

# Environmental Sensitivity Index Mapping

National Oil Spill Exercise 2012  
Sutera Harbour Resort Hotel  
Kota Kinabalu, Sabah  
19 – 21 June 2012

# Why ESI Mapping

- ESI is part & parcel of Risk Assessment.
- Identify vulnerable coastal locations before an emergency (e.g. oil spill) happens, so that:
  - proactive measure can be put in-place to prevent damage
  - recovery measures can be established to minimize the impact
  - cost effective clean-up strategies can be identified
  - damage assessment is easier – affected parties are readily identified
- An integral component of emergency preparedness including oil spill contingency planning and response.

# About the Map

- ESI Maps contain three (3) main information:
  - ✓ Shoreline ranking,
  - ✓ Sensitive biological resources and
  - ✓ Human-use resources.
- ESI Maps provides essential information to spill responders on
  - the different coastal features and resources
  - commercial, ecological and recreational resources
  - the environmentally sensitive areas

# The Earlier Study

- The Study along the coastlines of East Coast Peninsular Malaysia (Tumpat to Johor Bahru):
  - 1983: Dungun to Chukai,
  - 1988: Chukai to Penor,
  - 1990: Penor to Johor Bahru,
  - 1993: Dungun to Tumpat,
  - 1998: Restudy Chukai To Penor,

The studies were commissioned to UPM, Terengganu by PETRONAS/PCSB and EPMI

# The Earlier Study

The Study along the West Coast of Sabah & Sarawak from Tg Datu, Kuching, Sarawak to Tg. Tiga Papan, Kudat Sabah began in 1999 and was completed in March 2001.

The Study was commissioned to the Institute of Biodiversity and Environmental Conservation, UNIMAS, Sarawak, by PCSB, SSB/SSPC.

# The Present Study

The Study along the coastlines of East Coast Peninsular Malaysia from Tumpat to Johor Bahru was commissioned to Universiti Malaysia Terengganu.

The Study along the West Coast of Sabah & Sarawak from Tg Datu, Kuching, Sarawak to Tg. Tiga Papan, Kudat was commissioned to UNIMAS.

Both studies began in 2010 and completed in 2011 .

# The Map

- ESI map are typically based on shoreline characteristics and its sensitivity to oil
  - Effects of wave action
  - Penetration of oil into the substratum
  - Natural oil retention
  - Biological productivity of shore organism

# ESI Ranking & Symbol

## KEY

### ESI COLOUR CODE

















































	EXPOSED ROCKY HEADLANDS, WAVE CUT PLATFORMS AND SEAWALLS	ESI 1
	EXPOSED FINE - GRAINED SAND BEACHES AND SANDY SHOALS	ESI 2
	EXPOSED MEDIUM TO COARSE - GRAINED SAND BEACHES	ESI 3
	EXPOSED MIX SAND AND GRAVEL BEACHES AND SAND - GRAVEL FILL	ESI 4
	SHELTERED TIDAL FLAT AND CORAL FLATS	ESI 5
	EXPOSED TIDAL	ESI 6
	SHELTERED ROCKY SHORES, SEAWALLS, SAND BEACHES AND RAISED RIVERBANK (INCLUDING POCKET BEACHES)	ESI 7
	SHELTERED TIDAL FLATS AND CORAL FLATS	ESI 8
	EXPOSED MANGROVE	ESI 9
	SHELTERED MANGROVE	ESI 10

