KURSUS PEMODELAN HIDRAULIK 1 BAGI PROJEK PEMBANGUNAN DI PANTAI DAN LUAR PANTAI

PEMAHAMAN ISTILAH DAN PROSES ZON PANTAI YANG BERKAITAN

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Akar Beach Resort, Port Dickson

Content of Presentation

- Understanding coastal zone terminology
- Description of wave
- Types of wave
- Constructive and destructive waves
- The theory of coastal erosion
- Causes of coastal erosion
- Transportation and description of sediment in coastal areas
- Shoreline currents
- Coastal deposition
- Littoral environment observation
- Examples of analysed current and wave data
- Video clip on wave processes

Coastal Terminology

- ***Beaches*** are accumulations of loose sand or pebbles which change rapidly due to changes in wave energy; movement of beach sediment dissipates some of the energy of a wave breaking on the shore.
  - ***Littoral zone :*** *stretches between seaward limit of land plants and region below sea-level where sediment is not disturbed by wave action during fair weather conditions (10-20m depth).*
    - ***Foreshore/intertidal zone*** is the part of littoral zone that is exposed at low water when tide is out, but is covered when tide is in; active zone of beach.
    - ***Backshore*** is above mean high tide and is only influenced by the sea when there are storm waves or exceptionally high tides; sediment here is deposited and dries out quickly.
    - ***Offshore*** is seawards of the foreshore and is permanently covered by water.

Coastal Terminology

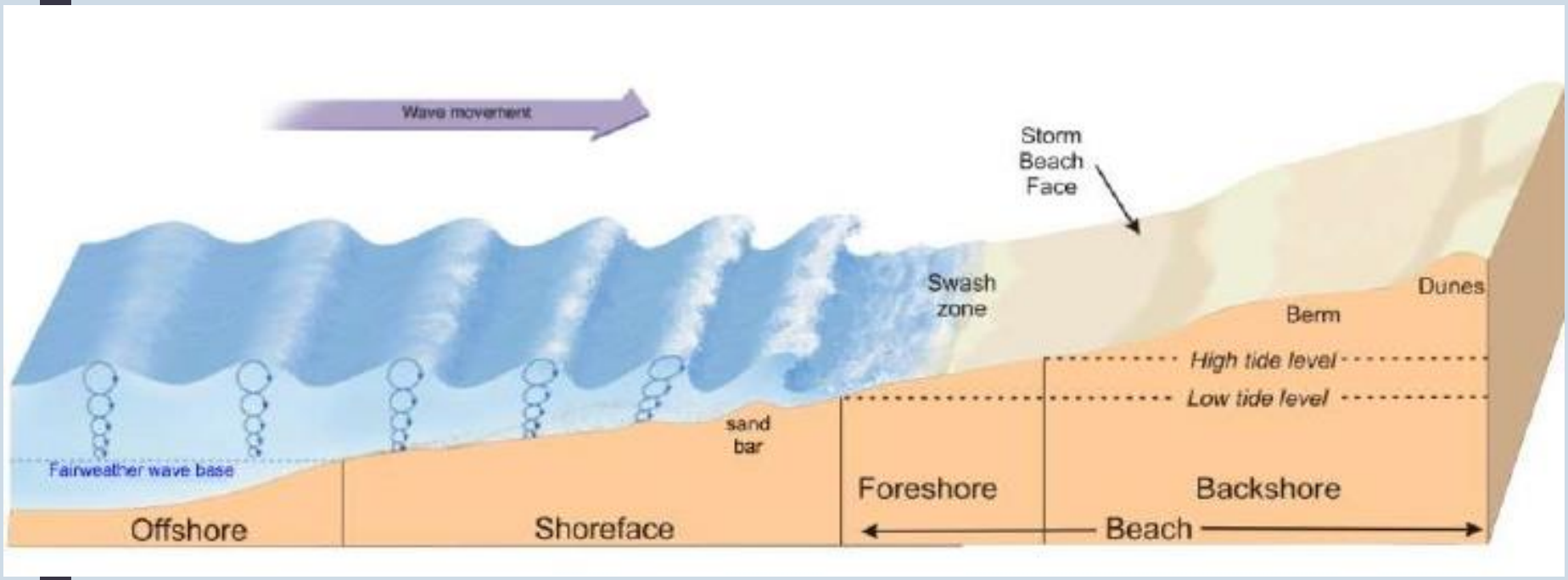
- ***Breaker zone***: where the waves become unstable and break.
- ***Surf zone***: where much shallower waves are projected up the beach face.
- ***Swash zone (splash zone):*** alternatively covered (the swash) and uncovered (the backwash) by water.
- ***Offshore bar (sandbar):*** submerged or partly exposed ridge of sand or coarse sediment that is built by waves offshore from a beach.
- ***Longshore bar***: offshore sandbar that parallel the coast.
- ***Berm*** of the backshore: flat-topped ridge which develops at the limit of wave swash on steeply sloping features.
  - ***Berm crest****: high point on the beach (peaked top of berm)*
- ***Beach face (low tide terrace):*** sloping portion of the beach, below the berm.

