activities

- Industrial water intake
- Power generation
- Mangrove
- Ports/Harbours
- Boat Ramp
- Navy
- Domestic Water Intake
- Swamp Farming
- Jetties

Land use

- Salt Ponds
- Houses and buildings
- City and villages
- Sand/Mud flat
- Mangrove
- Marsh
- Lake/Lagoon
- Island
- Flooded areas

Transport lines

- Ferry
- Railway
- Road, Motorable all year
- Road, Occasionally closed
- Road, In dry season only
- Siding
- Track
- Trail
- Airstrip

Rivers

-

Birds

- Passerine Birds
- Waterfowl
- Waders
- Shorebirds
- Bird of Prey
- Pelagic Birds
- Gulls and Terns
- Diving Birds

Fish and shrimps

- Spawning areas
- Nursery areas

Reptiles and lizards

- Crocodiles
- Turtles
- Lizards

Mammals

- Manatees
- Dolphins
- Big Whales

National Protected Sites

- Forest Reserve
- Game Production Reserve
- Forest Reserve
- Game Production Reserve

International Protected Sites

- Ramsar Site
- Ramsar Area

Coast type

- Sandy beaches
- Mouth at open or semi closed lagoon
- Rocky shores

Human Use Ranking

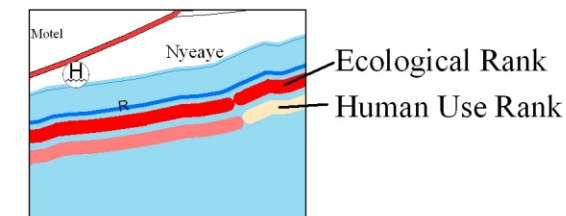
Rank

- Low
- Medium
- High
- Very high

Ecological Ranking

Rank

- Low
- Medium
- High
- Very high



Ecosystem in the coastal area or off shore	Sensitivity to oil spill
Open Waters Pelagic ecosystem	Low
Sandy beaches Sandy beaches with fine grained sand and low slope Sandy beaches with coarse sand, often mobile eroding Sandy beaches with turtle nesting sites	Low Low High
Rocky shores Steep exposed rock Exposed rock with low to moderate slope Mixed exposed rock and sandy beach Exposed rocky flats with abundant crevices Intertidal rocks with algae exposed at low tide	Low Medium Medium High High
Coastal lagoons Open coastal lagoon/estuary Semi closed coastal lagoon Open coastal lagoon/estuarine wetland important for birds (including Ramsar sites) Semi-closed coastal lagoon important for birds Mangroves	High Medium Very high High Very high

Human use feature in the coastal area or off shore	Sensitivity to oil spill
Fishery and Fishery Activities Fishery in open waters Fishing villages having vessels and canoes in number > 50 Fishing villages having vessels and canoes in number ≤ 50 Coast used for intensive beach seine fishery (villages having >5 nets) Coast used for beach seine fishery (villages having ≤5 nets) Coast with lagoon fishing and/or aquaculture	Low High Medium Very high High Very high
Industrial and Agriculture Activities Coast with salt production utilising marine water Coast with major port Coast with industrial plant relying on marine water intakes Coastal Farming (e.g. shallot cropping)	Very high Very high Very high Low
Tourism and recreational issues Coast with tourist hotels at the water front having > 20 rooms Coast with tourist hotels at the water front having ≤ 20 rooms Coast used for recreational purposes	High Medium Medium
Historical Monuments and Amenities Coast with historical monuments (forts/castles) near waterfront	Low