### SENSITIVE BIOLOGICAL RESOURCES

### HUMAN USE FEATURES

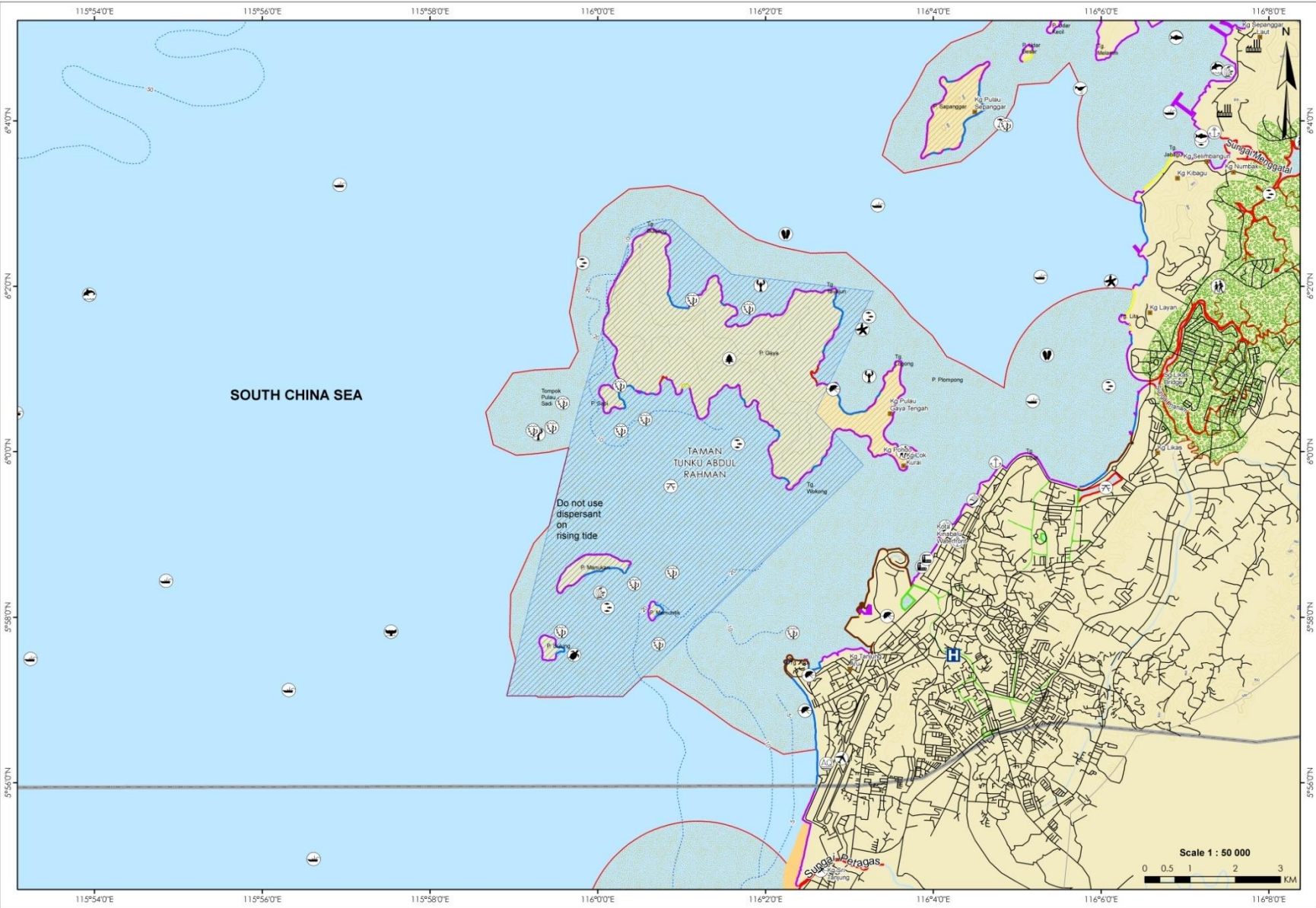
### TOTALLY PROTECTED AREA

### OTHER SYMBOL

	Aquaculture Site		Airport		Amenity Forest Reserve		Sand/Mud
	Nursery Area		Park		Forest Reserve		Rocky
	Commercial Fishing		Recreation: Beach, Resort		National Park		Shoal
	Crab Area		Camp		Nature Reserve		Dispersant Use Prohibited
	Shrimp Area		Ferry, Jetty		Wildlife Sanctuary		International Boundary
	Jellyfish Area		Bridge		Marine Park		State Boundary
	Lobster Area		National Park		Mangrove		District Boundary