Coastal Terminology

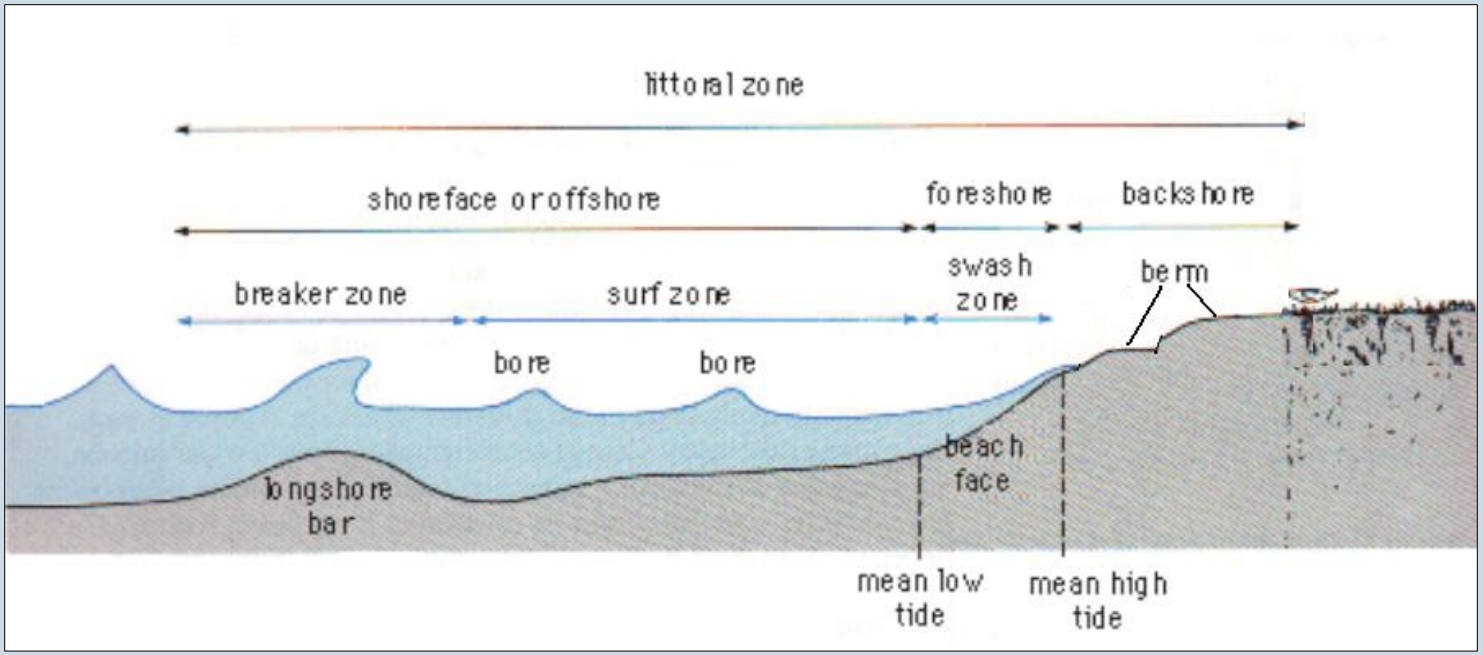
- Accretion is the process of coastal sediment returning to the visible portion of a beach or foreshore following a submersion event.
- Siltation:
  - *Pollution of water by fine particulate terrestrial classic material, with a particle size dominated by silt or clay.*
  - *It refers both to the increased concentration of suspended sediments, and to the increased accumulation of fine sediments.*
  - *Most often caused by soil erosion or sediment spill.*
  - *Also be used to refer to a chemical contamination of sediment accumulated on the bottom, or pollutants bound to the sediment particles.*

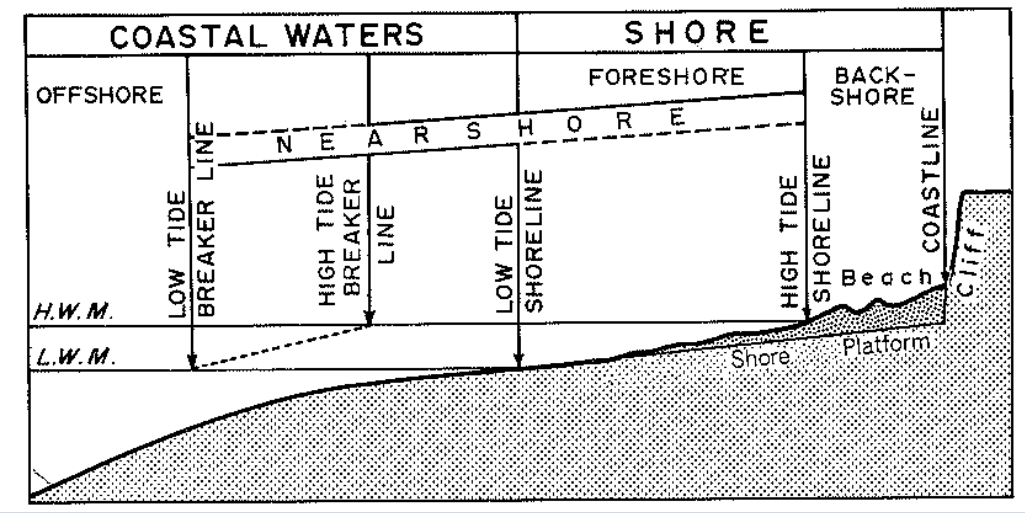
Coastal Zones

A beach is part of a coastal system, which includes several zones defined by their proximity to shore and the dominant processes that occurs within them.



Coastal Zones





Description of Wave

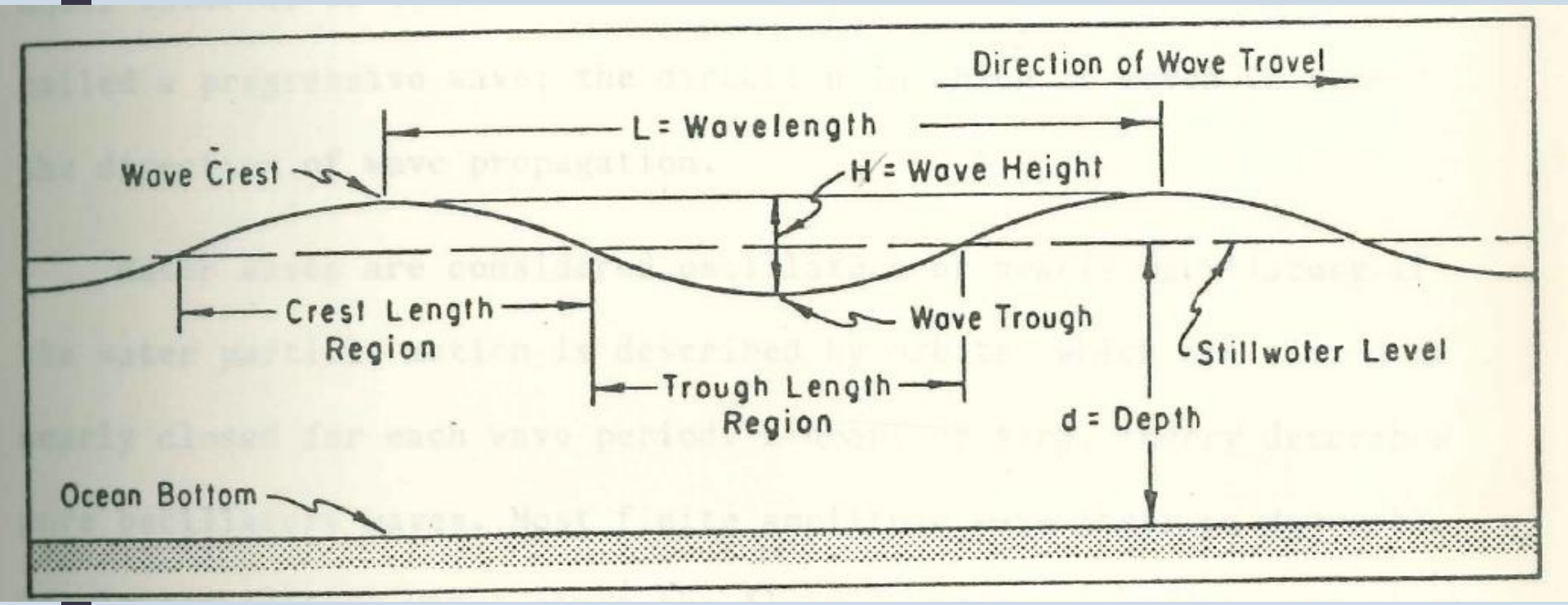
- Waves is open water called ***oscillatory waves.***
- The crest and the trough are respectively ***the highest and the lowest points of a wave.***
- Wave height ***is the distance between the crest and the trough.***
- Wave length (L) ***is the distance between two successive crests***.