7. Result of the Ranking

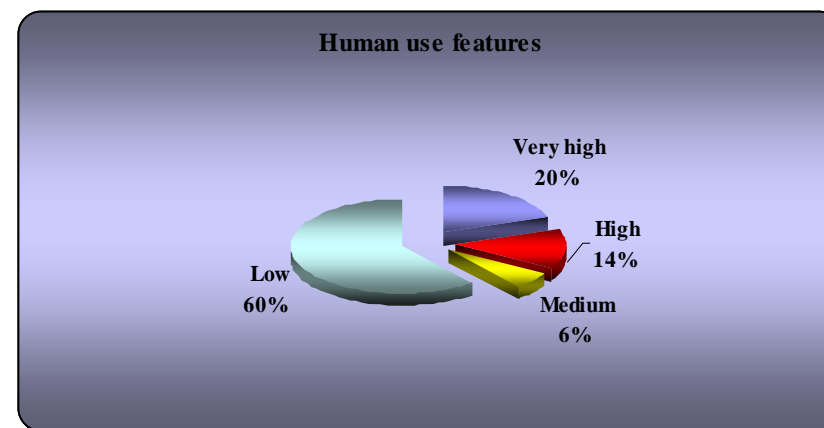
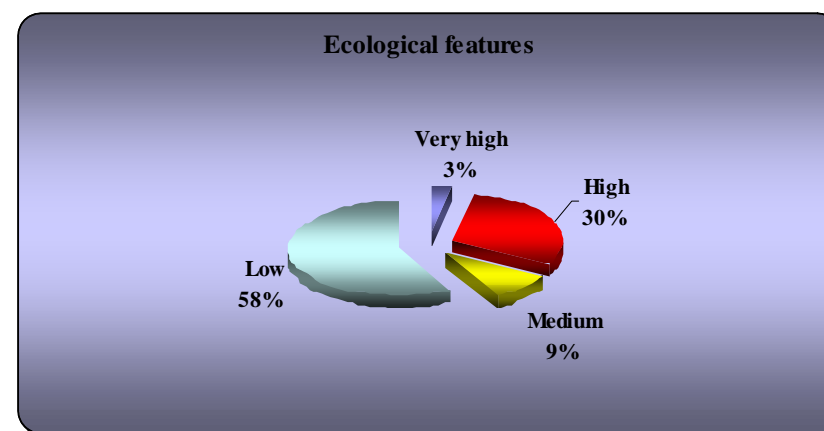
The main findings in ranking the sensitivity of the coast of Ghana to marine oil spills are summarised in the table.

Ranking	Ecological Features (km)	Human Use Features (km)
Very high sensitivity	19	115
High sensitivity	176	80
Medium sensitivity	52	34
Low sensitivity	338	356
Total length	585	585

About 3 % of the coastline has been ranked as having a very high sensitivity in terms of ecological features. These areas include the mouths of estuaries and open lagoons which are important feeding and roosting areas for internationally important numbers of migrant birds (i.e. mainly Ramsar sites) and/or having stands of mangroves.

About 20 % of the coast has been ranked as having a very high sensitivity in terms of human use features. These areas include important beach seining locations and mouths of lagoons in which salt production and/or lagoon fishing takes place.

The distribution of the categories is depicted in the diagrams.



8. Table of Contents of the Atlas

The Atlas comprises the following information, photos and maps:

Theme	Page / Map no.
Legends	page 3
Oblique photos from the Western, Central, Greater Accra and the Volta Region	pages 4 – 8
Bathymetry in the marine waters	page 9
Overview of the coastal map tiles	page 10
Coastal maps in 1:20,000 (from West to East):	
Coast between New Town – Axim	Map 1 - 18
Coast between Axim – Takoradi	Map 19 - 31
Coast between Takoradi – Cape Coast	Map 32 - 42
Coast between Cape Coast - Winneba	Map 43 - 55
Coast between Winneba – Accra	Map 56 - 64
Coast between Accra – Old Ningo	Map 65 – 72
Coast between Old Ningo – Ada	Map 73 – 81
Coast between Ada - Aflao	Map 82 - 96

9. Disclaimer

The consultant who had prepared the Atlas (Volume I), Volume II and Volume III of the Environmental Sensitivity Map project has made every effort to ensure the accuracy of the information gathered from a broad variety of data sources. However, they cannot accept any responsibility of loss, injury or misinterpretation resulting from information contained in the Atlas.

1. Introduction

Environmental Protection Agency of Ghana is the focal point for coastal zone management activities in Ghana and responsible for the National Oil Spill Contingency Plan. In order to strengthen the planning capabilities and support the Government of Ghana to perform sustainable coastal zone management, UNDP has supported the project 'Environmental Sensitivity Map for the Coastal Area of Ghana' with financial assistance from the Fund for Danish Consultancy Services administered by UNOPS.

The aim of the project has been i) to develop a GIS based environmental planning tool for coastal zone management, ii) to develop a management tool for use in planning and implementation of oil spill response, and iii) to train the EPA staff in operating the GIS system.

The project has been carried out in 2003 - 2004 by the joint venture of COWI and DDH Consulting both of Denmark with contributions from the national consultants Charles Biney, A.K. Armah, Ernest Kusi-Minkah and George Botchie.

The project has been anchored in the Environmental Protection Agency with the assistance of the core staff Daniel Amlalo, Roger Leh and Wilson Tamakloe.

The project has been reported in 3 volumes:

Volume I - Atlas. The Atlas contains 96 maps (scale 1:20,000) covering the entire coastline of Ghana. The maps illustrate geological, ecological and human use features relevant in coastal zone management and in oil spill combat. Each map sheet includes a short description of the main features and indicates the ranking of the coastline in terms of sensitivity to oil spills.