	Terrestrial Mammal		Wildlife Sanctuary				Contour
	Bird		Farm				Bathymetry
	Fish Fauna		Hospital				Major Road
	Epifauna		Police Station				
	Infauna		Hotel				
	Seagrasses		Industrial				
	Coral Reefs		Port				
	Dolphin		School				
	Turtle		Village, Residence				
	Whale		New Development				

# Map of Kota Kinabalu

SABAH  
KOTA  
KINABALU  
MAP 6.1



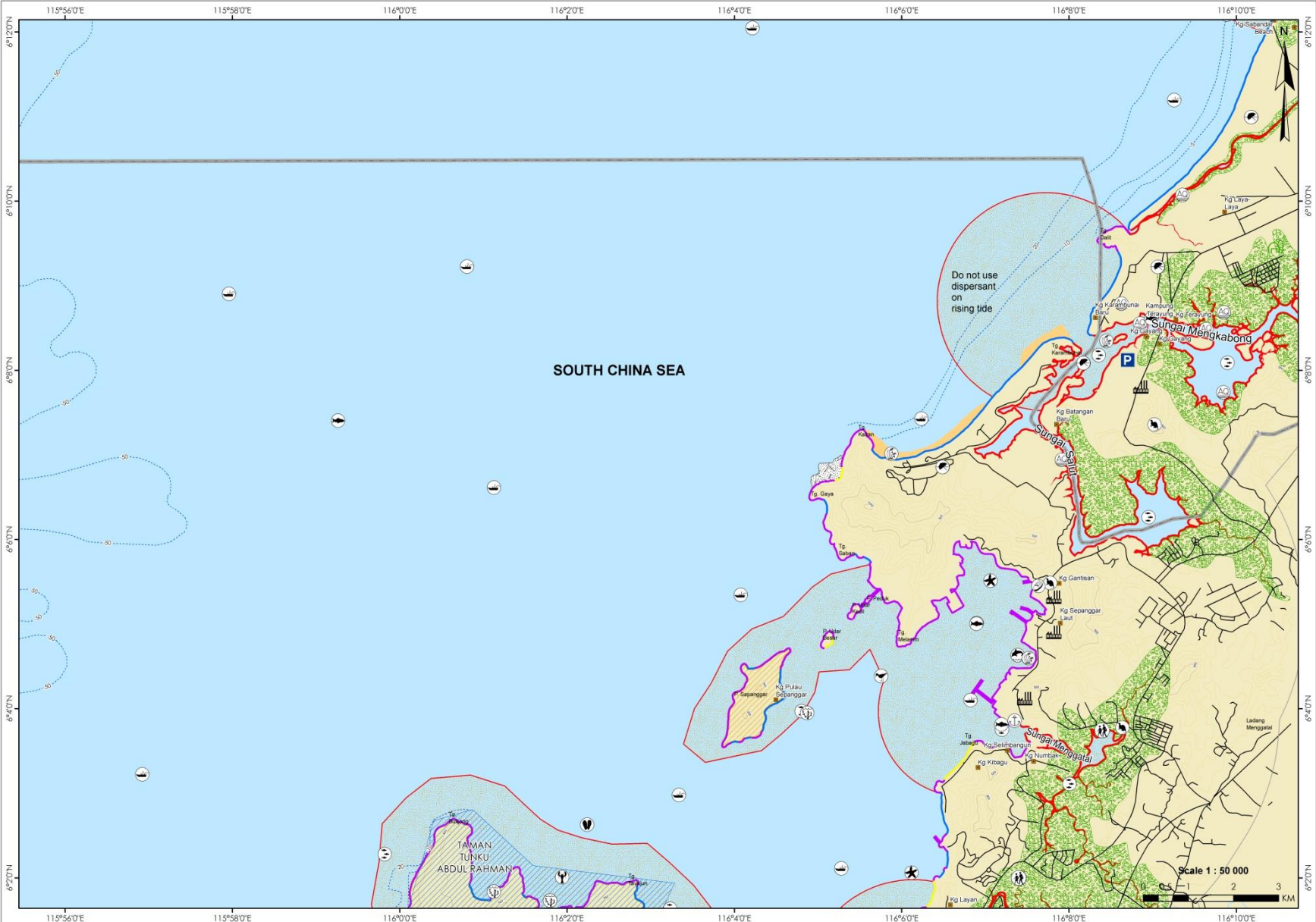
- ESI COLOUR CODE
- ESI 1
  - ESI 2
  - ESI 3
  - ESI 4
  - ESI 5
  - ESI 6
  - ESI 7
  - ESI 8
  - ESI 9
  - ESI 10