  It can be determined by the formula:

  $L=1.56T^2$

- Wave period (T) ***is the time taken for the wave to travel through one wavelength.***
- Wave frequency ***is the number of waves per minute.***
- Wave fetch ***is the amount of open water over which a wave has passed.***
- Wave velocity (C) ***is the speed of movement of a crest in a given period of time.***

Description of Wave



Speed of Wave

- Speed = $\frac{\text{Wavelength}}{\text{Period}}$

- Period: time it takes a wavelength to pass a given location.

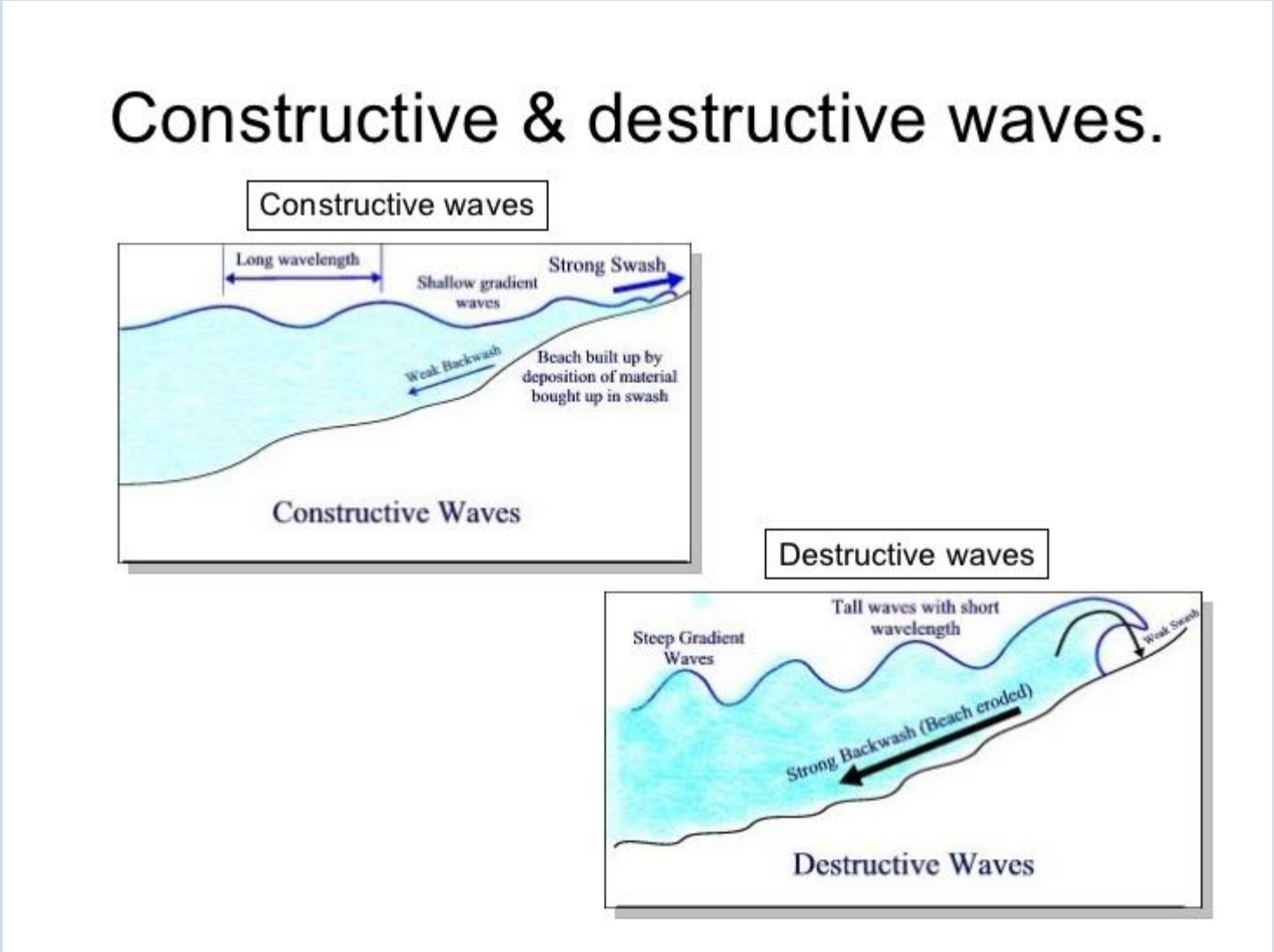
Sea Waves & Types of Waves

- Sea wave is generated by the drag effect of wind producing orbiting water particles. Height, length and velocity are all dependent upon wind speed, fetch and depth of water.
- Constructive wave:

  Constructive wave are low energy waves with stronger swash than backwash. Where there are less than 8 waves breaking each minute they tend to be constructive waves. Constructive waves tend to deposit material and build up a beach.
- Destructive wave:

  By contrast, destructive waves have much higher energy. They are much larger in height. They have a weak swash but a strong backwash, and they therefore erode the beach by pulling sand shingle (beach materials) down the beach as water returns to the sea.