Volume II - Coastal Environment. The Coastal Environment Report describes the geological-, hydrographical-, ecological- and socio-economical conditions mapped in the Atlas.

Volume III - Oil Spill Sensitivity Ranking. The Sensitivity Ranking Report describes the ranking system and the assessment of the sensitivity of the ecological and human use features to marine oil spill.

Report no.	Vol. I- Final
Issue no.	1
Date of issue	30 October 2004
Prepared	GIS: Søren Hinge-Christensen, Henrik Lyng, Ernest Kusi-Minkah Data and text: A.K. Armah, Erling Povlsen, Steen Øgaard Dahl
Checked	ERP/SDA
Approved	SDA

2. Definitions and Delineation

The Atlas is focusing on coastal environmental features within a coastal corridor of 4 - 5 km being the most sensitive area with respect to oil spills and containing focal issues in coastal zone management. Features further off shore extending to the continental shelf and the EEZ (Economic Exclusive Zone up to 200 nautical miles) are described in Volume 2.

The sensitivity assessment of oil spills is defined to be spills occurring in *marine waters*. Consequently, closed coastal lagoons and features behind the coastline are not included in the ranking but the features are described.

3. Basemaps and Aerial Survey 2004

The maps of the Atlas are based on an aerial survey carried out in February 2004 as part of the project. A coastal corridor with the width of 4.6 km and covering the entire coastline of approximately 550 km was surveyed. A total of 344 aerial colour photos were processed in scale 1:20,000 including 60 % overlap of the individual photos. In addition oblique photos were taken of typical coastal features. The oblique photos are included in the Atlas.

The aerial survey photos were scanned into a high-resolution digitised version and filed individually (as tiff format). Subsequently the photos were geo-referenced by CERSGIS to the Accra Ghana Grid. Finally, the individual photos have been mosaiced, compressed and used as basemaps in the Atlas. The EPA is in the possession of the aerial photos and files.

4. Topographical Information

Digitised geographical data (e.g. roads, rivers, contours, etc) are depicted in the Atlas overlaying the aerial survey photos. The digitised data are based on the Survey Department Ghana 1:50,000 Digital Topographical Database. The digitised topographical data were made available for the project by Survey Department.

The Digital Topographical Database origins from 1997 and data are derived from the hardcopy topographical maps through a conversion process using scanning, vectorizing and direct digitisation of stable base manuscripts. The topographical maps are partly based on surveys from 1972/74 and partly from 1995/96.

Data from the Digital Topographical Database have not been subject to additional updating, except for corrections of feature coding in order to harmonise the digital version of the topographical layers to the hardcopy maps and make features identical in the individual tiles.

There might be differences and discrepancies between the information derived from the aerial survey carried out in 2004 and

the older topographical information due to the development of the coast, uncertainties in digitising the topographical data as well as the geo-referencing. Furthermore gaps in features in the digitised topographical data are observed.

The Digital Topographical Database was received in the Transverse Mercator Projection and the British War Office spheroid (a=20,926,201 feet; b=20,855,505 feet, flattening 1/296; False coordinates of origin: 900,000 feet East; 0 foot North) and converted to Accra Ghana Grid. The contour interval is 50 feet.

5. GIS system

The maps are stored and extracted from a GIS database made in ArcView version 8.3 from ESRI. All vector-data are stored in ESRI shape-file format and raster data in MrSID format.

6. Coastal Environment and Sensitivity Ranking

The Atlas show important coastal environmental features in a coastal strip of approximately width of 5 km. The features have been pinpointed on the maps using point symbols.

The coast is divided into 585 segments of a length of 1 km. The segments are used in a sensitivity ranking system developed for assessment of *marine* oil spills and coastal sensitivity. Ecological and human use features are ranked separately.

The ecological ranking is based on a classification of ecosystems found along the coast of Ghana and off shore (in total 14 ecosystems). Subsequently, the ranking categories of very high sensitivity, high sensitivity, medium sensitivity and low sensitivity are applied taking the fate of oil in the ecosystem and the biological sensitivity of oil pollution into account.

The human use along the coast is classified into 11 features having individual characteristics in terms of daily livelihood, employment, economical importance and vulnerability towards marine oil spill. Similar to the ecological ranking the sensitivity ranking of the human use features is divided into four categories of very high sensitivity, high sensitivity, medium sensitivity and low sensitivity.

The rationale of the ranking is elaborated in details in Volume III of the report. The summary of the sensitivity ranks is seen in the tables overleaf.

The sensitivity ranking is illustrated on 96 coastal Atlas sheets in terms of a four-graduated colour code in bands parallel to the shoreline. The band closest to the shoreline represents the ecological ranking and the outer band represents the human use ranking.