PROJECTION:  
WGS 1984 (LAT/LONG)

# Map of Kota Kinabalu

SABAH  
KOTA  
KINABALU  
MAP 6.2



SOUTH CHINA SEA

Do not use dispersant on rising tide

ESI COLOUR CODE

- ESI 1
- ESI 2
- ESI 3
- ESI 4
- ESI 5
- ESI 6
- ESI 7
- ESI 8
- ESI 9
- ESI 10

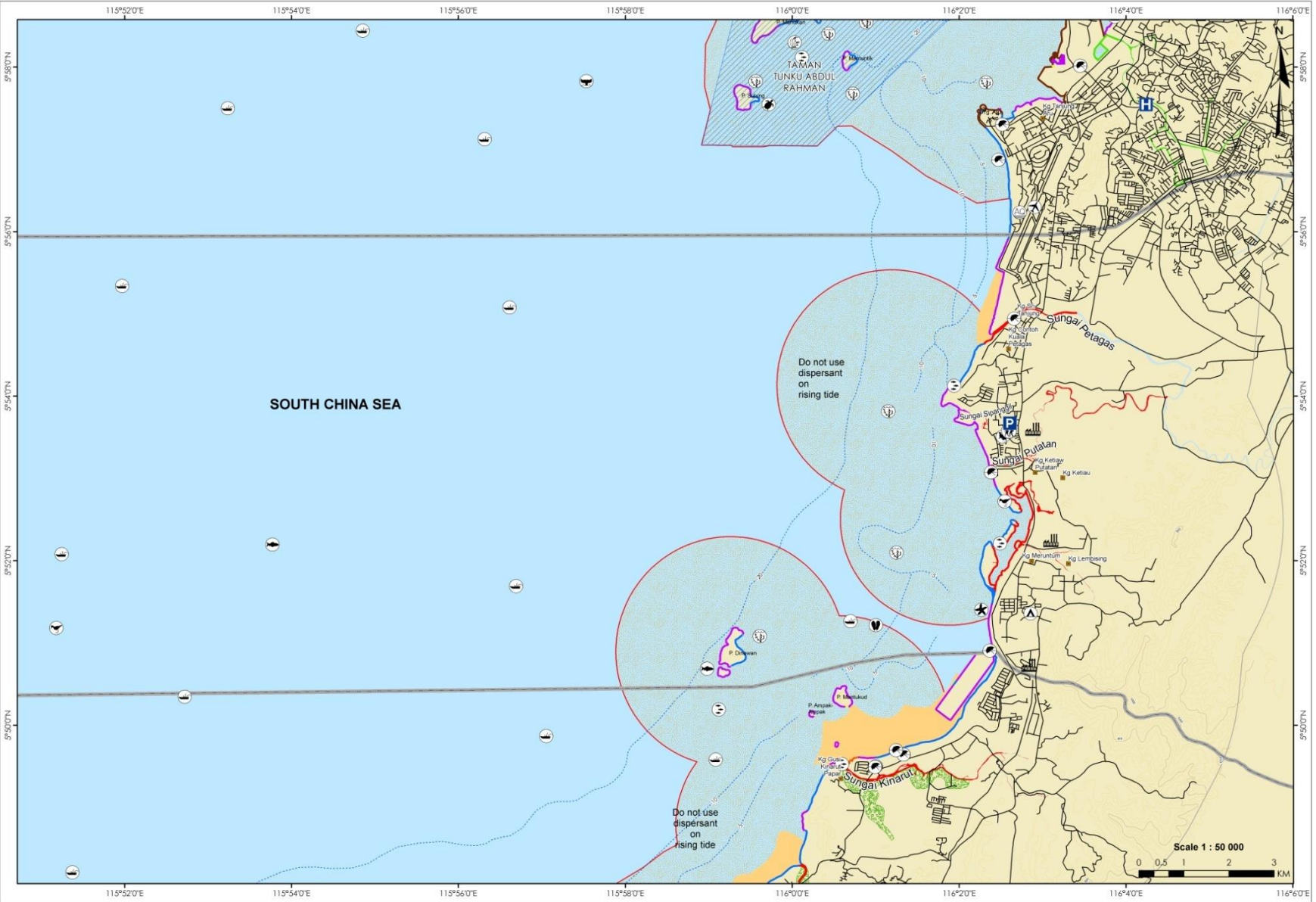
Scale 1 : 50 000



PROJECTION:  
WGS 1984 (LAT/LONG)

# Map of Penampang

SABAH  
PENAMPANG  
MAP 5.1



ESI COLOUR  
CODE

- ESI 1
- ESI 2
- ESI 3
- ESI 4
- ESI 5
- ESI 6
- ESI 7
- ESI 8
- ESI 9
- ESI 10



PROJECTION:  
WGS 1984 (LAT/LONG)



# **ESI Ranking & Classification**

# ESI 1

## EXPOSED, ROCKY HEADLANDS, WAVE-CUT PLATFORMS AND SEAWALLS

- Exposed bedrock (usually granite or quartzite)
  - occur at headlands as steep walls, platforms or boulders
  - exposed to high wave energy
  - sensitivity to impacted oil – low
- Man-made concrete or tightly cemented seawalls
  - located at shoreline, facing open ocean or open fetch areas exposed to high waves or strong currents
  - sensitivity to impacted oil - low

# Wave-cut Platform



# Rocky Headland



29.07.2009 11:31

# Rocky cliff



# EXPOSED, FINE-GRAINED SAND BEACHES AND SANDY SHOALS

- Fine-grained sand beaches
  - compacted sediment
  - moderate to high wave energy
  - sensitivity to impacted oil – low