Constructive & destructive waves



The Theory of Coastal Erosion

- Coastal erosion processes include hydraulic, quarrying (cavitation), corrosion and solution.
  - *Hydraulic action: the constant force of waves crashing on the shore damages it.*
  - *Abrasion: wave bring with them bits of rock and sand. These help to grind down cliffs.*
  - *Attrition: waves cause rocks and pebbles on the shore to smash into each other and break down.*
  - *Solution/corrosion: acids contained in sea water will slowly dissolve certain types of rock.*
  - *Examples. Explain how coastal erosion can affect cliff coastlines. (Formation of wave-cut platform)*

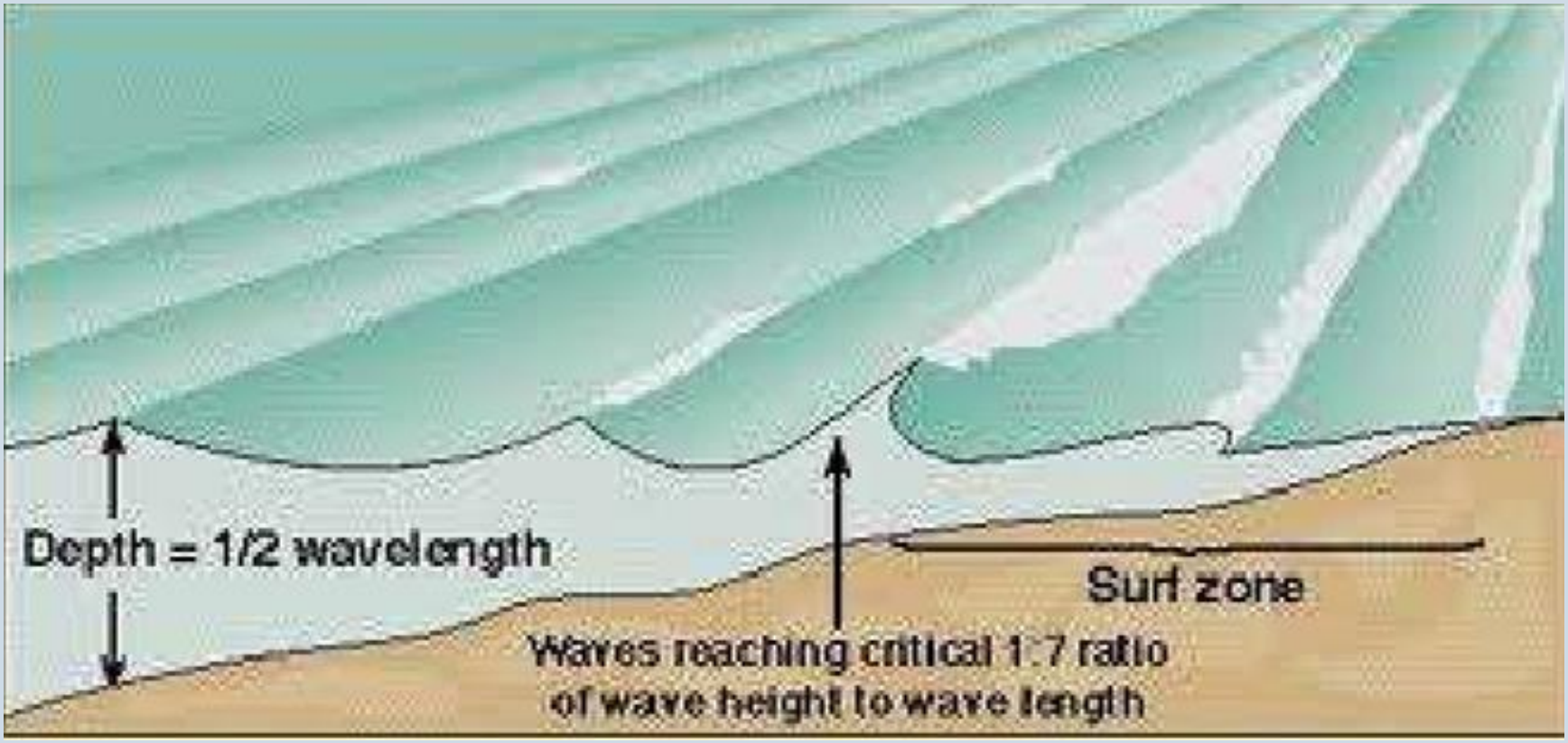
Causes of Coastal Erosion

Natural	Man Induces
a. Sea Level Rise	a. Land subsidence from removal of subsurface resources
b. Variability in sediment supply to the littoral zone	b. Interruption of material in transport
c. Storm waves	c. Reduction of sediment supply to the littoral zone
d. Wave and surge overwash	d. Concentration of wave energy on beaches
e. Deflation	e. Increase water level variation
f. Longshore sediment transport	f. Change in natural coastal protection
g. Sorting of beach sediment	g. Removal of material from the beach

Transportation and deposition of sediment in coastal areas

- Waves can transport sediment that has been produced by coastal erosion or from river; this is achieved by carrying light material in suspension or pushing it along beaches (beach drift) and coast (longshore drift). The orbital motion of waves and tidal currents help prevent the material being deposited. Deposition occurs where velocity is reduces as waves breaks (swash) on beaches or where there is shallowing of the coast or a change in direction of the coast. All lead to a reduction in the velocity of waves and hence their ability to carry sediment.

Formation of Breakers



How is sediment transported along a coastline?

- Most waves move toward the shore at a slight angle.

- Water (swash) from each breaking wave is oblique.

Shoreline Currents

Rip Currents

- Strong surface currents that flow away from the beach.

- Too much water converges at the shore.

- 2 longshore currents meet.

Coastal Deposition

When the sea losses energy, it drops the sand, rock particles and pebbles that it carries.

- *when the swash is stronger than the backwash.*
- *when waves enter an area of shallow water.*
- *when waves enter a sheltered area, eg bay.*
- *when there is a little wind.*
- *when there is a good supply of material.*

LITTORAL ENVIRONMENT OBSERVATIONS

(LEO program form No. 113-72-8 , United States Army Corps of Engineers, 1972)

1. **Wave Period**: The time is recorded in seconds for 11 wave crests to pass some stationary point. 11 crests will include 10 complete waves (crest and troughs). The first crest selected for observation is recorded as time zero and the eleventh crest will be stop or cut time.
2. **Breaker height**: This observation is based solely on the observer's judgement. Natural or man-made features on the shoreline or in the surf zone whose dimensions are known may aid in judging the height of a wave.
3. **Wave Direction**: To determine the direction from which the waves are approaching the beach. A self-made protractor is used. The 0-180° line of the protractor is oriented along the shoreline. The protractor is the used to sight the direction from which the waves are approaching when they are first breaking.

LITTORAL ENVIRONMENT OBSERVATIONS
(LEO program form No. 113-72-8 , United States Army Corps of Engineers, 1972)

4. **Types of breaking waves**: Types of breaking waves are identified by the following criteria.
   - **Spilling** – spilling occurs when the wave crest becomes unstable at the top and the crest flows down the front face of the wave producing an irregular foamy water surface.
   - **Plunging** – plunging occurs when the wave crest curls over the front face of the wave and falls into the base of the wave producing a high splash and much foam.
   - **Surging**- surging occurs when the wave crest remains unbroken while the base of the front face of the wave advances up the beach.
   - **Spill/Plunge** - a combination of both spilling and plunging.
5. **Wind speed**: A wind meter is used for this purpose.
6. **Wind direction**: After the appropriate orientation of the beach with respect to north has been defined, the observer can determine the direction from which the wind is coming.
7. **Foreshore slope**: For the measurement of the foreshore slope an Abney level is used. Observation is made as close to the midswash position a possible. The Abney level is placed on the straight –edge from which the reading is taken.
8. **Width of the surf zone**: This is based solely on the observer's judgement. The distance is estimated from the shoreline to the line of the most seaward breaks.

LITTORAL ENVIRONMENT OBSERVATIONS

(LEO program form No. 113-72-8 , United States Army Corps of Engineers, 1972)

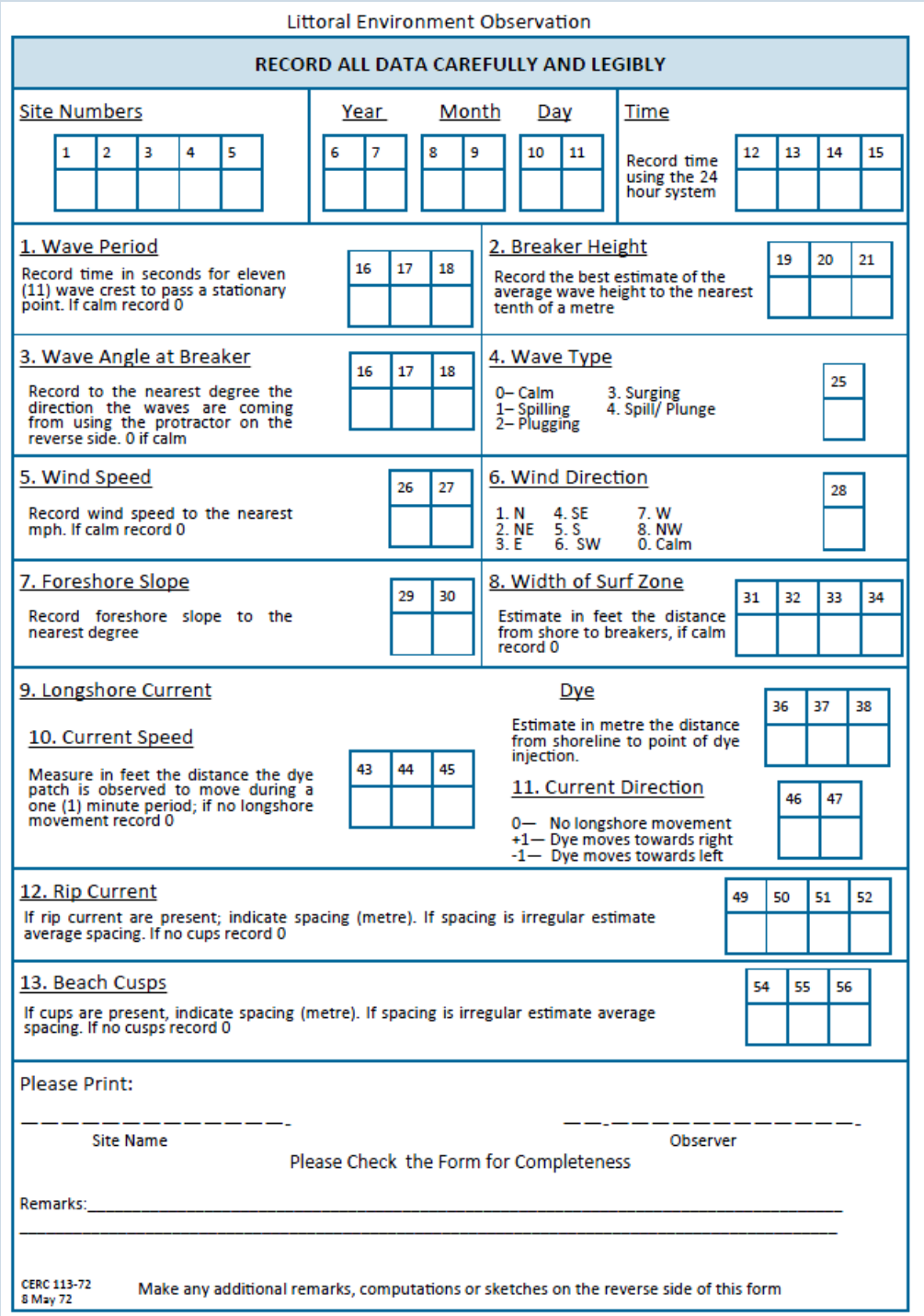
9. **Longshore current dye distance:** Sodium fluorescien is used and it is injected just shoreward of the breakers when possible. The distance from the shoreline to point of injection is recorded in meters.
10. **Longhore current speed**: The point on the beach opposite the injected dye is marked, and the second mark is made to indicate the dye position after one minutes has lapsed. The distance between these marks is recorded in meters to represent total dye patch movement.
11. **Longshore current speed:** A record of – 1 is made if the dye has moved to the left when looking seaward, and +1 if it is to the right. 0 is recorded to indicate no movement.
12. **Rip currents:** These defined as seaward-moving threads of water which return the water that has been piled up along the shore by incoming waves. Rip currents are sustained by feeder currents of water moving along the shore. Two currents join and extend out in what is known as the 'neck' where the water rushes through the breaker zone in narrow lane. Beyond the breaker zone the current spreads out and dissipates in what is called the 'head'. If rip currents are present their spacing is estimated in meters. '0' is given for absence of such currents.