- Shoals
  - located near the river mouths; result in shallow river openings
  - medium to coarse-grained sand
  - sensitivity to impacted oil - low

# Fine-grained sandy beach



# Fine-grained sandy beach



## ESI 3

### EXPOSED, MEDIUM TO COARSE-GRAINED SAND BEACHES

- Coarse-grained sand beaches
  - composed of moderately sorted coarse-grained to very coarse-grained quartz sand with few shells fragments
  - beach-faces slope steeply
  - exposed to high wave energy
  - sensitivity to impacted oil – variable
- Medium-grained sand beaches
  - composed of moderately well-sorted, medium quartz sand
  - generally gently to high waves energy
  - sensitivity to impacted oil - variable

# Medium to coarse grained sandy beach



# Medium to coarse grained sandy beach



## ESI 4

# EXPOSED, MIXED SAND AND GRAVEL BEACHES AND SAND GRAVEL FILLS

- Mixed sand and gravel beaches
  - coarse material composed of sand, shells and coral fragment, gravel and cobble sediments
  - moderate to high wave activity
  - sensitivity to impacted oil - low to moderate
- Sand-gravel fills
  - composed of poorly-sorted mixture of mud to cobble sediments
  - low to moderate wave activity
  - sediment can be very hard-packed
  - sensitivity to impacted oil - low to moderate