LITTORAL ENVIRONMENT OBSERVATIONS

(LEO program form No. 113-72-8 , United States Army Corps of Engineers, 1972)

13. **Cusps:** These are semi-circular or crescent-shaped features cut out in the beach face. If such shapes are observed, the distance between the 'horns' of the cusps which indicates the spacing is recorded in meters. Where the space is irregular, the average spacing is estimated. '0' indicates that no cusps are present.

Littoral Environment Observations



Littoral Environment Observation

RECORD ALL DATA CAREFULLY AND LEGIBLY

Site Numbers (1 2 3 4 5)

Year (6 7) **Month** (8 9) **Day** (10 11)

Time — Record time using the 24 hour system (12 13 14 15)

1. Wave Period (16 17 18)
Record time in seconds for eleven (11) wave crest to pass a stationary point. If calm record 0

2. Breaker Height (19 20 21)
Record the best estimate of the average wave height to the nearest tenth of a metre

3. Wave Angle at Breaker (16 17 18)
Record to the nearest degree the direction the waves are coming from using the protractor on the reverse side. 0 if calm

4. Wave Type (25)
0– Calm
1– Spilling
2– Plugging
3. Surging
4. Spill/ Plunge

5. Wind Speed (26 27)
Record wind speed to the nearest mph. If calm record 0

6. Wind Direction (28)
1. N
2. NE
3. E
4. SE
5. S
6. SW
7. W
8. NW
0. Calm

7. Foreshore Slope (29 30)
Record foreshore slope to the nearest degree

8. Width of Surf Zone (31 32 33 34)
Estimate in feet the distance from shore to breakers, if calm record 0

9. Longshore Current

10. Current Speed (43 44 45)
Measure in feet the distance the dye patch is observed to move during a one (1) minute period; if no longshore movement record 0

Dye (36 37 38)
Estimate in metre the distance from shoreline to point of dye injection.

11. Current Direction (46 47)
0— No longshore movement
+1— Dye moves towards right
-1— Dye moves towards left

12. Rip Current (49 50 51 52)
If rip current are present; indicate spacing (metre). If spacing is irregular estimate average spacing. If no cups record 0

13. Beach Cusps (54 55 56)
If cups are present, indicate spacing (metre). If spacing is irregular estimate average spacing. If no cusps record 0

Please Print:

_____ Site Name

_____ Observer

Please Check the Form for Completeness

Remarks:_____

_____

CERC 113-72
8 May 72

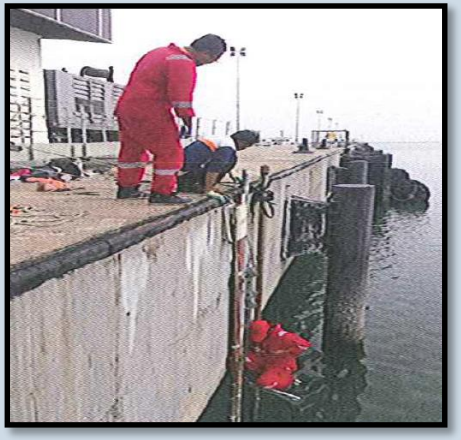
Make any additional remarks, computations or sketches on the reverse side of this form

Grades Size of Sedimentary Particles

Grades Size Of Sedimentary Particles		
Millimetres(mm)	Micrometres(μm)	Wentworth Grade
64	64000	Cobbles
44.8	44800	--60.0mm--
32	32000	Coarse gravel
22.4	22400	
16	16000	--20.0mm--
11.2	11200	Medium gravel
8	8000	--6.0mm--
5.6	5600	
4	4000	Fine gravel
2.8	2800	
2	2000	--2.0mm--
1.4	1400	
1	1000	
0.71	710	Coarse sand
0.5	500	--0.6mm--
0.355	355	
0.25	250	Medium sand
0.18	180	--0.2--
0.125	125	
0.090	90	Fine sand
0.063	63	--0.06mm-
0.045	45	
0.032	32	Coarse sand
0.23	23	--0.02mm--
0.16	16	
0.011	11.0	Medium sand
0.008	8.0	--0.006mm--
0.0055	5.5	
0.004	4.0	Fine sand
0.00275	2.75	--0.002mm--
0.002	2.0	Clay
0.00138	1.38	
0.001	1.0	

Current Data

Peralatan Sebelum Pemasangan

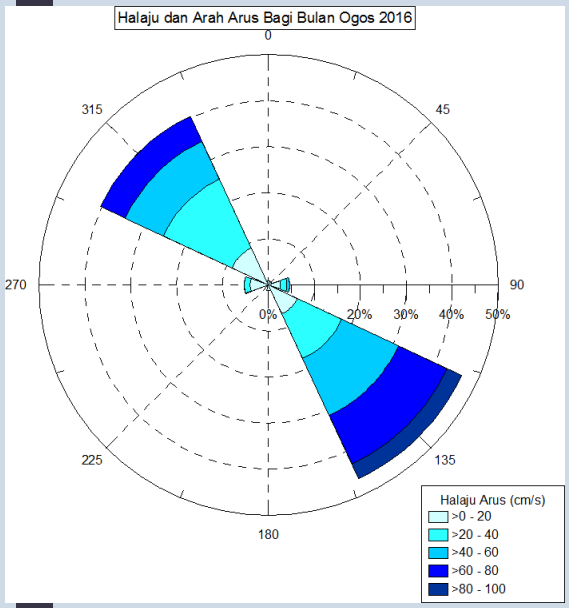


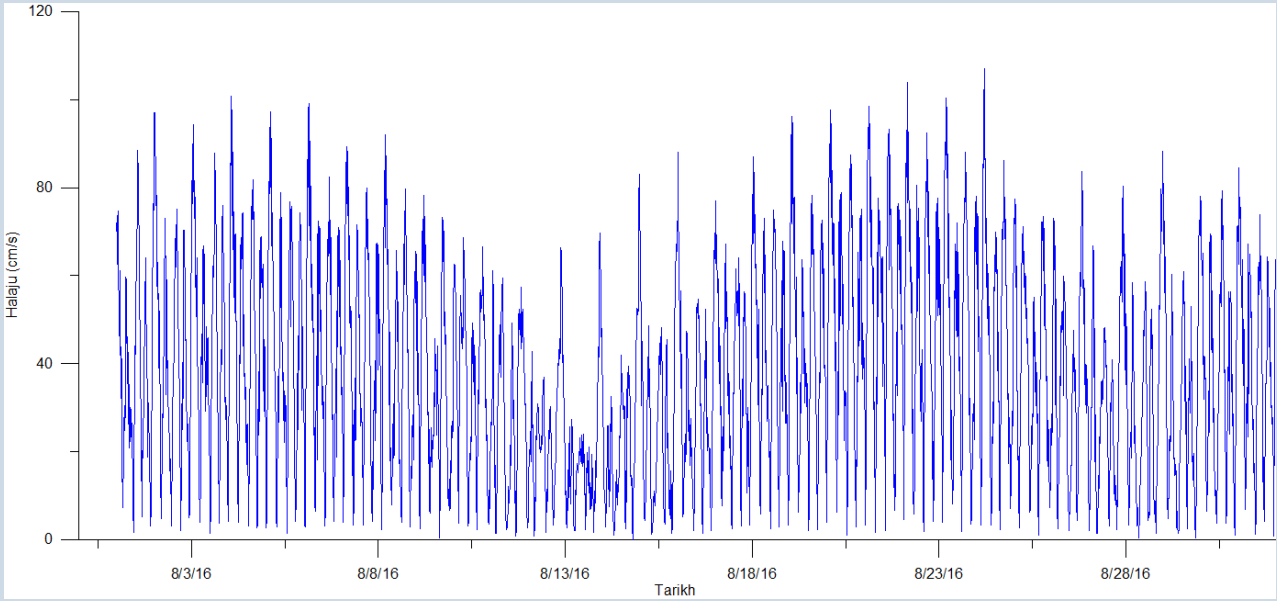
Peralatan Selepas Pemasangan

Raw Data ADCP

Year	Month	Day	Hour	Minute	Second	VelocityE	Velocity N	Level	StdError1	StdError2	StdError3	SNR1	SNR2	SNR3	SignalAmp1	SignalAmp2	SignalAmp3	Noise1	Noise2	Noise3	IceDetection	Heading	Pitch	Roll	StdDevHeading	StdDevPitch	StdDevRoll	Temperature
2016	7	29	16	30	0	-36.6	19.4	4.011	0.8	0.5	0	21.1	19.4	0	74	69	0	25	24	18	0	307.4	0.4	-0.4	0	0	0	30.2
2016	7	29	16	40	0	-30.2	20.3	4.057	0.8	0.6	0	18.9	20.6	0	69	71	0	25	23	19	0	307.5	0.4	-0.4	0	0	0	30.2
2016	7	29	16	50	0	-31.5	19.3	4.108	0.7	0.7	0	19.4	20.2	0	70	71	0	25	24	19	0	307.6	0.4	-0.4	0	0	0	30.3
2016	7	29	17	0	0	-30.9	19.4	4.162	0.7	0.5	0	19.8	21.5	0	73	73	0	27	23	19	0	307.6	0.4	-0.4	0	0	0	30.3
2016	7	29	17	10	0	-28.8	18	4.211	0.6	0.6	0	19.8	22.4	0	72	75	0	26	23	20	0	307.6	0.4	-0.4	0	0	0	30.2
2016	7	29	17	20	0	-20.4	10	4.25	0.6	0.4	0	21.9	20.2	0	77	71	0	26	24	20	0	307.6	0.4	-0.4	0	0	0	30.2
2016	7	29	17	30	0	-21.8	12.4	4.291	0.7	0.6	0	21.9	21.5	0	76	73	0	25	23	19	0	307.5	0.4	-0.4	0	0	0	30.1
2016	7	29	17	40	0	-20.1	14	4.324	0.8	0.6	0	20.6	21.9	0	73	75	0	25	24	19	0	307.6	0.4	-0.4	0	0	0	30.2
2016	7	29	17	50	0	-15.9	10.8	4.353	0.7	0.6	0	21.9	21.9	0	77	75	0	26	24	19	0	307.6	0.4	-0.4	0	0	0	30.1
2016	7	29	18	0	0	-15.4	6.9	4.372	0.9	0.7	0	21.1	21.9	0	75	74	0	26	23	19	0	307.6	0.4	-0.4	0	0	0	30.1
2016	7	29	18	10	0	-12	7.9	4.375	0.8	0.7	0	19.8	21.1	0	71	72	0	25	23	19	0	307.6	0.4	-0.4	0	0	0	30.0
2016	7	29	18	20	0	-7.9	4.7	4.387	0.9	0.6	0	20.2	20.6	0	72	72	0	25	24	19	0	307.5	0.4	-0.4	0	0	0	30.0
2016	7	29	18	30	0	-6.9	5.3	4.394	0.9	0.5	0	18.9	19.8	0	68	71	0	24	25	19	0	307.6	0.4	-0.4	0	0	0	30.1
2016	7	29	18	40	0	-2.5	0.9	4.394	0.6	0.7	0	17.2	17.6	0	65	65	0	25	24	19	0	307.5	0.4	-0.4	0	0	0	30.1
2016	7	29	18	50	0	5.6	-5.3	4.382	0.7	0.7	0	18.5	19.4	0	68	68	0	25	23	21	0	307.6	0.4	-0.4	0	0	0	30.1
2016	7	29	19	0	0	13.9	-9.9	4.367	0.9	0.4	0	18.1	18.5	0	67	67	0	25	24	19	0	307.6	0.4	-0.4	0	0	0	30.1
2016	7	29	19	10	0	20.6	-17	4.346	0.7	0.7	0	18.1	18.9	0	67	68	0	25	24	19	0	307.6	0.4	-0.4	0	0	0	30.0
2016	7	29	19	20	0	22.3	-17.6	4.324	0.7	0.7	0	17.6	19.4	0	68	68	0	27	23	19	0	307.6	0.4	-0.4	0	0	0	30.0
2016	7	29	19	30	0	31.2	-24	4.292	0.7	0.6	0	18.1	20.2	0	70	71	0	28	24	19	0	307.5	0.4	-0.4	0	0	0	30.1
2016	7	29	19	40	0	31	-26.3	4.256	0.7	0.6	0	20.2	19.8	0	72	71	0	25	25	19	0	307.5	0.4	-0.4	0	0	0	30.1
2016	7	29	19	50	0	36.2	-25.8	4.218	0.6	0.7	0	18.1	19.8	0	68	70	0	26	24	19	0	307.6	0.4	-0.4	0	0	0	30.1