# Mixed Sand and Gravel Beach



# Sand Gravel Fills



24.06.2009 11:40

## ESI 5

### EXPOSED GRAVEL BEACHES AND RIP-RAPS

- Exposed gravel beaches
  - predominantly gravel
  - moderate to high wave energy
  - sensitivity to impacted oil – low
- Rip-Raps
  - generally composed of granite boulders of irregular shape and sizes
  - moderate to high wave activity
  - little or no beach at low tide
  - designed for shoreline protection or as break-waters
  - sensitivity to impacted oil - moderate

# Exposed Gravel Beach



# Rip-Raps



# Rip-Raps



## ESI 6

### EXPOSED TIDAL FLATS

- vary in width
- sediment composition dominated by sand with minor amounts of mud and decomposing litter
- low to moderate wave activity and tidal currents
- located in open bays, or near tidal inlets
- generally fringed by mangrove forest
- can be sparsely to moderately vegetated by sea grasses
- sensitivity to impacted oil - moderate

# Exposed Tidal Flats



# Exposed Tidal Flats



# ESI 7

## SHELTERED ROCKY SHORES, SEAWALLS, SAND BEACHES (INCLUDING POCKET BEACHES) AND RAISED RIVER BANKS

- Sheltered rocky shores
  - out-crops of exposed rocks
  - associated with pocket sand-beaches
  - exposed to low wave energy and tidal currents
  - sensitivity to impacted oil - moderate

## SHELTERED ROCKY SHORES, SEAWALLS, SAND BEACHES (INCLUDING POCKET BEACHES) AND RAISED RIVER BANKS

- Man-made seawalls are of two-type:-
  - Concrete cement walls
    - built along rivers banks to protect the shoreline especially near populated towns
    - vertical walls with smooth regular surfaces
    - sensitivity to impacted oil – moderate
  - Granite boulders cemented together to form walls
    - vertical and with rough surfaces
    - sensitivity to impacted oil – moderate

# ESI 7

## SHELTERED ROCKY SHORES, SEAWALLS, SAND BEACHES (INCLUDING POCKET BEACHES) AND RAISED RIVER BANKS

- Raised river banks
  - found along the rivers
  - with or without vegetation
  - with or without evidence of human habitation and agricultural activity
  - sensitivity to impacted oil - moderate

# Rocky shores



19.09.2009 12:07

# Sea Wall



# Sea walls



## SHELTERED TIDAL FLATS AND CORAL FLATS

- Sheltered tidal flats
  - composed of moderately well-sorted, fine to medium-grained sand
  - occur mainly along river banks and near river mouths
  - sheltered from wave and/or strong tidal currents
  - very shallow, even at high tide
  - moderate to high wave activity
  - sensitivity to impacted oil - moderate to high
- Coral flats
  - substrate may include sand, shells, coral rubble and dead coral skeletons
  - limestone skeleton of living coral varies in shape and size
  - moderate to high wave activity
  - sensitivity to impacted oil - moderate to high

# Coral flats



## EXPOSED MANGROVES

- possibility of exposure to relatively moderate wave-activity and currents
- sediments range from sandy mud to muddy peat
- topographic profile generally flat
- high biogenic activity
- accessibility limited by density and width of forest as well as by sediment type
- sensitivity to impacted oil - high

# Exposed Mangroves



# Exposed Mangroves



# ESI 10

## SHELTERED MANGROVE

- located in bays and along rivers, well-sheltered from waves and strong tidal currents
- sediment composed of thin to thick deposits of mud
- high biogenic activity
- very flat topographic profile
- sensitivity to impacted oil - very high

# Sheltered Mangroves



25.06.2009 09:42

# Sheltered Mangroves



TERÍMA KASÍH

Thank You