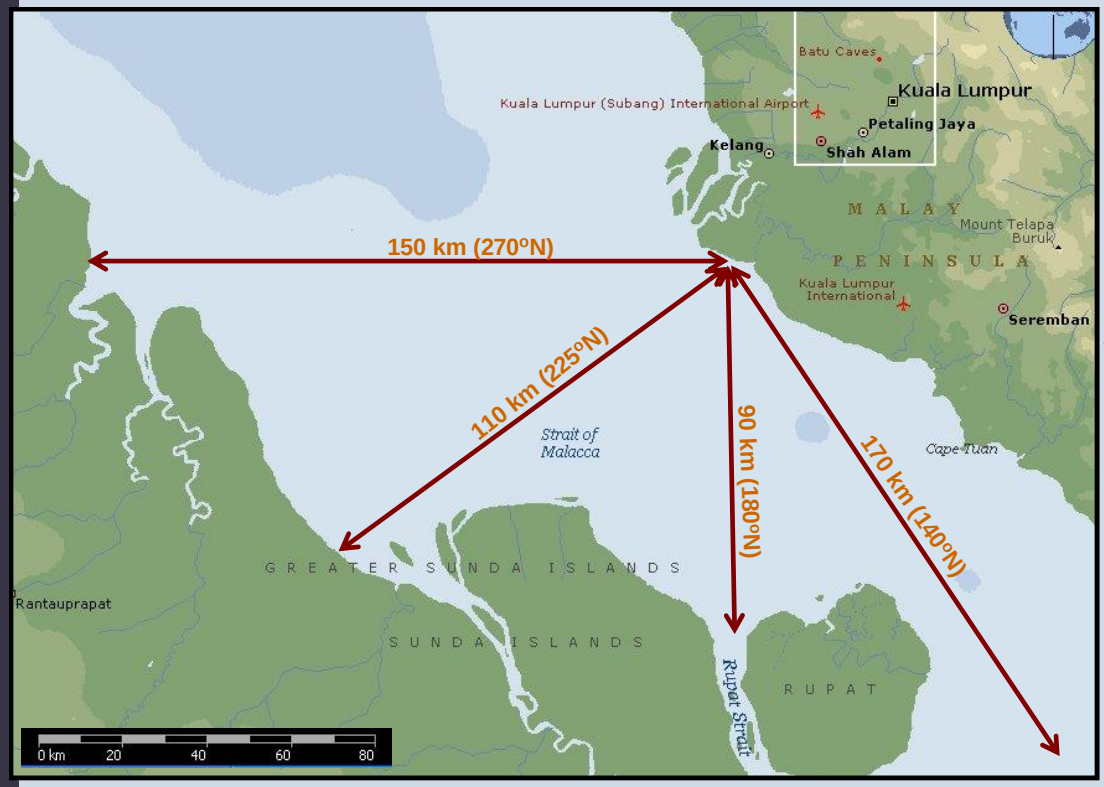
Analysed ADCP Data



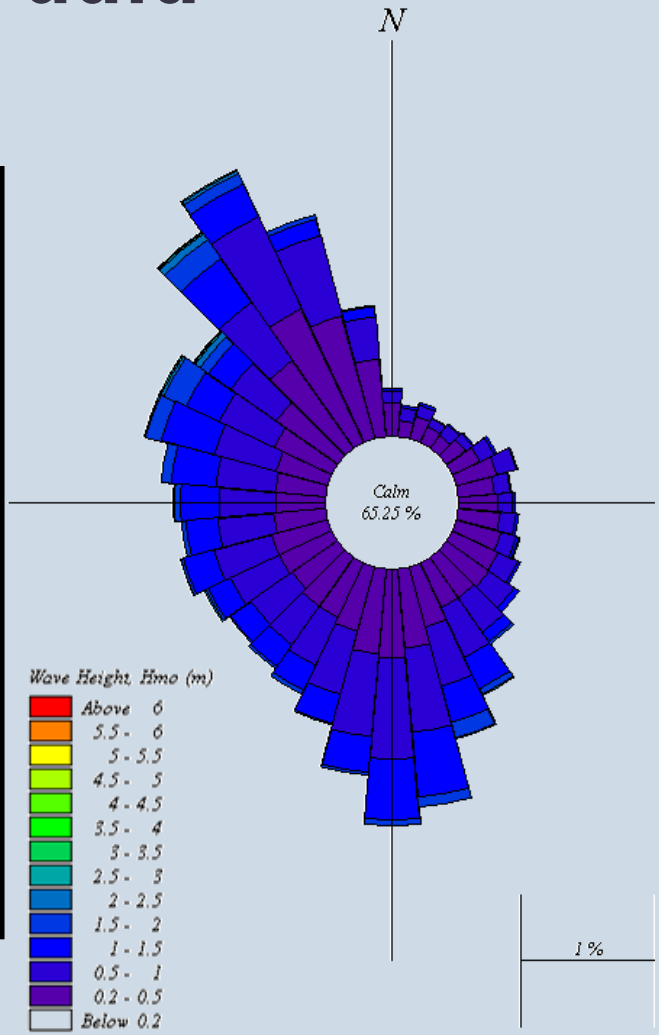


KD Sultan Ismail, Johor

Analysed Wave data



Pulau Carey, Selangor



Plumes


Show Village/
should be removed
Silt Curtain
Seagrass/No intervention program
Seagrass/No intervention program
Silt Curtain
Existing CG Causeway/
should be removed
Serious Spillage (Surface as islands)
- Not Suppose to Happen
Silt Curtain

Plumes

Plumes are spotted surrounding the activities

Summerset Resort, Rompin

Senggarang, Batu Pahat, Johor

THANK YOU